Informatics

IN001-EB-X

Establishing a Quality Control Program to Assure Accurate Anatomic Models Using 3D Printing Techniques: Principles and Clinical Experience

All Day Location: IN Community, Learning Center

Participants
Jonathan M. Morris, MD, Rochester, MN (*Presenter*) Nothing to Disclose
Shuai Leng, PhD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Kiaran P. McGee, PhD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Thomas A. Foley, MD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Terri J. Vrtiska, MD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Joel L. Kuhlmann, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Ahmed Halaweish, PhD, Rochester, MN (*Abstract Co-Author*) Employee, Siemens AG
Jane S. Matsumoto, MD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

Techniques for acquiring optimal imaging data and verification/validation and accuracy of 3D models are an integral part of creating 3D anatomic models. A Quality Control program defines and assures accuracy of 3D printed anatomic models from imaging data. Production of consistently accurate models contributes to enhanced clinical care through comprehension of complex anatomy and focused clinical care discussions

TABLE OF CONTENTS/OUTLINE

Clinical Experience: 150 models over 22 months in a Radiology based 3D printing lab Clinical cases: orthopedic, cardiovascular, neurologic, abdominal CT and MR Imaging Data Hardware and Software Optimizing Image Acquisition ACR accredited CT and MR scanners Trained personnel Scanning and ReconstructionTechniques Contrast enhancement Role of Dual Energy MR: Cube, thin section, distortion Accuracy of Segmentation and Processing Qualified Trained Personnel Automatic and Manual Segmentation Image Registration Image Manipulation Printing Validation Software accuracy Routine maintenance Printing resolution Material integrity Quality Control Program Accredited radiology equipment and personnel Quality checks for segmentation and processing Monthly creation of phantoms: block and anatomic simulation models

IN002-EB-X

3D Printing Workflow for Fabrication of a Patient Specific Model from Medical Imaging: A to Z

All Day Location: IN Community, Learning Center

Awards
Certificate of Merit

Participants
Haekang Kim, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Guk-Bae Kim, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Koeun Lee, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Namkug Kim, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Stockholder, Coreline Soft, Inc
Joon Beom Seo, MD, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Dong Hyun Yang, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
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Choung-Soo Kim, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Yeon-Mok Oh, MD, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Semyeong Jang, Seoul, Korea, Republic Of (*Abstract Co-Author*) Employee of Coreline Soft Inc

TEACHING POINTS

We will review basic principles and related technologies for medical application of 3D printing, focused on patient specific model from medical images.We will provide practical guidelines of medical 3D printing for obtaining clinically successful results.We will introduce applications of 3D printing for clinical setting.

TABLE OF CONTENTS/OUTLINE

Introduction of 3D printing technology including 3D printing machines, 3D modelling software from medical images, and materials. Procedure for medical 3D printing: data acquisition, preprocessing, image segmentation, 3D modelling, CAD modeling, STL conversion, 3D printing, post-processing. Accuracy testing of soft 3D printing for partial nephrectomy: 3D accuracy among medical image, 3D model, 3D fabricated model Prospect of 3D printing: current outcomes, technical obstacles and potentials.

IN003-EC-X

Educational App for CT Interpretation: Head-to-Toe Measurement Guide

All Day Location: IN Community, Learning Center

Participants
Pamela T. Johnson, MD, Baltimore, MD (*Presenter*) Nothing to Disclose
Madison Johnson, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Hannah Ahn, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Sara Raminpour, BS, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Christopher R. Bailey, MD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Elliot K. Fishman, MD, Owings Mills, MD (*Abstract Co-Author*) Research support, Siemens AG Advisory Board, Siemens AG Research support, General Electric Company Advisory Board, General Electric Company Co-founder, HipGraphics, Inc
Rachel B. Thomas, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

CT interpretation requires knowledge of both normal anatomy and alterations in size and attenuation indicative of pathology. The purpose of this educational iPhone/iPad Application is to provide normal measurements of a range of anatomic structures and critical Hounsfield unit thresholds, to aid in CT interpretation. The information is presented with rich graphics and a search tool to enable easy accessibility or review for self-study purposes. Each measurement or HU threshold reported is derived from publication(s), and the App provides a link to the abstract in Pubmed. The goals of this educational tool are to: Increase radiologists' knowledge with respect to normal anatomic size criteria Review important Hounsfield unit thresholds to distinguish benign lesions from potentially malignant or life threatening pathology Facilitate access to the literature from which this information was derived for additional knowledge increase

TABLE OF CONTENTS/OUTLINE

Home page Anatomic overview Search toolPrimary Categories Head and Neck Chest Abomen Pelvis Extremity-Subcategories (for each primary category) Vasculature Lymphatics Solid organs Hollow organs Diagnostic attenuation measurements

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Elliot K. Fishman, MD - 2012 Honored Educator
Elliot K. Fishman, MD - 2014 Honored Educator

IN004-EC-X

Artificial Intelligence User Interface Including Conversational Computing and Deep Learning for Future Radiology: What Radiologists Should Know

All Day Location: IN Community, Learning Center

Participants
Norio Nakata, MD, Tokyo, Japan (*Presenter*) Nothing to Disclose
Tomoyuki Ohta, Tokyo, Japan (*Abstract Co-Author*) Nothing to Disclose
Makiko Nishioka, MD, Tokyo, Japan (*Abstract Co-Author*) Nothing to Disclose
Kunihiko Fukuda, MD, Tokyo, Japan (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

To learn artificial intelligence (AI) including deep learning for future radiology. To learn the user interface (UI) trends and the feasibility of AI UI including conversational UI for radiologists.

TABLE OF CONTENTS/OUTLINE

Artificial intelligence (AI) including deep learning (DL) and natural language processing (NLP) is one of key topics for future radiology. DL, which is a class of machine learning algorithms, has produced breakthrough results in many areas including image understanding recently. Despite the advantages of computer-aided diagnosis (CAD), radiologists have not yet use it routinely except for some applications. One reason is the old inadequate user interface (UI). UI researchers were divided in AI and intelligence amplification (IA) groups in the early stages. The concept of IA is the idea that computer is a tool to assist the human intellectual activity. The mouse and graphical UI are classified as IA UI. Conversational UI (CUI) is a kind of AI UI with NLS. CUI with cognitive speech capabilities and voice operation will open the new possibility of seamless and reasonable reading for radiologists. This exhibit is to demonstrate the CUI of DICOM viewing, reporting, and web browsing including ARRS Gold Miner and RadLex using Automator's dictation commands of Mac OS X. The ethics and correct knowledge of AI including DL are also discussed.

IN005-EC-X

Development of an Eye Gaze Tracking System with Infrared LEDs/cameras for Analysis of Radiologists' Image Interpretation

All Day Location: IN Community, Learning Center

FDA Discussions may include off-label uses.

Participants

Mitsuru Sato, Maebashi, Japan (*Abstract Co-Author*) Nothing to Disclose
Toshihiro Ogura, PhD, Maebashi, Japan (*Presenter*) Nothing to Disclose
Shoko Tsutsumi, Maebashi, Japan (*Abstract Co-Author*) Nothing to Disclose
Kiyoshi Isobe, Tokyo, Japan (*Abstract Co-Author*) Nothing to Disclose
Mikio Hasegawa, Tokyo, Japan (*Abstract Co-Author*) Nothing to Disclose
Kunio Doi, PhD, Chicago, IL (*Abstract Co-Author*) Shareholder, Hologic, Inc; License agreement, Hologic, Inc; License agreement, Deus Technologies, LLC; License agreement, Riverain Technologies, LLC; License agreement, Mitsubishi Corporation; License agreement, MEDIAN Technologies; License agreement, General Electric Company; License agreement, Toshiba Corporation; Research support, Deus Technologies, LLC; Research support, E. I. du Pont de Nemours & Company; Research support, Elcint Medical Imaging Ltd; Research support, FUJIFILM Holdings Corporation; Research support, General Electric Company; Research support, Hitachi, Ltd; Research support, Eastman Kodak Company; Research support, Konica Minolta Group; Research support, Mitaya Manufacturing Co, Ltd; Research support, Mitsubishi Corporation; Research support, Koninklijke Philips NV; Research support, Hologic, Inc; Research support, Riverain Technologies, LLC; Research support, Seiko Corporation; Research support, Siemens AG; Research support, 3M Company; Research support, Toshiba Corporation
Mika Okajima, Gunma, Japan (*Abstract Co-Author*) Nothing to Disclose
Norio Hayashi, PhD, Maebashi, Japan (*Abstract Co-Author*) Nothing to Disclose
Haruyuki Watanabe, RT, Ichihara, Japan (*Abstract Co-Author*) Nothing to Disclose
Toru Negishi, Maebashi, Japan (*Abstract Co-Author*) Nothing to Disclose
Akio Ogura, PhD, Maebashi, Japan (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

An eye-camera system with headgear has been used to track radiologists' viewing points on chest images, in order to understand image interpretation process. However, it is difficult to use this system casually and widely due to a complex calibration required. We developed a new eye-tracking system without headgear which can be calibrated simply by observing five markers placed at four corners and at the center on a LCD screen. Therefore, this system can be used easily for tracking viewing points on any radiological images displayed on a monitor. This device has two infrared LEDs and two infrared cameras for detection of pupil point and corneal reflection point in the dark pupil image, thus determining gaze points using the central position of corneal curvature and the pupil. In this study, we attempted to understand how trainees can be improved to a level achieved by trained observers in viewing chest images for detection of lung nodules. We investigated gaze points by trained observers and trainees for image reading of chest images with lung nodules, and analyze the time for detection and gaze points.

TABLE OF CONTENTS/OUTLINE

Real-time demonstration of an eye gaze-finder system Calibration and tracking of gaze points in clinical images Comparison of the difference in gaze points due to image reading by trained observers and trainees

IN006-EC-X

New Tools for Analysis of Peripheral Lung Structures by Virtual Microscopy and Three Dimensional Printed out Scale up Tangible Model for Realization by Micro Focused CT Data of the Lung Specimen

All Day Location: IN Community, Learning Center

FDA Discussions may include off-label uses.

Participants
Hiroshi Natori, MD, PhD, Sapporo, Japan (*Presenter*) Nothing to Disclose
Hirotsugu Takabatake, MD, PhD, Sapporo, Japan (*Abstract Co-Author*) Nothing to Disclose
Kensaku Mori, PhD, Nagoya, Japan (*Abstract Co-Author*) Nothing to Disclose
Masahiro Oda, PhD, Nagoya, Japan (*Abstract Co-Author*) Nothing to Disclose
Masaki Mori, MD, Sapporo, Japan (*Abstract Co-Author*) Nothing to Disclose
Hirotoshi Homma, MD, Sapporo, Japan (*Abstract Co-Author*) Nothing to Disclose
Hiroyuki Koba, MD, PhD, Sapporo, Japan (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

1. We demonstrate virtual microscopic navigation method for 3D understanding of peripheral lung structures based on micro focused CT data of inflated fixed lung specimen by Heitzman's method. Viewer for virtual microscope has functions for morphometry.2. Viewing tangible twenty times scale up model is printed out from micro focused CT data to easy observation of virtual 3D histology at bronchioles and alveoli by own eyes.3. Real optical endoscopic images of airways in the scale up model are also presented.

TABLE OF CONTENTS/OUTLINE

1. PowerPoint presentation with video clip of virtual microscopic navigation in the virtual lung specimen.2. Hands on onsite demonstration of virtual microscopy application with measurement function in peripheral lung are prepared. Measurements demonstrate sizes of alveoli, alveolar ducts, and the orifice of respiratory bronchioles in diameter. Shapes of alveoli are polyhedral rather than spherical.3. Peripheral lung structures are realized in twenty times scale up 3D printed out tangible model from the virtual lung data. Architectures and sizes are compared with virtual study. Optical endoscopic images of airways of 3D printed scale up model are also presented.SummaryRadiologists may gain from this presentation, basic and clinical new insight into imaging analysis of the peripheral lung diseases.

IN100-ED-X

Practical Approach to Understanding the Basic Foundations of Imaging Informatics: A Beginner's Primer

All Day Location: IN Community, Learning Center

Participants
Daniel J. Yoon, MD, New York, NY (*Presenter*) Nothing to Disclose
Nii O. Koney, MD, MBA, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Jason A. Tam, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Stuart H. Golbey, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Stephen I. Zink, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Alexander W. Ho, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

Using the recently published ACGME and ABR approved clinical informatics milestone project as a rough guide, we have designed a practical case-based approach to educating residents and fellows about the basic foundation of imaging informatics and the important role it plays across the spectrum of care. Attendees will have a better understanding of: 1. The various apparent and less evident ways in which imaging informatics affects the full spectrum of patient care; 2. The alphabet soup involved in imaging informatics including DICOM, PACS, HL7, LAN, RIS and how they are interconnected; 3. The imaging informatics workflow involved in a typical radiology examination with a focus on common causes of downtime; 4. Emerging clinical informatics advances in the era the Affordable Care Act and potential impact on radiology departments.

TABLE OF CONTENTS/OUTLINE

Introduction to clinical and imaging informatics Case study introduction Typical radiology informatics workflow Common causes of downtime and troubleshooting mechanisms Imaging informatics in the era of the Affordable Care Act Take Home Points

IN101-ED-X

Infographics in Radiology

All Day Location: IN Community, Learning Center

Participants
Sergey Kochkine, MD, Boston, MA (*Presenter*) Nothing to Disclose
Harprit S. Bedi, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

"Info-graphics" or "information graphics," an emerging formof data visualization with viral appeal, allowusers to build visual diagrams from overwhelming volumes of data. These pictorial illustrations have been traditionally generated by professional graphic designers via software packages such as Photoshop, Illustrator, Indesign, and Inkscape. However, within the recent year, new and user-friendly online infographic design technology platforms such as Piktochart, Easel.ly, Infogr.am, Visual.ly have become available, making Infographic design simple and straightforward for the general public. We present an introduction to what Infographics are, why they work so well in radiology, an overview of the different types of infographics (including static, interactive, and motiongraphics, and best practices for the use of each), the do's and don'ts of radiology Infographic design, optimal strategies to visualize different types of data (statistical data, radiologic findings, lists, relationships, concepts), review potential uses for radiology trainees, and discuss potential for implementation in teaching. Finally, a step by step approach to creating radiology infographics will be detailed.

TABLE OF CONTENTS/OUTLINE

Overview of infographics and infographic design platforms. Applications for residents and teaching. How to build a radiology infographic.

IN105-ED-X

Scroll, Swipe, Pinch and Tap: A Novel Electronic Resource for Reaching of Cross-sectional Anatomy and Radiology to Undergraduates and Junior Doctors

All Day Location: IN Community, Learning Center

Participants
Melisa Sia, Farnworth, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Vikas Shah, MRCP, FRCR, Leicester, United Kingdom (*Presenter*) Nothing to Disclose

TEACHING POINTS

In contrast to plain film teaching, there is variable inclusion of cross-sectional radiology in undergraduate (UG) syllabi. Various international bodies such as the Royal College of Radiologists have created UG radiology curricula. Our global survey of UGs identified a desire for more teaching, and for content delivery using tablet technology, with many students using iPads for learning. Apple's iBooks platform enables creation of interactive e-books with embedded scrollable image stacks, animations, galleries, annotations and quizzes. A free iBook was created with chapters on: Essential CT, MRI and ultrasound physics Guidelines on indications and 'how to request' Head and spine, chest and abdominal imaging including labelled anatomy, description of pathology and quiz cases

TABLE OF CONTENTS/OUTLINE

The current status of cross-sectional radiology teaching within medical schools, and results of global survey on UG perception of teaching and means of content delivery. Explanation of why the iBooks platform is suited to this educational need. Description of how the content was chosen with reference to published suggested curricula and competencies expected of junior doctors. Examples of use of image stacks, animations, galleries, annotations and quizzes. Limitations of this resource and future directions.

IN106-ED-X

Are You Up to the Test? Improving Multiple Choice Question Writing in Undergraduate Radiology Education

All Day Location: IN Community, Learning Center

Participants
Joseph J. Budovec, MD, Milwaukee, WI (*Presenter*) Nothing to Disclose
Ann K. Helms, MD, Milwaukee, WI (*Abstract Co-Author*) Nothing to Disclose
Scott J. Erickson, MD, Milwaukee, WI (*Abstract Co-Author*) Nothing to Disclose
Keith E. Baynes, MD, Milwaukee, WI (*Abstract Co-Author*) Nothing to Disclose
Parag P. Tolat, MD, Milwaukee, WI (*Abstract Co-Author*) Nothing to Disclose
Mark D. Hohenwalter, MD, Milwaukee, WI (*Abstract Co-Author*) Nothing to Disclose
Cesar A. Lam, MD, Menomonee Falls, WI (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

Multiple choice questions (MCQs) are the de facto standard method of assessment in medical education. Poorly written or designed MCQs significantly reduce the validity and reliability of the assessment and contribute to learner dissatisfaction. Since most radiology faculty have little training in constructing well-designed MCQs, this exhibit will:1. Explain the importance of well-constructed MCQs in assessment of both medical student achievement of learning goals as well as the efficacy of presented curriculum. 2. Describe the basic principles in currently accepted MCQ design.3. Teach learners to design reliable, valid, and defensible MCQs examinations appropriate for medical students in a radiology rotation.4. Summarize effective question-writing strategies with examples to help educate medical student and resident clinician-educators.

TABLE OF CONTENTS/OUTLINE

1. Introduction2. Anatomy of MCQ3. Basic Principles of Writing Effective MCQs a. Content b. Formatting c. Style d. Stem e. Options4. Creative Item Writing5. Number and types of MCQs6. Common Flaws and Counterexamples7. Considerations for MCQs written for medical students in radiology electives8. Resources and guides for writing better MCQs

IN107-ED-X

3D Printed Prostate Cancer Models Based on Multi-parametric MRI: Application in Focal Ablative Therapy

All Day Location: IN Community, Learning Center

Participants
Nicole Wake, MS, New York, NY (*Presenter*) Nothing to Disclose
Samir S. Taneja, MD, New York, NY (*Abstract Co-Author*) Consultant, Eigen Consultant, GTx, Inc Consultant, Bayer AG Consultant, Healthtronics, Inc Speaker, Johnson & Johnson Investigator, STEBA Biotech NV Royalties, Reed Elsevier
Andrew B. Rosenkrantz, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

(1) Anatomically accurate 3D printed prostate cancer models can be generated based on highly detailed multi-parametric MRI data sets.(2) Technical aspects of the 3D printing process, as related to prostate cancer, are reviewed.(3) 3D models based on MRI exams performed before focal ablative therapy can help depict the relationship of dominant tumors to key anatomic structures in order to help guide treatment.(4) 3D models based on MRI exams performed after focal ablative therapy can be used to help monitor treatment outcomes.

TABLE OF CONTENTS/OUTLINE

(1) Overview of workflow required to produce anatomically correct 3D printed models. (2) Magnetic Resonance Imaging (MRI) requirements for 3D printing. (3) Post-processing techniques for obtaining printable files (STL outputs) and re-meshing techniques to prepare STL files for printing. (4) Use of the 3D model to depict the dominant tumor and its relationship to key anatomic structures, including the neurovascular bundles, urethra, prostatic capsule, rectal wall, and bladder neck. (5) Application of 3D printed prostate models to guide and monitor focal ablative therapy for prostate cancer.

IN108-ED-X

ReportDiff: Analytics and Feedback for Resident Dictated Reports

All Day Location: IN Community, Learning Center

Awards
Magna Cum Laude

Participants
Phillip M. Cheng, MD, MS, Los Angeles, CA (*Presenter*) Nothing to Disclose
Miriam Romero, MD, Pasadena, CA (*Abstract Co-Author*) Nothing to Disclose
M. Victoria Marx, MD, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

To understand the concept of using edit distance for feedback on resident dictated reports. To understand the mechanics and output of an open source software system for collecting reports and calculating edit scores from a radiology dictation system.

TABLE OF CONTENTS/OUTLINE

A. Feedback for resident reports - concept and strategiesB. Edit distance - algorithm, variants, value and pitfallsC. ReportDiff, an open source software system for collecting and processing edit scores from a dictation database 1. Structure and operation 2. Pilot data from 36475 reports at one institution

IN109-ED-X

Novel Quality Metrics Toward Establishing the Accuracy of 3D-Printed Medical Models

All Day Location: IN Community, Learning Center

Participants
Dimitris Mitsouras, PhD, Boston, MA (*Presenter*) Research Grant, Toshiba Corporation; Speakers Bureau, Toshiba Corporation
Tianrun Cai, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Peter C. Liacouras, PhD, Bethesda, MD (*Abstract Co-Author*) Nothing to Disclose
Beth A. Ripley, MD, PhD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Gerald T. Grant, MD, MS, Louisville, KY (*Abstract Co-Author*) Nothing to Disclose
Frank J. Rybicki III, MD, PhD, Ottawa, ON (*Abstract Co-Author*) Research Grant, Toshiba Corporation;
Amir Imanzadeh, MD, Cambridge, MA (*Abstract Co-Author*) Nothing to Disclose
Tatiana Kelil, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

The purpose of this exhibit is to1. Describe the numerous applications of 3D printing in medicine, ranging from surgical planning to intraoperative guidance and prosthesis design with emphasis on the accuracy of the printed models.2. Emphasize the lack of quality assurance metrics to establish either the accuracy of the intended printed models, or the "printability" of the underlying medical images.3. Describe emerging metrics of accuracy of 3D printed medical models in each step of the conversion process from medical images to printable models.

TABLE OF CONTENTS/OUTLINE

Conversion of DICOM images to 3D-printable standard tessellation language (STL) format data - Example applications: Maxillofacial, vascular, soft tissue- Errors in each step of the conversion process - Segmentation (eg, bone vs blood pool vs soft tissue) - Application-specific STL manipulations (eg, extruding a hypothetical vessel wall) - 3D printer tolerances and typical printing "artifacts".- Novel accuracy metrics to assess 3D-printed models and establish resolution, signal-to-noise and contrast-to-noise requirements of the underlying imaging modality - The concept of remnant STL volumes compared to STLs derived from ideal imaging - Key application-specific dimensional measurements - Key 3D-printing modality-specific caveats to avoid

IN110-ED-X

#FOAMrad - Free Open Access Radiology Education

All Day Location: IN Community, Learning Center

Participants
David Little, MBChB, FRCR, Bristol, United Kingdom (*Presenter*) Nothing to Disclose
Vikas Shah, MRCP, FRCR, Leicester, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Fiona Pathiraja, FRCR, MSc, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Jeremy B. Jones, MRCP, FRCR, Melbourne, Australia (*Abstract Co-Author*) Nothing to Disclose
Matthew D. Bull, MBBS,FRCR, Bracknell, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Andrew F. Dixon, MBBS, FRANZCR, East Melbourne, Australia (*Abstract Co-Author*) Nothing to Disclose
Lynne Armstrong, MBChB, PhD, Bristol, United Kingdom (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

'Free open access medical education' (#FOAMed) spontaneously emerged on social media through collaboration towards the common goal of improving medical education. It is constantly evolving and 'free open access radiology education' (#FOAMrad), which was born on and is still most popular on Twitter, is a natural extension with the aim of sharing radiology education material via social media. #FOAMrad is not owned by an individual or institution although organisations such as Radiopaedia have supported the development of the #FOAMrad community.The purpose of this exhibit is to illustrate to all radiologists the benefits of #FOAMrad in allowing learners to access a wider range of material, teachers to have a greater audience, removing international boundaries and flattening traditional hierarchies. We will also explore concerns around quality assurance, lack of peer review and reliability of content.

TABLE OF CONTENTS/OUTLINE

What is #FOAMrad and where did it come from? How to get involved in #FOAMrad Consuming and creating content Staying professionalDiffusion of innovation and the development of sub tags (#RadBasics)Copyright infringement and image ownershipThe downsides Quality assurance Free open access and the risk of misinformation Debunking the myths - aren't textbooks better?

IN111-ED-X

Relieve the Neck Pain - How to Automatically Group and Map CT Exam Protocols to Appropriate Exam Types in the Participation of ACR Dose Index Registry

All Day Location: IN Community, Learning Center

Participants
Da Zhang, PhD, Boston, MA (*Presenter*) Nothing to Disclose
Mythreyi Bhargavan-Chatfield, PhD, Reston, VA (*Abstract Co-Author*) Nothing to Disclose
Bob Liu, PhD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Xinhua Li, PhD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Cristy Savage, RT, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Jenifer W. Siegelman, MD, MPH, Brookline, MA (*Abstract Co-Author*) Siemens Healthcare, Research Consultant; Research Grant, Elucid Bioimaging, Inc
Matthew R. Palmer, PhD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

Upon completion of this exhibit, the reader will learn Features of the standardized protocol naming system (RadLex Playbook) used by ACR DIR The source of heterogeneity and large number of CT protocol nomenclature A method to decompose a CT protocol name into multiple describing phrases and the core protocol name A method to automate the mapping process based on: protocol decomposition, regular expression based text matching, and the new batch processing feature of ACR DIR website

TABLE OF CONTENTS/OUTLINE

1. Standardization of the CT protocol nomenclature 1. RadLex Playbook 1. Atomic describing terms 2. RPID, short names, and long names 3. Radiology orderables vs. radiology procedures 4. Evolving of new protocol nomenclature systems: RadLex Playbook 2.02. The heterogeneous and complex naming of CT protocols 1. Population groups and granularized CT protocols 2. How an exam is named: study description vs. protocol name3. Automated decomposition and grouping of local CT protocol names 1. Rigid treatment of slight variations in names by IT systems 2. Describing phrases and core protocol names 3. Regular expression based text manipulation4. Automatic protocol mapping to ACR DIR standard names 1. Hash table, text matching, and protocol mapping 2. ACR DIR's batch processing feature for uploading the mapping results

IN112-ED-X

Review of Free Smartphone Based Audience Response Sytems: Application in Radiology Education

All Day Location: IN Community, Learning Center

Participants
Andrew Kesselman, MD, Brooklyn, NY (*Presenter*) Shareholder and Consultant, Figure 1
Scott A. Lehto, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
John B. Amodio III, MD, Woodbury, NY (*Abstract Co-Author*) Nothing to Disclose
Harry L. Zinn, MD, Hewlett, NY (*Abstract Co-Author*) Nothing to Disclose
Daniel L. Zinn, MD, Brooklyn, NY (*Abstract Co-Author*) Nothing to Disclose
Srinivas Kolla, MD, Brooklyn, NY (*Abstract Co-Author*) Nothing to Disclose
Stephen A. Waite, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

The purpose of this exhibit: 1. To review the benefits of Audience Response System in radiology learning 2. To briefly discuss the technology involved enabling internet based audience response 3. To learn about some of the freely available smartphone based Audience Response Systems and their application

TABLE OF CONTENTS/OUTLINE

Introduction: Radiology education can be easily improved by implementing Audience Response System (ARS). The benefits of ARS are well known in adult learning. There are free cloud based ARS programs that utilize smartphones clients, obviating the need for dedicated hardware and software. Benefits: Advantages of ARS include increased attentiveness, retention, and engagement. Teaching effectiveness can be tested. Data collection and analysis is made easier and resident progression can be monitored. Programs: Sample ARS programs like OnlineTED, Polleverywhere and Socrative are tested. Implementation is straight forward. Even though the background technology is similar, there are advantages and disadvantages to each of these applications. Conclusion: ARS is an excellent way to instantly improve radiology teaching and learning. It need not be expensive or technically prohibitive to be successfully implemented. Smartphone based ARS programs are fairly easy to integrate into the education program.

IN113-ED-X

Rocking the iRADS: Reporting and Data Systems

All Day Location: IN Community, Learning Center

Participants
Alicia Huang, MD, New York, NY (*Presenter*) Nothing to Disclose
Alexander C. Kagen, MD, New York, NY (*Abstract Co-Author*) Speakers Bureau, Bayer AG

TEACHING POINTS

- This educational display will discuss the history and appropriateness of the following iRAD criteria: breast, lung, liver, prostate- An example of each score will be given to highlight the pertinent imaging findings. Through this educational display, readers will gain a better understanding of how to apply each of the reporting and data systems and how it pertains to patient follow up.

TABLE OF CONTENTS/OUTLINE

A. IntroductionB. BI-RADS: Breast Imaging Reporting and Data System a. History/Appropriateness b. Explanation of the scores (0, 1, 2, 3, 4, 5, 6) c. An example for each score, and how it affects patient care.C. LI-RADS: Liver Imaging Reporting and Data System a. History/Appropriateness b. Explanation of the scores (1, 2, 3, 4A, 4B, 5A, 5B, 5V, M, OM) c. An example for each score, and how it affects patient care.D. Lung-RADS: Lung Imaging Reporting and Data System a. History/Appropriateness b. Explanation of the scores (0, 1, 2, 3, 4A, 4B, 4X, 5, C) c. An example for each score, and how it affects patient care.E. PI-RADS: Prostate Imaging Reporting and Data System a. History/Appropriateness b. Explanation of the scores (1, 2, 3, 4, 5) c. An example for each score, and how it affects patient care.F. Future iRADS a. HI-RADS

IN114-ED-X

#MummyScan: Using Social Media to Market an Event for a Radiology Practice

All Day Location: IN Community, Learning Center

Awards
Cum Laude

Participants
Alex Towbin, MD, Cincinnati, OH (*Presenter*) Author, Reed Elsevier; Consultant, Reed Elsevier; Shareholder, Merge Healthcare Incorporated; Consultant, Guerbet SA; Grant, Guerbet SA

TEACHING POINTS

Social media has become a standard form of marketing in most industries. However, most radiology practices do not have a social media presence. The purpose of this exhibit is to: Describe the steps a radiology practice can take to market an event via social media Review the metrics used to measure the impact of an advertising campaign

TABLE OF CONTENTS/OUTLINE

Preparing for the event Selecting a hashtag Notifying people of an event Preparing content During the event Live-tweeting Developing media-rich content Engaging your audience Responding to criticism After the event Cross-promotion Creating enduring content Measuring the impact of social media promotion Define marketing analytics Describe how to get analytics via different social media channels

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Alex Towbin, MD - 2014 Honored Educator

IN117-ED-X

3D MR/CT Fusion for Cortical Surface Localization of Intracranial EEG Electrodes Using Synapse 3D

All Day Location: IN Community, Learning Center

Participants
Darryl Hwang, PhD, Los Angeles, CA (*Presenter*) Nothing to Disclose
Christiane Heck, MD, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose
George Nune, MD, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose
Saman Hazany, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Charles Y. Liu, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose
Jonathan Russin, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose
Eu-Meng Law, MBBS, Los Angeles, CA (*Abstract Co-Author*) Speakers Bureau, Toshiba Corporation; Medical Advisory Board, Bayer AG; Medical Advisory Board, Bracco Group; Medical Advisory Board, FUJIFILM Holdings Corporation;
Paul E. Kim, MD, Santa Monica, CA (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

Understand the need for fusion imaging in Phase 2 epilepsy surgical planning. Creation of 3D MR/CT fusion images using Synapse 3D Understand the current limitations of software. Examination of strategies for improved results.

TABLE OF CONTENTS/OUTLINE

PURPOSE/AIM Demonstrate the use of Synapse 3D for the 3D fusion of MR and CT volumetric images. Illustrate the use of the fusion model for epilepsy surgical planning. Illustrate some current issues with misregistration of the MR and CT volumes. Discuss some possible areas of improvement.CONTENT ORGANIZATIONI. Explanation of current needs of 3D visualization with epilepsy surgical planningII. Overview of workflow in Synapse 3D Volume registration 3D image generation MR/CT fusion image generationIII. Discussion of possible improvements Non-linear registration User controlled deformation fields 3D tessellated objectsIV. Discussion of application of 3D fusion for other clinical needs.

IN118-ED-X

Using Modality Log Files to Improve Imaging Efficiency and Quality

All Day Location: IN Community, Learning Center

Awards
Certificate of Merit

Participants
Martin L. Gunn, MBChB, Seattle, WA (*Presenter*) Research support, Koninklijke Philips NV; Spouse, Consultant, Wolters Kluwer NV; Medical Advisor, TransformativeMed, Inc;
Bruce E. Lehnert, MD, Seattle, WA (*Abstract Co-Author*) Research support, Koninklijke Philips NV
Christopher Hall, PhD, Briarcliff Manor, NY (*Abstract Co-Author*) Employee, Koninklijke Philips NV
Thomas Amthor, Hamburg, Germany (*Abstract Co-Author*) Employee, Koninklijke Philips NV
Julien Senegas, Hamburg, Germany (*Abstract Co-Author*) Employee, Koninklijke Philips NV
Daniel R. Elgort, PhD, Briarcliff Manor, NY (*Abstract Co-Author*) Employee, Koninklijke Philips NV
Ramesh Siddalingaiah, PhD, Bangalore, India (*Abstract Co-Author*) Employee, Koninklijke Philips NV
Norman J. Beauchamp JR, MD, Seattle, WA (*Abstract Co-Author*) Research Grant, Koninklijke Philips NV
Jonathan Carnell, MD, Seattle, WA (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

Affordable, accessible, patient centered imaging is possible when imaging assets are used efficiently and patient time on scanner is limited to ensuring comfort, scan preparation and scan duration not greater than needed for diagnostic confidence. Imaging equipment log files are a list of every event on a scanner, containing detailed data about patient workflow and equipment utilization that is unavailable on RIS and PACS.After reviewing this exhibit, the learner should: Understand what information can be mined from modality log files, Know how to apply this data for analysis of equipment and human resource utilization, quality improvement, medical error reduction, patient satisfaction, variability.management, and critical equipment alerts. Be able to apply these approaches in their clinical practice.

TABLE OF CONTENTS/OUTLINE

The exhibit provide a practical approach, outlining how to analyze log files in a radiology department. What is contained with modality logs? Techniques for constructing imaging workflow from log data. Existing and novel metrics to measure workflow efficiency and quality. How to automate data gathering and monitor quality metrics using log files. Data standardization. Future uses of log files.

IN119-ED-X

From Signal to Screen: The Science Behind Radiologic Images

All Day Location: IN Community, Learning Center

Participants
Uygar Teomete, MD, Miami Beach, FL (*Presenter*) Nothing to Disclose
Georgios Z. Papadakis, MD, Bethesda, MD (*Abstract Co-Author*) Nothing to Disclose
Onur Osman, PhD, Istanbul, Turkey (*Abstract Co-Author*) Nothing to Disclose
Ozgur Dandin, MD, Bursa, Turkey (*Abstract Co-Author*) Nothing to Disclose
Ulas Bagci, PhD, MSc, Orlando, FL (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

1. To provide a brief overview of recent progress in image processing and analysis methods in quantitative/diagnostic radiology 2. To review the modality specific image quantification techniques in general radiology: Morphometry and Texture. 3. To highlight the necessity of clinical interpretation in output of image processing methods radiological images. 4. To discuss Radiomics: future trends in image processing to aid radiologic imaging with clinical and genomic data integration.

TABLE OF CONTENTS/OUTLINE

1. Introductiona. Definition and overview of image processing/analysis methods in Radiology: From past to future, evolution of accuracy.b. Clinical Image Processing.c. Quantitative Radiology and Radiomics2. Postprocessing for increasing the interpretability of the radiological imagerya. Volume rendering (Are PiXar-like renderings possible?) and surface rendering for tumor segmentation b. Noise Removal in PET, CT, and MRIc. Image Registration and its role in longitudinal studies3. Automatic Characterization of Tumors/lesionsa. Texture features can classify intensity patterns!b. Shape feature extraction and its potential use in pathology detection.c. How to integrate texture, shape, clinical, and genomic data?d. Can Machine Learning solve everything? Examples from Deep Learning of Google, FaceBook, and Baido search engine.

IN120-ED-X

Concept for Immediate and Mobile Reporting in Polytrauma Using an IHE MRRT-compliant Template with Automated Scoring Calculation

All Day Location: IN Community, Learning Center

Participants
Theresa L. Gockner, MD, Mainz, Germany (*Presenter*) Nothing to Disclose
Daniel Pinto dos Santos, MD, Mainz, Germany (*Abstract Co-Author*) Nothing to Disclose
Ruben Oberle, Mainz, Germany (*Abstract Co-Author*) Nothing to Disclose
Gordon Klos, Mainz, Germany (*Abstract Co-Author*) Nothing to Disclose
Peter Mildenberger, MD, Mainz, Germany (*Abstract Co-Author*) Stockholder, GeSIT GmbH

PURPOSE

To explore the possibilities of immediate reporting on a mobile device in a polytrauma setting using a dedicated IHE MRRT-compliant template with automated calculation of a simplified injury severity score.

METHOD AND MATERIALS

A web-based reporting tool was developed that supports the use of IHE MRRT-compliant reporting templates. With the software running on a server inside the institution we enabled a mobile tablet with access to the reporting system via the institutions wireless network. Radiologists were given the opportunity to use the tablet to write a preliminary report using a dedicated template for polytrauma scans whilst at the modality, eliminating the need to switch to their PACS workstation. The preliminary report was stored in the PACS as DICOM-PDF, where clinicians could view it using standard viewing software.

RESULTS

As only standard web-technology was used, the implementation of this solution was easy and radiologists expressed high interest in such a solution. The tablets speech-recognition capabilities could be used to some extent with only few medical terms not being recognized. Preliminary reports could be made available to the clinicians within minutes after the examination and included a simplified injury severity score. Clinicians generally approved of these possibilities.

CONCLUSION

IHE MRRT-compliant templates made available through a web-based reporting platform via wireless network enable the radiologist to take reporting closer to the modality providing the possibility for immediate reporting even while the examination is being performed.

CLINICAL RELEVANCE/APPLICATION

Using a mobile device, reporting of initial findings in polytrauma scans can be facilitated.

FIGURE (OPTIONAL)

IN122-ED-X

Synchronized Surgical Simulation using Bio-elastic Organ Replica: The Next Step of 3D Medical Imaging and 3D-printed Injection Molding

All Day Location: IN Community, Learning Center

Awards
Certificate of Merit

Participants
Maki Sugimoto, MD, PhD, Kobe, Japan (*Presenter*) Nothing to Disclose

TEACHING POINTS

1) To learn the solutions of 3D-printed injection molding.2) To learn how to use bio-elastic organ replica in surgical simulation 3) To show illustrative examples of 3D-printed injection molding, such as in surgical planning and synchronized surgical simulation.

TABLE OF CONTENTS/OUTLINE

1. The potential role and limitations of current 3D printing in clinical practice.The 3D printing technology in organ replication can carry a product only so far into the development process, primarily due to material constraints. The parent materials are usually incompatible with the current 3D printer. 2. The solutions of 3D-printed injection molding.Injection molding is capable of producing highly accurate plastic parts in parent materials. We developed hybrid 3D imaging and 3D-printed injection molding technology for manufacturing bio-elastic organ replicas. 3. How to use bio-elastic organ replica in surgical simulation Such organ models can be soaked in water to look and feel closer to real organs. With the wet model, surgeons can experience the softness of organs and see them bleed, to help them in practice on lifelike models before stepping into real surgery.

IN123-ED-X

"The Checklist Manifesto" - Experiences with Structured Reporting (SR) at an Academic Medical Center

All Day Location: IN Community, Learning Center

Awards
Certificate of Merit

Participants
Parag P. Tolat, MD, Milwaukee, WI (*Presenter*) Nothing to Disclose
Rajeev Mannem, MD, Milwaukee , WI (*Abstract Co-Author*) Nothing to Disclose
Scott J. Erickson, MD, Milwaukee, WI (*Abstract Co-Author*) Nothing to Disclose
Joseph J. Budovec, MD, Milwaukee, WI (*Abstract Co-Author*) Nothing to Disclose
Greg Holl, Milwaukee, WI (*Abstract Co-Author*) Nothing to Disclose
Stacy D. O'Connor, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

In his book "The Checklist Manifesto," Atul Gawande, MD has shown that checklists have improved efficiency and reduced human error in the fields of medicine, construction, and aviation. The RSNA website of online SR (radreport.org) has 1.9 million views/downloads.The purpose of this exhibit is to:1. Review the merits of SR2. Guide implementation of SR

TABLE OF CONTENTS/OUTLINE

1. Case for Structured Reporting (SR): A review of the literature a. Provider preferences b. Patient expectations c. Billing/payments (i.e., PQRS) d. Q/A initiatives (i.e, PQI) e. Minable data to improve patient care2. History of reporting at our institution a. Transition to structured reporting b. Formalization of SR workgroup c. Formalization of Department Polices3. How we create structured reports a. Sub-specialty driven SR report creation b. Many SR are created in conjunction with other medical specialties4. Key steps to maximize efficiency a. Auto-population of SR within the dictation palate b. Enable talking fields c. Ability to send to transcription for final editing5. Conclusion

IN260

National Library of Medicine (NLM) Literature Searches Demonstration

All Day Location: IN Community, Learning Center

Participants

TEACHING POINTS

The National Library of Medicine (NLM) provides free web access to over 24.5 million citations for biomedical and clinical medical articles back to the early 1800's through PubMed.gov. PubMed includes links to sites providing full text articles and related resources. Additional freely available NLM databases include images, genetics, environmental health and toxicology, many with resources for patient and families. The NLM coordinates delivery of library services to health professionals through the National Network of Libraries of Medicine (NN/LM). Librarians from the NN/LM Greater Midwest Region (GMR) will staff the booth and coordinate additional volunteer faculty to staff the booth, provide one-on-one training and consultation, and teach the instructional courses.

IN261

IHE/RSNA Image Sharing Demonstration

Participants

TEACHING POINTS

This demonstration will showcase developments in standards-based interoperability that enhance the quality, efficiency and safety of care in radiology. The demonstration will show enhanced radiology reporting and image sharing based on IHE profiles and the RSNA Image Share network, a pilot project funded by the National Institute of Biomedical Imaging and Bioengineering (NIBIB). Location: South Building - Hall A, Booth 1345 Demonstration Hours: 10:00 AM - 4:00 PM daily, Sunday through Thursday

IN262

Introduction to Medical 3D Printing

All Day Location: IN Community, Learning Center

Participants
William J. Weadock, MD, Ann Arbor, MI (*Presenter*) Owner, Weadock Software, LLC

TEACHING POINTS

After visiting this exhibit, the attendee will: 1) Understand the different technologies involved with 3D software and printers. 2) Learn how this new technology can be incorporated into a radiology practice. 3) Learn about current and future medical applications of 3D printing.

ABSTRACT

Over the past few years, there has been a dramatic increase in the number of medical applications in 3D printing. These have been extensively covered in the lay press, with examples of individualized treatment devices, surgical tools and prosthetics. The conversion of CT and MRI data into a tangible object which can be used in medical decision making and treatment has captured the imagination of patients and physicians alike. There are several steps involved in this complex transition which have been made easier to accomplish through advancements in software and 3D printing devices. This exhibit will show these steps and also show examples of how 3D printing has been used throughout medicine.

IN263

Computer Assisted Radiology and Surgery (CARS)

All Day Location: IN Community, Learning Center

Participants

IN264

The Society for Imaging Informatics in Medicine (SIIM)

All Day Location: IN Community, Learning Center

Participants

RCA11

Data Collection, Organization and Analysis with Excel - A Hands-On Tutorial (Hands-on)

Sunday, Nov. 29 11:00AM - 12:30PM Location: S401AB

IN

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
Jaydev K. Dave, PhD, MS, Philadelphia, PA, (jaydev.dave@jefferson.edu) (*Presenter*) Nothing to Disclose
Raja Gali, MS, Philadelphia, PA (*Presenter*) Nothing to Disclose
Manish Dhyani, MBBS, Boston, MA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Describe techniques for creating a spreadsheet to allow trouble-free data analysis. 2) Demonstrate key data management skills. 3) Describe tools for performing basic descriptive statistics. 4) Identify how to perform simple statistical tests and perform these tests with a sample dataset. 5) Understand how bad data (or bad data acquisition techniques) may corrupt subsequent data analyses. 6) Practice data plotting/representation techniques. 7) Identify differences between a spreadsheet and a database. 8) Identify statistical tasks that require more sophisticated software. Pre-requisites: Familiarity with Microsoft Windows and Microsoft Excel environment will be assumed

ABSTRACT

A spreadsheet program is commonly employed to collect and organize data for practicing quality improvement, for research, and for other purposes. In this refresher course, we will demonstrate to a user, familiar with Microsoft Excel environment, how this spreadsheet program may be used for such purposes. The course will begin with describing efficient approach for data acquisition and highlight key data management skills; and with reviewing commons errors that may be avoided during data logging. Then we will provide a brief introduction on basic descriptive tests before proceeding with a hands-on tutorial using a sample dataset to calculate basic descriptive statistics, and to perform basic statistical tests like t-test, chi-square test, correlation analysis, etc. Effect of corrupted data on such analysis will also be demonstrated. The final hands-on component for this course will include data plotting and representation including the use of pivot tables. The course will conclude with a discussion on identifying differences between a spreadsheet and a database, limitations of a spreadsheet program and avenues where a dedicated statistical software program would be more beneficial. A list of some of these dedicated statistical software programs for analyses will also be provided.Pre-requisites:Familiarity with Microsoft Windows and Microsoft Excel environment will be assumed

RCB11

Basic DICOM with Horos/Osirix and dcm4che (Hands-on)

Sunday, Nov. 29 11:00AM - 12:30PM Location: S401CD

IN

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
Marc D. Kohli, MD, San Francisco, CA (*Presenter*) Research Grant, Siemens AG
Simon Rascovsky, MD, MSc, Bogota, Colombia (*Presenter*) Officer, eDx Tecnologia en Salud SAS

LEARNING OBJECTIVES

1) Describe basic DICOM object metadata structure. 2) Demonstrate familiarity with Osirix/Horos DICOM viewer functions including image display, and measurements. 3) Use Osirix/Horos to send/receive DICOM objects. 4) Name several common dcm4che toolkit tools, and describe their purpose.

RCC11

Principles and Practice of 3D Printing

Sunday, Nov. 29 11:00AM - 12:30PM Location: S501ABC

IN

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

FDA Discussions may include off-label uses.

Participants
Frank J. Rybicki III, MD, PhD, Ottawa, ON (*Moderator*) Research Grant, Toshiba Corporation;
Jonathan M. Morris, MD, Rochester, MN (*Moderator*) Nothing to Disclose

LEARNING OBJECTIVES

1) Learn the basics of 3D printing technologies. 2) Discuss how these can be used clinically. 3) Discuss the current limitations of this technology as it relates to health care. 4) Use case examples to define current uses of this technology in surgical and medical specialties.

ABSTRACT

3D printing/additive manufacturing is a growing industry. Within the medical field there is growing interest in this technology and its impact on patients lives. In this talk we will discuss the basics of 3D printing and how they can be incorporated into medical uses from surgical design of implants to anatomic modeling of complex surgery.

Sub-Events

RCC11A 3D Printing for the Radiologist: A Primer and Introduction to Sessions

Participants
Frank J. Rybicki III, MD, PhD, Ottawa, ON (*Presenter*) Research Grant, Toshiba Corporation;

LEARNING OBJECTIVES

1) To become familiar with 3D printing technologies. 2) To have an introduction of materials used to create 3D-printed anatomical models and how they can be used in medical applications. 3) To be exposed to the process of 3D printing and those realized and potential clinical benefits in radiology, stratified by organ section.

ABSTRACT

While advanced visualization in radiology is instrumental for diagnoses and communication with referring clinicians, there is an unmet need to render DICOM images as three-dimensional (3D) printed models capable of providing both tactile feedback and tangible depth information of both anatomic and pathologic states. 3D printed models, already entrenched in the non-medical sciences, are being rapidly embraced in medicine as well as in the lay community. Incorporating 3D printing from images generated and interpreted by radiologists presents particular challenges including training, materials and equipment, and guidelines. The overall costs of a 3D printing lab must be balanced by clinical benefits. The RSNA 2015 program includes 6 hours of didactic lectures that review and summarize numerous studies that support such benefits from 3D printing, as it is expected that the number of 3D printed models generated from DICOM images for planning intervention and fabricating implants will grow exponentially. The program also includes multiple hands-on courses that will enable radiologists, at a minimum, to become familiar with 3D printing software and hardware as it relates to our field.

RCC11B 3D Printing Technologies

Participants
Peter C. Liacouras, PhD, Bethesda, MD (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand the basic principle of Additive Manufacturing (3D Printing) and how it differs from subtractive technology. 2) Understand the principles of the software needed to convert Medical Images into three-dimensional printed models and what factors contribute to the quality of each model. 3) Become familiar with the different types of Additive Manufacturing (3D Printing) technologies.

ABSTRACT

This presentation will provide a novice to Additive Manufacturing the general knowledge applicable to the medical field. The basic principles of Additive manufacturing (3D Printing) will be discussed along with the different technologies which encompass the field. The steps of converting radiographic images into three-dimensional printable files and the differences between the multitude of additive manufacturing techniques will be the primary focuses.

RCC11C Techniques for Current 3D Printing

Participants
Gerald T. Grant, MD, MS, Louisville, KY (*Presenter*) Nothing to Disclose

RCC11D 3D Printing Software

Participants
Andreas Giannopoulos, MD, Boston, MA, (agiannopoulos1@partners.org) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To become familiar with common 3D printing software terminology and software capabilities. 2) To be acquainted with the line of software needed in transforming medical images to 3D printable files. 3) To appreciate the implementation of 3D printing software in everyday clinical practice.

ABSTRACT

3D printers cannot recognize DICOM images and further steps are necessary to make DICOMs readable by 3D printers. While adequately trained personnel can perform many of those steps, the role of the radiologist is essential to ensure that the model will be clinically useful. A variety of software packages for STL generation from medical imaging as well as software for 3D part manipulation, known as Computer-Aided Design (CAD), will be discussed. Basic technical terminology and commonly used techniques will be presented. Real life paradigms from own medical 3D printing experience will be provided.

RCC11E 3D Printing with Open Source Freeware

Participants
Michael W. Itagaki, MD, MBA, Seattle, WA (*Presenter*) Owner, Embodi3D, LLC

LEARNING OBJECTIVES

1) To become familiar with the steps of converting a medical imaging scan in standard Digital Imaging and Communications in Medicine (DICOM) format into a 3D printable medical model. 2) To become familiar with the free, open-source software packages that can perform each step.

ABSTRACT

This presentation will provide an overview of the basic steps of converting a medical scan into a 3D printed medical model, using free, open-source software for each required step. Conversion of computed tomography image data in Digital Imaging and Communications in Medicine (DICOM) format to stereolithography (STL) file format using the open-source software package 3D Slicer will be reviewed. Further manipulation of the STL file in preparation for 3D printing using the open-source software package Blender will also be discussed.

Active Handout:Michael Ward Itagaki

http://abstract.rsna.org/uploads/2015/15002970/RCC11E.pdf

RCC11F Implementing 3D Printing into a Clinical Practice

Participants
Jonathan M. Morris, MD, Rochester, MN (*Presenter*) Nothing to Disclose

ABSTRACT

3D printing/additive manufacturing is a growing industry. Within the medical field there is growing interest in this technology and its impact on patients lives. In this talk we will discuss how we incorporated this technology into a quaternary referral center as a real time clinical service. We will specifically discuss the advantages as well as limitations of this technology as it relates to the medical/surgical field. We will discuss "How we do it" and what resources are needed to develop a service. As the impact of this technology is growing we will also discuss what evidence will we need to have global acceptance as a clinical service and why it should be housed in radiology.

INS-SUA

Informatics Sunday Poster Discussions

Sunday, Nov. 29 12:30PM - 1:00PM Location: IN Community, Learning Center

IN

AMA PRA Category 1 Credit ™: .50

Participants
Christopher R. Deible, MD, PhD, Pittsburgh, PA (*Moderator*) Nothing to Disclose

Sub-Events

IN200-SD-SUA1 Predictive Modeling of Epidermal Growth Factor Receptor Mutation Status using Semantic Image Features in Non-small Cell Lung Cancer

Station #1

Participants
Olivier Gevaert, PhD, Stanford, CA (*Presenter*) Nothing to Disclose
Sebastian Echegaray, MS, Stanford, CA (*Abstract Co-Author*) Nothing to Disclose
Amanda Khuong, Stanford, CA (*Abstract Co-Author*) Nothing to Disclose
Chuong D. Hoang, MD, Stanford, CA (*Abstract Co-Author*) Nothing to Disclose
Joseph Shrager, MD, Stanford, CA (*Abstract Co-Author*) Nothing to Disclose
Sylvia K. Plevritis, PhD, Stanford, CA (*Abstract Co-Author*) Nothing to Disclose
Sandy Napel, PhD, Stanford, CA (*Abstract Co-Author*) Medical Advisory Board, Fovia, Inc; Consultant, Carestream Health, Inc; Scientific Advisor, EchoPixel, Inc
Ann N. Leung, MD, Stanford, CA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To develop and validate a multivariate model-based on semantic image features to predict the mutation status of epidermal growth factor receptor (EGFR) in non-small cell lung cancer (NSCLC) patients.

METHOD AND MATERIALS

We studied 138 cases of NSCLC who had preoperative CT scans between 4/7/2008 and 09/15/2014 at two medical centers. We gathered preoperative thin slice CT and a radiologist annotated 89 semantic image features. Mutation testing was done for EGFR using SNaPshot genotyping. We built a predictive model of the presence of EGFR mutations using a classification tree. We split our data set in a training set of 111 patients and a test set of 27 patients in a stratified manner. We stratified this split based on smoking, gender, histology and medical center. We estimated the performance of the model using the area under the receiver operating characteristic curve (AUC).

RESULTS

Our cohort of 138 non-small cell lung cancer patients contained 36 patients positive for a mutation in EGFR. In total, 89 semantic image features were used to build a decision tree predicting presence and absence of EGFR mutation status. This decision tree had a test set performance of 0.77 AUC (std 0.08) based on four semantic image features. These features include the presence of emphysema and the presence of airway abnormalities characteristic of EGFR wild type tumors, and the proportion of ground glass opacity and the irregularity of the margins characteristic of EGFR mutated tumors.

CONCLUSION

Multivariate decision tree analysis of semantic image features can reliably predict the presence of EGFR mutations in NSCLC patients.

CLINICAL RELEVANCE/APPLICATION

Linking molecular properties of lung tumors with image features allows for novel non-invasive biomarkers.

IN201-SD-SUA2 The Effect of Manually Reviewing Free-text Clinical Information from Providers using Computerized Radiology Order Entry with Clinical Decision Support for Advanced Inpatient Imaging

Station #2

Participants
Chad Klochko, MS, MD, Farmington Hills, MI (*Presenter*) Nothing to Disclose
Aaron Green, BS, Detroit, MI (*Abstract Co-Author*) Nothing to Disclose
Andrew K. Moriarity, MD, Grand Rapids, MI (*Abstract Co-Author*) Nothing to Disclose
Safwan Halabi, MD, Stanford, CA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To retrospectively evaluate inpatient requests for advanced imaging according to the American College of Radiology (ACR) Appropriateness Criteria (AC) using clinical information submitted through the computerized radiology order entry (CROE) portal before and after the implementation of integrated clinical decision support (CDS). Recent studies have shown improvements in the CDS generated AC score for requests in multiple settings, however none have examined how CDS impacts the amount of clinical information provided for requests.

METHOD AND MATERIALS

2250 consecutive requests were collected from CROE immediately before and then 12 months after full CDS implementation. Providers selected a 'relevant clinical scenario' and 'signs and symptoms' from pull-down menus during CROE and could provide

optional free-text information in the 'clinical history' and 'additional information' fields. Free-text information was reviewed for requests that were not automatically scored by CDS software and an AC score was generated, when possible, using contemporaneously available ACR AC.

RESULTS

74% of baseline requests did not have sufficient structured data to automatically generate an AC score compared with 71% with CDS implementation. The average AC of all requests during the respective periods was 1.8 and 2.1. After manual review of the provided free-text clinical information, these percentages decreased to 14% in the baseline period and 3% with CDS and the average AC score increased to 6.2 and 6.7 respectively. Results are compared by physician specialty training.

CONCLUSION

The significant majority of inpatient advanced imaging requests submitted using CROE did not contain sufficient structured clinical data to automatically generate an AC score at the point of care. Manual review of the free-text clinical information resulted in a significant improvement in the percentage of requests with an AC score and the average AC score for all requests overall. Both effects were more pronounced when providers were aware of CDS.

CLINICAL RELEVANCE/APPLICATION

Current CROE CDS implementations require highly structured clinical data for meaningful analysis of imaging requests, however this may significantly limit the ability of software to effectively serve referring providers and methods of improving and facilitating clinical data entry should be undertaken.

IN202-SD-SUA3 Computer-Aided Detection and Artificial Neural Network for Predicting Pelvic Nodal Metastasis in Endometrial Cancer Patient Based on Diffusion Weighted Imaging and Apparent Diffusion Coefficient Values

Station #3

Participants
Tiing-Yee Siow, MD, ???, Taiwan (*Presenter*) Nothing to Disclose
Yu-Chun Lin, MSC, Taoyuan, Taiwan (*Abstract Co-Author*) Nothing to Disclose
Kuan-Tzu Tseng, BEng, Taoyuan, Taiwan (*Abstract Co-Author*) Nothing to Disclose
Gigin Lin, MD, Guishan, Taiwan (*Abstract Co-Author*) Nothing to Disclose

CONCLUSION

CAD for automatic labeling of lymph nodes on DWI can accelerate the assessment process and improve reproducibility. The ANN can help to predict the pelvic nodal status in patients with endometrial cancer, although there are considerable overlapping in the morphological appearances and ADC values between malignant and benign lymph nodes.

Background

The purpose of the present study is to develop a computer decision support system which includes a computer-aided detection (CAD) algorithm for automatic labeling of lymph node based on diffusion weighted imaging (DWI) and an artificial neural network (ANN) for prediction of pelvic nodal metastasis.

Evaluation

Twenty female patients (age 42-60 years) with pathological confirmed endometrial cancer were enrolled. DWI was obtained on a 3-T magnetic resonance system, in the axial plane using a single-shot spin-echo echo-planar with chemical-shift-selective fat-suppression technique, b-values of 0 and 1000 s/mm2. CAD was designed to automatically label all visible lymph nodes on DWI based on Hessian analysis and active contour segmentation. The developed ANN is a feed-forward multilayer ANN, which contains three layers: an input layer, a hidden layer containing 10 perceptrons, and a final output layer. The input data set includes the numbers, average sizes, average long-to-short axis ratios and average apparent diffusion coefficient (ADC) values of the lymph nodes in respective regions. All codes were written in MATLAB version 7.4 R2007a (MathWorks,Natick, MA, USA).

Discussion

The CAD for automatic labeling of pelvic lymph nodes showed a sensitivity of 85.0% and positive predictive value of 76.9%. The ANN correctly predicted 70.0% of the surgical-pathological nodal status in a region-by-region basis.

IN203-SD-SUA4 Radiologist Acceptance of Structured Reporting Tool for Lung Cancer Screening

Station #4

Participants
Jeffrey C. Taylor, BA, Pittsburgh, PA (*Abstract Co-Author*) Nothing to Disclose
Anna L. von Reden, MA, BEng, Pittsburgh, PA (*Abstract Co-Author*) Nothing to Disclose
Brian J. Kolowitz, DSc,MBA, Pittsburgh, PA (*Abstract Co-Author*) Nothing to Disclose
Christopher R. Deible, MD, PhD, Pittsburgh, PA (*Presenter*) Nothing to Disclose

PURPOSE

The purpose of this project was to evaluate if radiologists will accept an integrated structured reporting application in order to report on Low-dose CTs for lung cancer screening. The advantages of a structured reporting application include ability to capture measurement data and automate nodule characterization and ensuring nodules are identified and tracked properly in follow-up as required by new CMS guidelines.

METHOD AND MATERIALS

We developed an integrated application that links nodule classification with measurement tools provided by our PACS for use in reporting on low dose lung cancer screening CT exams. When interpretation is complete, radiologists are able to export a structured report describing the 4 nodules of highest concern, as well as an overall nodule score with associated follow up recommendations per Lung-RADS criteria. The prototype was evaluated for viability and usability with 7 radiologists from thoracic, abdominal, and

women's imaging subspecialties. Women's imaging and abdominal radiologists were consulted for usability feedback and to assess the applicability of the tool to breast, liver, and colon screening workflows. Each radiologist completed 2 scenarios: one for a new patient with no history of tracked nodules, and 1 for a follow-up patient with an existing nodule history.

RESULTS

Radiologists were able to complete both scenarios and reported that using the prototype for interpretation was an improvement over free dictation of nodule findings in reports. All 7 radiologists agreed that automated capture and tabulation of measurement data was helpful but would also like to drive series and image navigation flow from the list of prior nodules. They also agreed that automated nodule classification saved time and would lessen mental fatique.

CONCLUSION

Our results suggest that the application is a valuable proof-of-concept with strong implications for intelligent nodule tracking and reporting workflows in next generation diagnostic imaging solutions. All radiologist who used the application were enthusiastic about the potential benefits of this to help with reporting on lung cancer screeening as well as other screening applications where standard nomenclatures are available.

CLINICAL RELEVANCE/APPLICATION

The capture of structured data using a novel integrated structured reporting application will improve quality of reports and provide strucutred data to ensure clinical follow-up of findings.

IN204-SD-SUA5 A Standardized Model for Common Data Elements in Radiology

Station #5

Participants
Daniel L. Rubin, MD, MS, Palo Alto, CA (*Presenter*) Nothing to Disclose
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Tarik K. Alkasab, MD, PhD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Charles E. Kahn JR, MD, MS, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose

CONCLUSION

We developed a model for CDEs in radiology to enable standardization, sharing, and interoperability of radiology information in the major work products of radiology, including structured reports, RDS modules, and image annotations.

Background

Common data elements (CDEs) define a standard that enable interoperability of data in radiology systems. CDEs comprise the attributes and allowable values of a unit of information, such as the shape of mass, its anatomic location, its coordinates on the image, or its size. Many radiology applications-including radiology reports, computer assisted reporting decision support (RDS) modules, and image annotations-collect and convey data contained within CDEs. CDEs developed in other domains, such as oncology, enable interoperability of clinical trial data; however, to our knowledge, no such effort has been undertaken within radiology to enable computational access and interoperability of radiology data.

Evaluation

We developed a model of CDEs that is object-based and captures data elements and values using controlled terminology (see Figure) such as RadLex and DICOM. CDEs can be assembled into data collection templates for a variety of applications. Each CDE contains a unique identifier, a data element concept name (the data that CDE collects), and a value domain (the type of data that is collected and its value). CDEs also contain other attributes, such as provenance information and metadata needed by applications to determine how to use CDEs. We are evaluating our CDE model by applying it to represent data elements in the Management of Radiology Report Templates (MRRT), RDS modules, and image annotation and markup (AIM).

Discussion

Our CDE model meets the requirements of key radiology use cases. The object-based model is extensible, so that additional metadata can be added to meet the needs of future use-cases. We are working with RSNA and ACR to establish a public registry of CDEs that will be populated based on the major informatics activities in which these organizations are involved. Use of CDEs across projects such as structured reporting, reporting decision support, and AIM will enable interoperability of radiology data in the hospital enterprise.

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Daniel L. Rubin, MD, MS - 2012 Honored Educator
Daniel L. Rubin, MD, MS - 2013 Honored Educator
Charles E. Kahn JR, MD, MS - 2012 Honored Educator

IN205-SD-SUA6 Dollars and Rems: Potential Cost and Radiation Benefits of Raw CT Data Storage for Future Reformatting Driven by Automated Clinical Decision Support Tools

Station #6

Participants
Felix T. Nautsch, MS, BA, New Haven, CT (*Presenter*) Nothing to Disclose
William B. Zucconi, DO, Stony Brook, NY (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Computed tomography (CT) raw data is usually discarded shortly after acquisition and the diagnostic images are stored long term. Data storage has traditionally been costly as it must be HIPAA compliant and redundant to ensure data safety and security. There are potential benefits to storing raw data, as it can be reformatted to create different sets of diagnostic imaging examinations from a single body region. These benefits could be realized by avoiding both the unnecessary radiation exposure to our patients and the costs of repeat examinations. This retrospective review seeks to determine the number of examinations that could be potentially reformatted rather than rescanned over a given time span.

METHOD AND MATERIALS

All CT examinations performed between 11/1/2013 and 11/30/2014 were retrieved from the electronic medical record. IRB approval for medical record review was obtained. Examinations with reportable results were exported into Excel. Five regions of interest were defined: Head, neck, chest, abdomen and pelvis. Patients with a study imaging the same body area within 4 months were included. Subsequently, 108 randomly selected cases were manually reviewed and evaluated by two radiologists to identify scenarios of interest.

RESULTS

Of 125832 examinations performed in 13 months, 29208 studies performed on 10865 patients met inclusion criteria. Of the 108 manually reviewed cases, two episodes of care would have benefited from raw data storage.

CONCLUSION

With less expensive commercial HIPAA compliant cloud storage available raw data storage is feasible. The vast majority of the repeatedly imaged patients justified imaging follow up. We further defined the frequency of cases where raw data storage could have averted repeat imaging at our institution as 1.9%, potentially over 2000 CT scans per year. As raw data from a prior scan ages, its clinical relevance wanes with respect to reformatting it for additional queries. At the same time, storage costs rise. Further study could include a model seeking to define a clinically optimized storage period and weigh its cost against the potential savings realized by decreasing ionizing radiation dosage and the financial burden of unnecessary exams.

CLINICAL RELEVANCE/APPLICATION

Raw Data storage of CT exams could be used to avoid unnecessary future examinations. This type of analysis could be automated and incorporated into a clinical decision support tool.

IN206-SD-SUA7 How Does REDCap Compare with an Excel Spreadsheet for Data Collection?

Station #7

Participants
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Udo Hoffmann, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Brian B. Ghoshhajra, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

CONCLUSION

Data collection for our registry database using a customizable web-based case recording form was faster than using a spreadsheet, which allows more efficient follow-up of cases.

Background

REDCap (Research Electronic Data Capture, Vanderbilt University, TN) is a web-based data collection tool that allows biomedical researchers to create secure online forms for data collection, management and analysis with minimal effort and training. We hypothesized that it would be faster to collect Emergency department (ED) coronary CTA (CCTA) registry data on REDCap compared to standard Excel spreadsheet.

Evaluation

This is a crossover study comparing the time to collect data in minutes between REDCap and Excel spreadsheets. Two data collectors with 5 months' experience in their common project went over the same 61 patients and collected relevant clinical and imaging data regarding ED CCTA, switching data collection tool after 30 patients. This method (Figure A) was chosen to account for differences in data collection speed inherent to each collector. The data collection forms on each data collection tool had identical variables (dichotomous variables, continuous variables, and text fields for comments, example in Figure B). Statistical analysis was made using paired t-test. Mean time to collect data using REDCap was 6.2 ± 0.3, whereas using Excel was 8.0 ± 0.3 ($p < 0.0001$). We saw 2 continuous variable typographical errors in Excel that a single data-collector made. Data collection tools showed no differences in accuracy of data between each other.

Discussion

ED CCTA is a powerful tool that benefits from follow-up data to ensure quality and safety. REDCap forces data collection organized into online forms, stored securely, and easily exported to statistical software. Regarding the time to collect data endpoint, a small difference in time can make a significant additive difference when collecting large datasets, and it took 6.3 hours in REDCap compared to 8.1 hours in Excel. While we did not see enough major differences in data collection quality that could be attributed to a specific tool in our study, setting up ranges in REDCap would have prevented the two typographical errors in Excel.

Honored Educators

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Udo Hoffmann, MD - 2015 Honored Educator

Awards

IN-03-ED-SUA8 Change that Protocol Now! A Real-Time CT Radiation Dose Display for Reading Rooms

Station #8

Cum Laude

Participants
Tim O'Connell, MD, Meng, Vancouver, BC (*Presenter*) President, Resolve Radiologic Ltd; Speake, Siemens AG
Savvas Nicolaou, MD, Vancouver, BC (*Abstract Co-Author*) Institutional research agreement, Siemens AG
Luck J. Louis, MD, Vancouver, BC (*Abstract Co-Author*) Nothing to Disclose
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Debra Chang, MD, Vancouver, BC (*Abstract Co-Author*) Nothing to Disclose
John R. Mayo, MD, Vancouver, BC (*Abstract Co-Author*) Speaker, Siemens AG

TEACHING POINTS

1. That real-time displays can be used to provide instantaneous feedback about scan radiation dose and quality metrics for radiologists2. That real-time displays can be used to monitor patient safety and effect change in CT protocols3. That real-time radiation dose displays are a very useful patient and clinician relations tool in busy reading rooms where clinicians frequently visit, such as in ER/Trauma radiology reading rooms.

TABLE OF CONTENTS/OUTLINE

1. Overview of Visual Control in time-sensitive workplaces2. Goals of this systema) Immediate feedback on scan quality and safetyb) Educational tool for radiologists, trainees, and CT technologistsc) Patient and Clinician relations tool for use in a busy reading room area3. System architecturea) The use of MongoDB, a 'big-data' non-relational databaseb) Hardware and software overviewc) Information flow between network elements: how the system gets its datad) Display of real-time dose data in the reading room4. Use since implementationa) Clinician relationsb) CT Protocol changes as a result of overdose eventsc) Trainee education

INS-SUB

Informatics Sunday Poster Discussions

Sunday, Nov. 29 1:00PM - 1:30PM Location: IN Community, Learning Center

IN

AMA PRA Category 1 Credit ™: .50

FDA Discussions may include off-label uses.

Participants
Christopher R. Deible, MD, PhD, Pittsburgh, PA (*Moderator*) Nothing to Disclose

Sub-Events

IN207-SD-SUB1 DWI Made Simple with Color-coded Images

Station #1

Participants
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Luis T. Tibana, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Nitamar Abdala, MD, PhD, Mogi Das Cruzes, Brazil (*Abstract Co-Author*) Nothing to Disclose

CONCLUSION

Color-coded images reached the objective to differentiate in a single image, restriction, facilitation, T2 shine-through and blackout effect. Possible applications for this algorithm are: (1) to reduce MRI reading time performed by radiologists, (2) to make DWI interpretation easier for radiology residents and non-radiologists. Another important aspect of this work is the potential to avoid misinterpretation, either by inattention or by those who are not accustomed to the sequence. Further studies are needed to verify the potential of this algorithm.

Background

Diffusion-weighted imaging (DWI) was first created for brain imaging application, but its use in other anatomical sites has gained wide acceptance due to its undeniable diagnostic contribution. The most common use of these sequences is to analyze images with high 'b'-values and compare them with its corresponding ADC map. We propose a diagnostic tool capable of providing diffusion and ADC map information in a single image, in order to simplify MRI reading.

Evaluation

An algorithm was implemented in C# to analyze the signal intensities from both diffusion and ADC map of a given MRI exam in order to generate a novel image that assigns a default color for each of the four main possibilities (restriction, facilitation, T2 shine-through and blackout). Detailed description of the algorithm will be available in the complete form of this work.

Discussion

The program generates a new color image in which, by convention, restriction appears in blue, facilitation in yellow, T2 shine-through in white and the blackout effect in black. These colors were chosen because they yielded the best contrast, although any combination of colors could be used. A few head MRI scans were used for qualitative analysis of the algorithm.

IN208-SD-SUB2 Efficiency Investigation of Surgery Planning for Uterine Fibroid Removal by using 2D MR Images, 3D Advanced Visualization and Physical Models from 3D Printing

Station #2

Participants
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Kayo Miyaki, Gifu, Japan (*Abstract Co-Author*) Nothing to Disclose

CONCLUSION

Patient-specific 3D printing is likely the best way for supporting the surgery planning of uterine fibroid removal in the future. However, the high product cost of 3D printing prevents it from routine practice, and 3D visualization is still the practical method to support the surgery planning now.

Background

Uterine fibroid removal is a major treatment option, and surgery planning is important and guided by MR images. Instead of traditional MR image interpretation on 2D sections, advanced 3D visualization of the uterine structures with the fibroids is an another intuitive way for decision support of the surgery planning. Patient-specific 3D printing is also expected as the next generation not only used for planning but also for surgery simulation before the operation. The purpose of this work is to investigate the efficiency of the above-mentioned methods for MR-guided surgery planning for uterine fibroid removal.

Evaluation

Ten subjects for uterine fibroid surgery were used for evaluation and each case was scanned by a 3T MR imaging system (Achieva Quasar Dual 3T; Philips Medical Systems) with a protocol: T2-weighted fast spin-echo imaging. Three view patterns: 1) 2D sagittal views on MR images; 2) 3D surface rendering of uterine fibroids; and 3) Physical uterine models based on 3D printing, were used as the reference during the surgical planning by two observers (gynecologists) with 12 and 2 years of post-training experience. The decision time, procedure, and the number of fibroids for operation from each observer were recorded and compared under each view pattern.

Discussion

The accuracy rates of each observer (concordance rate with the gold standard) were assessed. Comparing the results between 2D and 3D visualization, the decision times were 19.7±9.5s vs 10.4±5.1s for observer 1 ($p < 0.05$) and 47.5±12.3s vs 19.7±9.5s for observer 2 ($p < 0.01$). The accuracy rates of the planned surgical procedures were 50% vs 70% for observer 1 and 70% vs 70% for observer 2. The accuracy rates of the numbers of fibroids to be removed were 70% vs 80% for observer 1 and 70% vs 80% for observer 2. The advanced 3D visualization and intuitive patient model from 3D printing reduced the gap on experience between two gynecologists.

IN209-SD-SUB3 Computer-aided Diagnosis for Classifying Benign and Malignant Thyroid Nodules in 2D Ultrasound Images

Station #3

Participants
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Kang Dae Lee, Pusan, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Hyoung Shin Lee, Busan, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

CONCLUSION

Even with the aforementioned limitation of this study, the classification results in accuracy and AUC show the prospect of the proposed thyroid CAD for being adopted as a second opinion for radiologists in actual clinical practice.

Background

According to national cancer statistics in 2010, the number of thyroid cancer was the largest in South Korea among all cancer types. Therefore, we propose a semi-automated computer aided diagnosis (CAD) system using 2D ultrasound images of thyroid cancer to utilize CAD as a second opinion in clinical applications for differentiating malignant from benign cases.

Evaluation

Total 118 ultrasound images consisting of axial (A) and longitudinal (L) images of 59 patients were collected, where 29 and 30 cases were biopsy-proven as being benign and malignant, respectively. Thyroid CAD was developed to extract imaging features based on nodule segmentation using adaptive diffusion flow active contour and to perform automatic classification. Five feature groups (histogram, intensity difference, elliptical fit, gray level co-occurrence matrix and gray level run length matrix) were investigated and input to a support vector machine (SVM) classifier before leave-one-out cross-validation with a forward feature selection is applied to evaluate overall accuracies. Compared with gold standard by biopsy, CAD results in accuracy of 94.9% (sensitivity: 96.7%, false positive rate: 3.4%, false negative rate: 6.7%, and specificity: 93.1%). For comparison, we measured the classification results of radiologists' visual inspection based on nodule size, composition, shape, margin, echo type and calcification in A and L. ROC analyses with univariate and multivariate features showed that performance of CAD is not inferior to that of radiologists' visual inspection. The area under the curve (AUC) for multivariate analysis was 0.949 for both CAD and radiologists' inspection.

Discussion

This study has several limitations in that the CAD is semi-automatic, requiring radiologists to select an approximate center and edge point for generating the initial ROI in segmentation process, and that the sample size needs to be increased. Fully automated CAD with refined segmentation is under consideration.

IN210-SD-SUB4 The Role of 3D Printing in Pre-operative Planning for Trans-catheter Aortic Valve Replacement (TAVR): A Conceptual Look at the Aortic Root

Station #4

Participants
Ramin Javan, MD, Washington, DC (*Presenter*) Nothing to Disclose
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Robert K. Zeman, MD, Washington, DC (*Abstract Co-Author*) Nothing to Disclose

CONCLUSION

An alternative approach to learning the intricate three-dimensional anatomy of the aortic root and its geometry and relationship to the origin of the coronary arteries was designed. This method can be used in pre-operative planning before TAVR to assure proper sizing of the valve and improving the procedural outcome.

Background

Trans-catheter Aortic Valve Replacement (TAVR) is now an alternative to surgical aortic valve replacement in patients who are high-risk surgical candidates. Accurate measurement of the size of the annulus and sinotubular junction as well as the shape of the annulus are crucial factors in appropriate selection of the valve, reducing the risk of complications such as para-valvular leaks and annular rupture. The purpose of this exhibit is to utilize 3D printing to simplify the understanding and visualization of the 3D

anatomy of the aortic root and the origin of the coronary arteries. This approach may also help increase the accuracy of estimation of the size for the aortic valve, thus improving the procedural success rate.

Evaluation

CTA images of the left ventricular out flow, aortic root and ascending aorta was imported into Materialise Mimics 17.0 to create the contrast column, from which an arbitrary wall was created. A region growing threshold was applied to segment the aorta's calcified deposition. After eliminating artifacts, a 3D surface model was computed from the segmentation masks. Subsequently, dual material 3D printing is performed through a commercial online service, allowing the production of rigid and flexible parts. An additional color-coded model that can be split open was also created after import into Autodesk 3D Studio Max 2013. This approach simplifies the 3D understanding of the aortic root, by providing an alternative method of visualization of the origin of the coronary arteries, aortic valve leaflets, and the annulus.

Discussion

An enlarged multicolor physical model of the aortic root was created with individual structures portrayed conceptually for educational purposes. A 1:1 aspect ratio model was also created for the specific use of pre-procedural planning. The necessary software and the available options for acquiring 3D models are discussed.

IN211-SD-SUB5 Automatic Segmentation of Epicardial Fat fromCT Images

Station #5

Participants
Sofia Antunes, Milan, Italy (*Presenter*) Nothing to Disclose
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Caterina Colantoni, MD, Milan, Italy (*Abstract Co-Author*) Nothing to Disclose
Giovanna Rizzo, Milan, Italy (*Abstract Co-Author*) Nothing to Disclose
Alessandro Del Maschio, MD, Milan, Italy (*Abstract Co-Author*) Nothing to Disclose

CONCLUSION

In this work, the authors presented a fully automatic method that is capable of successfully segmenting the epicardial fat on cardiac CT scans that could be used in the quantification of important parameters, such as volume and thickness.

Background

Epicardial fat may play an important role not only in the development of cardiovascular disease, but also in the mimic of scar tissue during epicardial electro-anatomic voltage mapping. Obtaining automatically the 3D structure of the epicardial fat from routinely performed cardiac CT angiographic scans is therefore of clinical interest, because manual segmentation is very time consuming. The purpose of this work is to investigate the feasibility of automatic pericardium segmentation.

Evaluation

20 patients with recurrent ventricular tachycardia and an implantable cardioverter defibrillator underwent 64-slice-MDCT angiographic scan, acquired during the first pass of a high-concentration iodine contrast bolus.The method was developed in python, based on C++ class library VTK and ITK. Each volume was automatically segmented using a 3D Level set surface evolution method, with a stopping function composed of a directional edge detector based on a small scale Gaussian second derivative ($\sigma x=3$, $\sigma y=1$). We used the Hounsfield values of -190 to -30 as fat tissue mask for the possible positions of the 3D level set propagation. For the validation, 10 equally spaced slices were extracted for each volume and the epicardial fat was manually segmented by an expert radiologist. The Dice similarity index was used to compare corresponding manual and automatic segmented slices.The segmentation method was successfully applied to all subjects with no fails. Automatic segmentation of the pericardium was achieved with a Dice similarity index of 87 ± 5% with respect to manual segmentations.

Discussion

Automaticsegmentation of epicardial fat is feasible, and may be useful in the assessment of relevant information, such as its volume and thickness. In particular, volume describes the metabolic status of the patients, while thickness can significantly improve the interpretation of epicardial voltage maps.

IN212-SD-SUB6 Texture Analysis of Ultrasound Elastography Image for Quantitative Assessment of Cutaneous Carcinoma

Station #6

Participants
Michael A. Morris, MD, MS, Baltimore, MD (*Presenter*) Nothing to Disclose
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Bahar Dasgeb, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the feasibility of using quantitative texture features computed from high frequency ultrasound and ultrasound elastography (USE) images in the discrimination of benign from malignant skin lesions.

METHOD AND MATERIALS

A commercial ultrasound system with a 14 MHz transducer was used to visualize skin lesions requiring biopsy on clinical evaluation. Anatomic ultrasound and USE imaging of the skin lesions was performed using a 2-4 mm gel standoff pad before biopsy and histopathological evaluation. The ElastoAnalysis software developed for the texture analysis of ultrasound elastography images was provided by Hitachi. The software computes thirteen texture features within a region of interest (ROI) in three steps, which have demonstrated promise in diagnostic characterization of liver fibrosis staging and in quantitative elastography of breast cancer. This approach has not yet been studied in the quantitative assessment of skin cancer. Three different methods for creating an ROI for analysis were evaluated. Results were retrospectively compared to the the histopathological diagnosis and a diagnostic criteria with the goal of maximizing sensitivity was evaluated for each textural features.

RESULTS

Of the 39 lesions included, among 30 patients who participated, 13 lesions were malignant and 25 were benign. Eleven out of thirteen textural metrics computed by the software were useful in differentiating benign from malignant lesions with sensitivities ranging from 92-100% and specificities ranging from 28-92%.

CONCLUSION

This feasibility study demonstrated that textural analysis of USE may be useful in quantitatively differentiating cancerous from benign primary solitary skin lesions prior to biopsy.

CLINICAL RELEVANCE/APPLICATION

Ultrasound elastography augmented by computational texture analysis could one day provide a non-invasive approach to distinguish some benign from malignant skin lesions based on features not visible by physical examination alone and reduce the need for biopsy.

IN213-SD-SUB7 Multifeature Web-based Teaching File for Head CT Interpretation Skills

Station #7

Participants
Jens Borgbjerg, MD, Aarhus, Denmark (*Presenter*) Nothing to Disclose
Roland S. Talanow, MD, PhD, South Lake Tahoe, NV (*Abstract Co-Author*) President, InnoMed LLC;

CONCLUSION

A TF for search pattern acquisition in neuroimaging has been developed that is free and publicly available.

Background

An essential element in educating a radiology trainee is the development of a search pattern for timely and thorough reading of an imaging study. Hitherto only a few teaching files (TFs) have explicitly addressed the aspect of "how to read a study" and these TFs are limited in functionality. In an effort to address this deficiency we created an interactive open access TF for self-directed acquisition of head CT interpretation skills.

Evaluation

The developed TF has a PACS-like user interface where trainees can read cases in a manner which closely mirrors the work process at a radiological work station. A text with a checklist step-by-step approach on how to read a study can be shown alongside a case as well as video instruction showing the actual reading process. Case information provides elaborate and immediate feedback upon request. Representative cases of common neuroradiological entities and pitfalls in head CT were selected from our in-house resident case collection and uploaded to the TF. Based on a review of the literature we incorporated several attractive features in the TF not previously seen in combination: (1) web-based, platform agnostic and touch device compatible (2) multiplanar reconstructions with cross reference lines (3) measurement tools (4) hidden diagnosis, annotation visibility toggle and supplementary case information (5) elaborate search feature (6) quiz function (7) window-level selection (8) brightness/contrast, pan and zoom function (9) wikipedia integration. In addition a fully annotated head CT of the normal imaging anatomy is embedded for direct comparison with the provided cases. Furthermore a case authoring module is available. The TF is cloud-based and was developed using PHP/mySQL and HTML5/Javascript.

Discussion

Our multifeature TF expands upon the existing TFs by providing the trainee a tool for deliberate practice of a systematic approach to reading a head CT and thereby facilitating the formulation of a search pattern. Future plans include expanding the TF with other anatomical regions/modalities and assessing the learning efficiency of the TF.

IN104-ED-SUB8 Application of 3D Printing in Breast Cancer Management: Reconstruction Surgery and Radiotherapy

Station #8

Participants
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Dimitris Mitsouras, PhD, Boston, MA (*Abstract Co-Author*) Research Grant, Toshiba Corporation; Speakers Bureau, Toshiba Corporation
Stephanie A. Caterson, MD, Jamaica Plain, MA (*Abstract Co-Author*) Nothing to Disclose
Frank J. Rybicki III, MD, PhD, Ottawa, ON (*Abstract Co-Author*) Research Grant, Toshiba Corporation;
Robyn L. Birdwell, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

1. Volumetric analysis of the breasts through the use of 3D reconstruction and 3D printed models enables improved accuracy in preoperative planning and operative flap harvest.2. Preoperative planning may reduce intraoperative tissue plane alteration and resulting fat necrosis, operative and sedation times and associated complications and may yield better aesthetic outcomes minimizing revision surgeries3. 3D printing can be used to create patient specific brachytherapy templates and customized radiotherapy shields4. Customizable 3D printed breast phantoms can be used for training in localizing biopsy sites and practicing interventional procedures 5. Bio-printing of live skin and fat cells is being investigated to potentially improve nipple reconstruction

and fat grafting of lumpectomy sites

TABLE OF CONTENTS/OUTLINE

1- Epidemiology of breast cancer and overview of treatment options 2- Review current volumetric analysis techniques including anthropometric measurements, 3D photography and laser scanning3- Describe methods of 3D reconstruction from CT/MRI data to match breast and flap volumes and explore uses of 3D printed models in surgical planning.4- Describe applications of 3D printing for localization of mass and training for interventional procedures5- Duscuss future directions including bioprinting and personalized radiotherapy

Honored Educators

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Robyn L. Birdwell, MD - 2015 Honored Educator

RC153

Informatics-enabled Peer Review - Lessons from Large Scale Implementations

Sunday, Nov. 29 2:00PM - 3:30PM Location: S404CD

IN LM

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
Jonathan B. Kruskal, MD, PhD, Boston, MA, (jkruskal@bidmc.harvard.edu) (*Moderator*) Author, UpToDate, Inc

LEARNING OBJECTIVES

Sub-Events

RC153A ACR RadPeer Experiences

Participants
Hani H. Abujudeh, MD, MBA, Boston, MA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Discuss the components of the ACR RADPEER system. 2) List the strengths and weakness of RADPEER.

ABSTRACT

RADPEER is the ACR peer review system, used by over 17,000 radiologists. It is the largest radiology peer review system in the world. RADPEER has undergone many improvements since first released, and more improvements are coming in the future. RADPEER design includes an interesting case section. Future improvements may be in ways to use RADPEER data for Performance Improvement activities.

RC153B Focus on Workflow Integration

Participants
Tarik K. Alkasab, MD, PhD, Boston, MA, (talkasab@mgh.harvard.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Describe how RADPEER-based systems are typically integrated into radiology workflows. 2) Describe how alternative, group-based peer review systems can be integrated into radiology workflows. 3) Discuss emerging methods of integrating radiology peer review with the radiologist workday.

RC153C Peer Review Analytics

Participants
V. Anik Sahni, MD, Boston, MA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Describe the importance of analytics in the peer review process. 2) Explore the IT solutions available to develop an analytics tool. 3) Discuss data presentation and important key metrics.

RC153D Impact of Peer Review on the Quality of Interpretation

Participants
Jonathan B. Kruskal, MD, PhD, Boston, MA, (jkruskal@bidmc.harvard.edu) (*Presenter*) Author, UpToDate, Inc

LEARNING OBJECTIVES

1) Discuss emerging options for effective peer review. 2) Describe ways in which pee rreview can result in improved perfromancve. 3) Descibe methods for improving the utility and effectiveness of the peer review process.

ABSTRACT

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Jonathan B. Kruskal, MD, PhD - 2012 Honored Educator

RC154

Precision Medicine through Image Phenotyping

Sunday, Nov. 29 2:00PM - 3:30PM Location: S403A

CA CH VA BQ IN

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
Ella A. Kazerooni, MD, Ann Arbor, MI (*Moderator*) Nothing to Disclose

LEARNING OBJECTIVES

1) To learn what the term precision medicine means. 2) To understand how informatics intersects with clinical radiology to enable precision medicine in practice. 3) To learn through concrete examples how informatics based radiology precision medicine impacts health

ABSTRACT

Biomarkers have been emrabced by both the scientific and regulatory communities as surrogates end points for clinical trials, paving the way for their widespread use in medicine. The field of imaging biomarkers has exploded, and the their integration into clinical practice relies heaving on and intersects with the field of bioinformatics.. Once specific biomakers are show to have value, easily integrating them into the digital environment of the radiologist and communcating them to the health care providers and or directly to patients effeiciently and seamlessly is important for their value and impact on health to be realized. Culturally, it is taking radiologists from the era of description and largely qualitative reporting, into a quantitative future state, and leveraging informatics to extract information from imaging alone ot together with data available in the electronic medical record is essential for future sucess in this new world. To get there, understanding the impact of this approach as a value of our services, and standardization of imaging technques along the lines of what the RSNA QIBA initiative is designing, are essential, so that imaging biomarkers are robust, accurate and reprodicbile. Embraching this approach enables and facilitates new appracohes, relationships of imaging and IT researchers, vendors and consumers, to fully realize the possiblities. This course will discuss and describe the overall constructs, and use tangible exams of using this in practice today and for the future.

Sub-Events

RC154A Lung Nodules: Combining Population and Patient Specific Data to Inform Personalized Decision Making

Participants
Eliot L. Siegel, MD, Severna Park, MD (*Presenter*) Research Grant, General Electric Company; Speakers Bureau, Siemens AG; Board of Directors, Carestream Health, Inc; Research Grant, XYBIX Systems, Inc; Research Grant, Steelcase, Inc; Research Grant, Anthro Corp; Research Grant, RedRick Technologies Inc; Research Grant, Evolved Technologies Corporation; Research Grant, Barco nv; Research Grant, Intel Corporation; Research Grant, Dell Inc; Research Grant, Herman Miller, Inc; Research Grant, Virtual Radiology; Research Grant, Anatomical Travelogue, Inc; Medical Advisory Board, Fovia, Inc; Medical Advisory Board, Toshiba Corporation; Medical Advisory Board, McKesson Corporation; Medical Advisory Board, Carestream Health, Inc; Medical Advisory Board, Bayer AG; Research, TeraRecon, Inc ; Medical Advisory Board, Bracco Group; Researcher, Bracco Group; Medical Advisory Board, Merge Healthcare Incorporated; Medical Advisory Board, Microsoft Corporation; Researcher, Microsoft Corporation

LEARNING OBJECTIVES

1) Describe how data from a clinical trial can be repurposed as a decision support tool. 2) List some of the potential techniques that can be utilized to predict likelihood of a malignant nodule from the NLST database. 3) Explain how the Fleischner Guidelines can be personalized utilizing data from NLST and PLCO. 4) Detail the implications for lung screening trials of having access to NLST and PLCO data. 5) Demonstrate how a healthcare enterprise can create their own local reference database using information from their own patient population.

ABSTRACT

The era of personalized/precision medicine offers the potential to utilize patient and lesion specific data to personalize screening and diagnostic work-up, diagnosis, and treatment selection to a particular patient to optimize effectiveness. Although recently, the emphasis has been on utilization of genomic data in personalized medicine, there is a 'gold mine' of useful data in previously conducted clinical trials as well as patient medical electronic records that has, until now, gone largely untapped. The purpose of this presentation is to describe how the screening, diagnosis, and treatment of lung nodules can be personalized utilizing data from the NLST and PLCO clinical trials and how the Fleischner Guidelines and screening criteria for lung cancer can be modified according to the characteristics of an individual patient and individual nodule. The presentation will also include ways in which a facility can collect local data on their own patients to supplement these reference databases with experience from their own patient population.

RC154B Managing Cardiovascular Care through Image Phenotyping Combined with Patient Level Data

Participants
John J. Carr, MD, MS, Nashville, TN (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

ABSTRACT

Cardiovascular diseases(CVD) develop over an individual's lifetime. CVD is the number one cause of death and morbidity worldwide. Integrated application of genomics, quantitative imaging and "big data" has the potential to positively transform cardiovascular

prevention and care and reduce the health and economic consequence of CVD. In this talk we will review how easily obtainable imaging biomarkers, already available, can power this change. Measures of cardiac and vascular structure and function as well as body composition provide great insight into and individual's risk of CVD, level of physical activity, diet, vascular health and general well-being.

RCA12

National Library of Medicine: Find Articles You Need: Searching PubMed/MEDLINE Efficiently (Hands-on)

Sunday, Nov. 29 2:00PM - 3:30PM Location: S401AB

IN

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
Tony Nguyen, MLIS, Baltimore, MD, (tnguyen@hshsl.umaryland.edu) (*Presenter*) Nothing to Disclose
Holly Ann Burt, MLIS, Chicago, IL (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand how PubMed constructs a query and how to develop and refine effective search strategies in radiology. 2) Use PubMed tools including Clinical Queries, Related Articles, Single Citation Matcher and Loansome Doc. 3) Build focused searches using the Medical Subject Headings (MeSH) vocabulary for radiology and limit searches to radiology-oriented journals. 4) Understand how to save and download citations.

ABSTRACT

This hands-on workshop covers key searching techniques, changes to PubMed, and how to develop effective search strategies for PubMed and MEDLINE. Topics covered include: why keywords don't always give the results you expect, how to limit to specific journals, quick searches to find evidence-based citations, how to access full-text articles, and downloading citations to reference manger programs. The National Library of Medicine (NLM) provides free web access to nearly 24 million citations for biomedical and clinical medical articles through PubMed (available online at PubMed.gov). MEDLINE is a subset of PubMed which includes links to sites providing full text articles and to other related databases and resources.

URL

Handout:Holly Ann Burt

http://abstract.rsna.org/uploads/2015/13013403/2015pubmedRSNA.pdf

RCB12

Creating and Delivering Online and Mobile Education Content: From Online Courses to Interactive iBooks (Hands-on)

Sunday, Nov. 29 2:00PM - 3:30PM Location: S401CD

ED **IN**

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
George L. Shih, MD, MS, New York, NY, (george@cornellradiology.org) (*Moderator*) Consultant, Image Safely, Inc; Stockholder, Image Safely, Inc; Consultant, Angular Health, Inc; Stockholder, Angular Health, Inc;

LEARNING OBJECTIVES

1) Assess the potential of online and mobile e-learning innovations to augment your residents', medical students', and staff's educational curricula. 2) Acquire the domain knowledge to use already available content (eg, PowerPoint presentations) to both create video content and deploy e-learning courses on modern web-based and mobile platforms. 3) Acquire the domain knowledge to create an interactive Apple iBook (electronic books) with text, images, video, and interactive questions.

ABSTRACT

1. From OpenCourseWare to the Khan Academy, and now to Coursera and edX, e-learning has been dramatically improved over the last decade, changing education from the normal classroom into learning done at convenience, and also allows for more creative and engaging content during the typical lecture. Stanford Med published positive initial findings in utilizing video-based lectures in an interactive class setting. Leveraging this new way of learning, requires knowledge about the types of technology and platforms for these courses.2. The workflow required to host an e-learning course can be summarized in 3 steps: (a) creating the educational content, (b) hosting the materials, and (c) making the materials available to the intended audience. E-content today typically consists of lecture slides along with video recordings captured by technology like TechSmith Camtasia (non-free) and Apple Quicktime (free). Once the materials are created and edited, one must choose a suitable hosting platform realistic to the skills and goals of the instructor with options that include coursesites.com, iTunes U, and YouTube / Google Hangouts. Students can then be invited to view the material or the content can be made available to the public.3. Creating and publishing e-books is a great way to share your teaching material as an engaging interactive tool. Publishing in e-book format solves many logistical problems of conventional publishing and the e-book format has interactive features that paper books can't match. We will review the process of creating your own e-book from assembling material to layout design to submitting for e-publication. Specifically Apple iBooks Author software will be used to demonstrate converting an existing Powerpoint presentation or journal publication into an e-book. In addition, the course will go over how to publish with or without DRM (copy-protection) and ways to obtain an ISBN for publishing for sale. Online resources will also be reviewed.

Sub-Events

RCB12A Screencasting Basics on the Desktop and on the iPad

Participants
Ian R. Drexler, MD, MBA, New York, NY (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

RCB12B Massive Open Online Course (MOOC) Creation and Hosting

Participants
Kurt T. Teichman, BSc, MEng, New York, NY (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

RCB12C Interactive iBooks to Supplement your Online Course

Participants
Alan C. Legasto, MD, New York, NY (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

RCC12

IHE Workflow Efficiency from Acquisition to the Report

Sunday, Nov. 29 2:00PM - 3:30PM Location: S501ABC

IN

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
Bradley J. Erickson, MD, PhD, Rochester, MN (*Moderator*) Stockholder, Evidentia Health, Inc; Stockholder, OneMedNet Corporation; Stockholder, VoiceIt Technologies, LLC
Bradley J. Erickson, MD, PhD, Rochester, MN (*Presenter*) Stockholder, Evidentia Health, Inc; Stockholder, OneMedNet Corporation; Stockholder, VoiceIt Technologies, LLC
Harry Solomon, Barrington, IL (*Presenter*) Employee, General Electric Company
Brad Genereaux, Waterloo, ON, (brad.genereaux@agfa.com) (*Presenter*) Employee, Agfa-Gevaert Group

LEARNING OBJECTIVES

1) Understand the IHE profile for managing radiology report templates (MRRT). 2) Learn about the RSNA template library and how it works together with the MRRT profile so you can easily download and use RSNA templates. 3) Discover how the MRRT profile allows you to take your templates with you when you change systems or change jobs. 4) Review the enhanced features available in MRRT templates.

ABSTRACT

The purpose of this session is to demonstrate how existing and planned IHE profiles can help improve the workflow in a medical imaging department, and help those responsible for its operation, monitor what is happening. Prior IHE profiles focused heavily on traditional RIS and PACS. Newer projects are focused on departmental workflow management and monitoring, as well as exchange of images and reports between medical facilities. We will also describe future possible profiles for utilizing RadLex to improve radiologist efficiency and improve departmental workflow.

RCA13

3D Printing (Hands-on)

Sunday, Nov. 29 4:00PM - 5:30PM Location: S401AB

IN

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
Frank J. Rybicki III, MD, PhD, Ottawa, ON (*Moderator*) Research Grant, Toshiba Corporation;
Frank J. Rybicki III, MD, PhD, Ottawa, ON (*Presenter*) Research Grant, Toshiba Corporation;
Jane S. Matsumoto, MD, Rochester, MN (*Presenter*) Nothing to Disclose
Jonathan M. Morris, MD, Rochester, MN (*Presenter*) Nothing to Disclose
Dimitris Mitsouras, PhD, Boston, MA (*Presenter*) Research Grant, Toshiba Corporation; Speakers Bureau, Toshiba Corporation
Andreas Giannopoulos, MD, Boston, MA, (agiannopoulos1@partners.org) (*Presenter*) Nothing to Disclose
Nicole Wake, MS, New York, NY (*Presenter*) Nothing to Disclose
Peter C. Liacouras, PhD, Bethesda, MD (*Presenter*) Nothing to Disclose
Thomas A. Foley, MD, Rochester, MN (*Presenter*) Nothing to Disclose
Kiaran P. McGee, PhD, Rochester, MN (*Presenter*) Nothing to Disclose
Michael W. Itagaki, MD, MBA, Seattle, WA (*Presenter*) Owner, Embodi3D, LLC
Shannon N. Zingula, MD, Rochester, MN (*Presenter*) Nothing to Disclose
Leonid Chepelev, MD,PhD, Ottawa, ON (*Presenter*) Nothing to Disclose
Adnan M. Sheikh, MD, Ottawa, ON (*Presenter*) Nothing to Disclose
AiLi Wang, Ottawa, ON (*Presenter*) Nothing to Disclose
Wilfred Dang, BS, Ottawa, ON (*Presenter*) Nothing to Disclose
Ekin P. Akyuz, BSc, Ottawa, ON (*Presenter*) Nothing to Disclose
Taryn Hodgdon, MD, Ottawa, ON (*Presenter*) Nothing to Disclose
Carlos H. Torres, MD, Ottawa, ON (*Presenter*) Nothing to Disclose
Anji Tang, Boston, MA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Learn the Standard Tessellation Language (STL) file format that is used in 3D priting. 2) Be exposed to a software package to enable segmentation of DICOM images using semi-automated and manual segmentation algorithms, allowing the user to demarcate desired parts. The most commonly used tools are thresholding, region growing, and manual sculpting. 3) Learn refinement of an output STL output so that it can be optimized for accurate printing of the desired anatomy and pathology. This step uses Computer Aided Design (CAD) software is used to perform steps such as "wrapping" and "smoothing" to make the model more homogeneous.

ABSTRACT

"3D printing" refers to fabrication of a tangible object from a digital file by a 3D printer. Materials are deposited layer-by-layer and then fused to form the final object. There are several 3D printing technologies that share similarities but differ in speed, cost, and resolution of the product. Digital Imaging and Communications in Medicine (DICOM) image files cannot be used directly for 3D printing; further steps are necessary to make them readable by 3D printers. The purpose of this hands-on course is to convert a set of DICOM files into a 3D printed model through a series of simple steps. Some of the initial post-processing steps may be familiar to the radiologist, as they share common features with 3D visualization tools that are used for image post-processing tasks such as 3D volume rendering. However, some are relatively or completely new to radiologists, including the manipulation of files in Standard Tessellation Language (STL). It is the STL format that is read by the 3D printer and used to output the hand held part of the patient's anatomy. This 90 minute session will begin with a DICOM file and will proceed through the steps to create a printable STL file. An extensive training manual will be provided before the meeting. It is highly recommended that participants review the training manual to optimize the experience at the workstation.

URL

Active Handout:Frank John Rybicki

http://abstract.rsna.org/uploads/2015/14003455/Active RCA13.pdf

RCC13

Optimizing PowerPoint Slides

Sunday, Nov. 29 4:00PM - 5:30PM Location: S501ABC

ED IN

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
William J. Weadock, MD, Ann Arbor, MI (*Presenter*) Owner, Weadock Software, LLC
Sarah C. Abate, BS, Ann Arbor, MI (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Review the components of an optimal slide presentation. 2) Learn about common errors made in slide preparation and how they can be avoided. 3) Learn about how to improve the quality of a presentation by using optimal different slide backgrounds, font size and color, and image sizes. 4) Learn tips to ensure a smooth presentation.

ABSTRACT

Electronic presentations are very common in radiology practice. This hands-on demonstration and questions and answer session will show attendees how to optimize their presentations. The focus will be on the use of slide templates, color selection (font and background), font and image size, and animations. Additional review of image and video display and management will be covered. Demonstrations will include tips to decrease time creating and modifying presentations. Bring your questions!

RC218

Have RADS Gone Wild? Remaining Challenges of Standardized Reporting and Data Systems

Monday, Nov. 30 8:30AM - 10:00AM Location: N229

OI IN SQ

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants

Sub-Events

RC218A BI-RADS: Why Bother?

Participants
Carol H. Lee, MD, New York, NY (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand the rationale behind the development of BI-RADS. 2) Comprehend the application of BI-RADS in clinical practice. 3) Recognize the contribution of BI-RADS in improving patient outcomes.

RC218B LI-RADS: Pros, Cons and Solutions

Participants
Claude B. Sirlin, MD, San Diego, CA (*Presenter*) Research Grant, General Electric Company; Speakers Bureau, Bayer AG; Consultant, Bayer AG ; ;

LEARNING OBJECTIVES

1) To review the advantages, challenges, solutions, and future directions for standardized reporting of liver imaging examinations using LI-RADS.

RC218C PI-RADS: What Is the Supporting Evidence?

Participants
Hebert Alberto Vargas, MD, New York, NY, (vargasah@mskcc.org) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand the rationale for PI-RADS. 2) Highlight the updates included in PIRADS v2. 3) Discuss the evidence basis for PI-RADS and present the literature highlighting its strengths and limitations.

ABSTRACT

The Prostate Imaging Reporting and Data System (PIRADS), published in 2012, was one of the first well-orchestrated efforts focused on "integration, reporting and communication of multi-parametric prostate MRI". The guideline was updated in 2015 (PIRADS v2) to address some of the limitations of the original version. This session will cover the highlights of PIRADS v2 and discuss the published evidence supporting or questioning the recommendations included in this guideline.

RC224

Understanding and Using the STARD (Standards for Reporting Diagnostic Accuracy Studies) and PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) Guidelines

Monday, Nov. 30 8:30AM - 10:00AM Location: E352

IN

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
Herbert Y. Kressel, MD, Boston, MA (*Moderator*) Royalties, Bayer AG
Herbert Y. Kressel, MD, Boston, MA (*Presenter*) Royalties, Bayer AG
Deborah Levine, MD, Boston, MA, (dlevine@rsna.org) (*Presenter*) Editor with royalties, UpToDate, Inc; Editor with royalties, Reed Elsevier;
Patrick M. Bossuyt, PhD, Amsterdam, Netherlands (*Presenter*) Nothing to Disclose
Matthew D. McInnes, MD, FRCPC, Ottawa, ON, (mmcinnes@toh.on.ca) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1)To familiarize attendees with reasons for why quality improvement initiatives are important for the dissemination of published research. 2) To discuss the components of the STARD criteria and why these are important for studies of diagnostic accuracy. 3) To describe the PRISMA statement and why these make up key components of high quality systematic reviews. 4) To enable authors to improve completeness of reporting in their submitted manuscripts, to demonstrate study quality and thus enhance the liklihood that their manuscripts will be favorably reviewed when submitted to journals for publication.

ABSTRACT

The purpose of this session is to describe STARD and PRISMA, two documents that aim to improve scientific study quality by improving reporting. The Editor of Radiology, Dr. Herbert Kressel, Professor Radiology at Harvard Medical School, will introduce the importance of quality metrics in scientific research. Dr. Patrick Bossuyt, Professor of Clinical Epidemiology at University of Amsterdam, and one of the original authors of the STARD manuscript who is currently working to revise STARD, will discuss the components of the STARD criteria and why these are important for studies of diagnostic accuracy. Dr. Matthew McInnes, Associate Professor of Radiology at University of Ottawa, and our 2014 Eyler Editorial fellow will describe the PRISMA statement and the important key components of high quality systematic reviews. Dr. Deborah Levine, Professor of Radology at Harvard Medical School and the Senior Deputy Editor of Radiology will describe how to put all of this information together into your final study plan and written manuscript. Our goal is to enable authors to improve completeness of reporting in their submitted manuscripts, to demonstrate study quality and thus enhance the liklihood that their manuscripts will be favorably reviewed when submitted for publication. Please see our publication information for authors at : http://pubs.rsna.org/page/radiology/pia.

RC253

Leveraging Your Data: Informatics Approaches and Solutions to Improve Imaging Care Delivery

Monday, Nov. 30 8:30AM - 10:00AM Location: E353A

IN SQ

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
Arun Krishnaraj, MD, MPH, Charlottesville, VA (*Moderator*) Nothing to Disclose

LEARNING OBJECTIVES

1) Identify unmet needs of current and future practices with regards to emerging and existing informatics tools. 2) Apply existing and emerging informatics applications to improve report generation. 3) Demonstrate an understanding of how best to achieve consistency of radiologists' recommendations.

ABSTRACT

Existing and emerging informatics applications have the potential to markedly improve the quality of imaging care delivery. Much of the inefficiency and inconsistency of report generation could be potentially solved with the appropriate informatics application. In this session, the learner will gain an apprecation of the unmet needs of current and future pracitces and discover how novel applications developed at various institutions across the country are seeking to plug these voids and improve imaging care delivery.

Sub-Events

RC253A The Unmet Needs of Current and Future Practices

Participants
Michael E. Zalis, MD, Boston, MA (*Presenter*) Co-founder, QPID Health Inc; Chief Medical Officer, QPID Health Inc; Stockholder, QPID Health Inc

LEARNING OBJECTIVES

1) Describe some of the external mandates and requirements facing practicing radiologists. 2) Describe gaps in function that exist between these requirements and the functionality provided by EHR and PACS systems. 3) Provide example approaches and example solutions to bridge these gaps.

ABSTRACT

RC253B Augmenting Image Interpretation through the Use of Advanced Health Record Technology

Participants
Arun Krishnaraj, MD, MPH, Charlottesville, VA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Appreciate the current state of Electronic Health Record (EHR) technology and adoption in the United States. 2) Identify areas where EHR integration into the daily workflow of Radiologists is lacking. 3) Demonstrate an understanding of the importance of incorporating data contained in the EHR to generate high quality reports. 4) Understand the consequences of under utilizing data contained in the EHR.

ABSTRACT

Advanced heath information technologies, specifically EHR systems, are undergoing rapid dissemination and widespread adoption spurred by initiatives in the American Recovery and Reinvestment Act of 2009. When properly integrated into clinical workflow, an EHR can improve both the quality and efficiency of care delivery. Radiology has long been at the forefront with respect to information technology (IT), however the integration of EHR data into radiolgists' workflow is lacking which affects the efficiency, safety, and costs of Imaging. Emerging advanced heatlh record technologies which incorporate natural language processing and semantic search allow the radiologists to retrieve and incorporate relevant clinical data when generating reports thereby improving both efficiency and quality. In this session, the learner will explore how one such health intelligence platform, known as QPID (Queriable Patient Inference Dossier), allows for the creation of search queries tailored to the workflow of an abdominal radiologist.

RC253C Bone Age and Skeletal Atlas Decision Support Tools with Patient Context Integrated into Clinical Workflow

Participants
Cree M. Gaskin, MD, Keswick, VA, (cree@virginia.edu) (*Presenter*) Author with royalties, Oxford University Press; Author with royalties, Thieme Medical Publishers, Inc; ;

LEARNING OBJECTIVES

1) Review concepts for contemporary decision support tools for diagnostic radiologists. 2) Discuss bone age and skeletal atlas decision support tools integrated into clinical diagnostic workflow via context sharing.

ABSTRACT

There are numerous references available to radiologists to aid image interpretation or provide guidance on management of imaging findings. Given the vast amounts of information we are expected to know and the speed with which we are expected to perform our

clinical work, it is helpful to have quick and easy access to relevant resources at our point-of-care (e.g., during image interpretation and reporting). Such resources should be available in electronic format on our diagnostic workstations and, when relevant, be integrated with our clinical applications. Our Radiology Information System (RIS), PACS, and/or Electronic Health Record (EHR) can share study and patient context information with decision support tools to facilitate our diagnostic workflow. Examples to be shared include modern remakes of classic printed atlases in pediatric skeletal imaging, updated to contemporary electronic tools integrated with PACS and EHR applications to expedite workflow and reduce error.

RC253D Advanced Decision Support Tools for the Radiologists

Participants
Giles W. Boland, MD, Boston, MA (*Presenter*) Principal, Radiology Consulting Group; Royalties, Reed Elsevier

LEARNING OBJECTIVES

View learning objectives under main course title.

RC254

Health IT Policy Panel: The New Federal Requirement for Imaging Decision Support (H.R. 4302)

Monday, Nov. 30 8:30AM - 10:00AM Location: S102C

HP IN

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
David B. Larson, MD, MBA, Los Altos, CA (*Moderator*) Intellectual property license agreement, Bayer AG; Potential royalties, Bayer AG

Sub-Events

RC254A Overview of the Imaging Decision Support Requirement

Participants
Curtis P. Langlotz, MD, PhD, Menlo Park, CA, (langlotz@stanford.edu) (*Presenter*) Shareholder, Montage Healthcare Solutions, Inc; Advisory Board, Reed Elsevier; Advisory Board, Activate Networks, Inc;

LEARNING OBJECTIVES

1) Understand the requirements and scope of the new U.S. Federal decision support requirement in the Protecting Access to Medicare Act of 2014. 2) Learn the legal definition of appropriate use criteria. 3) Calculate the financial penalties for non-compliance. 4) Recognize the challenges CMS will face in implementing the law. 5) Recognize the challenges health care organizations will face in responding to the law.

Active Handout:Curtis P. Langlotz

http://abstract.rsna.org/uploads/2015/15003159/RC254A.pdf

RC254B The Origins of the Imaging Decision Support Legislation

Participants
Keith J. Dreyer, MD,PhD, Boston, MA (*Presenter*) Medical Advisory Board, IBM Corporation

RC254C Experience and Recommendations of the High Value Health Care Collaborative

Participants
Keith S. White, MD, Murray, UT, (keith.white@imail.org) (*Presenter*) Software support, Jidoka Systems

RC254D CMS Approach to Implementing the Legislation: Current Status

Participants
Joseph Hutter, Baltimore, MD (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand the key provisions of Section 218(b) of PAMA 2014. 2) Understand the CMS Final Rule setting up a new nationwide program for appropriate use criteria for imaging. 3) Understand the timetable for future components of the CMS program.

URL

https://www.federalregister.gov/articles/search?conditions%5Bregulation_id_number%5D=0938-AS40

RCA21

Creating, Storing, and Sharing Teaching Files Using RSNA's MIRC® (Hands-on)

Monday, Nov. 30 8:30AM - 10:00AM Location: S401AB

ED IN

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
Krishna Juluru, MD, New York, NY (*Moderator*) Nothing to Disclose
Andre M. Pereira, MD, Toronto, ON (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Learn how easy it is to install the new and improved RSNA teaching file software with the one-click installer. 2) Learn how to create, organize, and share teaching files, create conference documents and save interesting cases for yourself, your group or your department.

RCB21

Hands-on Introduction to Social Media (Hands-on)

Monday, Nov. 30 8:30AM - 10:00AM Location: S401CD

IN

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 0

Participants
C. Matthew Hawkins, MD, Decatur, GA, (matt.hawkins@emory.edu) (*Presenter*) Nothing to Disclose
Safwan Halabi, MD, Stanford, CA (*Presenter*) Nothing to Disclose
Neil U Lall, MD, Cincinnati, OH (*Presenter*) Nothing to Disclose
Tirath Y. Patel, MD, Toledo, OH (*Presenter*) Nothing to Disclose
Amy L. Kotsenas, MD, Rochester, MN (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Appreciate the professional relevance of social media for radiologists. 2) Understand the differences between Facebook pages and personal accounts. 3) Set up and use a Twitter account. 4) Understand the purpose of hashtags, lists, tweetchats, and DMs. 5) Get acquainted with other radiologists and radiology organizations on Twitter . 6) Understand the difference between and utility of professionally oriented social networking sites such as Doximity and LinkedIn. 7) Understand how to safely /securely communicate via social media while maintaining HIPAA requirements.

ABSTRACT

URL

http://bit.ly/RSNASocialMediaIntro

Active Handout:Safwan Halabi

http://abstract.rsna.org/uploads/2015/11035016/RCB21.pdf

Active Handout:Amy Louise Kotsenas

http://abstract.rsna.org/uploads/2015/11035016/RCB21.pdf

RCC21

Imaging Informatics: Year in Review (RSNA/AMIA/SIIM Joint Sponsorship)

Monday, Nov. 30 8:30AM - 10:00AM Location: S501ABC

IN

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants

Sub-Events

RCC21A Best of Ontologies, Reporting, and Natural Language Processing

Participants
Charles E. Kahn JR, MD, MS, Philadelphia, PA, (charles.kahn@uphs.upenn.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Review the year's most significant advances in imaging informatics. 2) Understand current directions in biomedical informatics research of importance to radiology, including ontologies, data mining, natural language processing, reporting systems, and decision support. 3) Describe recent advances in image processing and analysis, and their applications in radiology, including filtering, image reconstruction and visualization, computer-aided diagnosis, and pattern recognition.

ABSTRACT

Informatics plays an increasingly important role in radiology research and practice. This session, developed in partnership with the Americal Medical Informatics Association (AMIA) and the Society for Imaging Informatics in Medicine (SIIM), highlights the year's most important advances in imaging informatics. We present leading research in image processing, image analysis, and other areas of biomedical and health informatics that impact medical imaging, including filtering, image reconstruction and visualization, computer-aided diagnosis, and pattern recognition, decision support, ontologies, reporting, data mining, and natural language processing. The presentations will feature techniques that address clinical problems and systems that have been tested in clinical trials. This course provides a comprehensive 'Year in Review' of informatics in medical imaging.

URL

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Charles E. Kahn JR, MD, MS - 2012 Honored Educator

RCC21B Best of Image Processing and Analysis

Participants
Bradley J. Erickson, MD, PhD, Rochester, MN (*Presenter*) Stockholder, Evidentia Health, Inc; Stockholder, OneMedNet Corporation; Stockholder, VoiceIt Technologies, LLC

LEARNING OBJECTIVES

1) In this session, important advances in knowledge about image processing will be reviewed.

ABSTRACT

A number of key papers have been published in the past year focusing on image processing, information extraction, and computer aided diagnosis. We will review these papers and describe the relevance of them to current and future practice.

URL

MSAS22

Got Smart Data? Trailblazing the Path from Insights to Actions in Radiology (Sponsored by the Associated Sciences Consortium) (An Interactive Session)

Monday, Nov. 30 10:30AM - 12:00PM Location: S105AB

IN

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
Patricia Kroken, Albuquerque, NM (*Moderator*) Nothing to Disclose
Dana Aragon, RT, Albuquerque, NM (*Moderator*) Nothing to Disclose
Jon Hernandez, Parker, CO (*Presenter*) Nothing to Disclose
Nicole Newsom, MHA, Greenville, SC, (nnewsom@advbi.com) (*Presenter*) Employee, MSN Innovative Strategies
Philip Heckendorn, Dallas, TX (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Recognize the importance of innovative solutions in value-based care delivery. 2) Describe Business Intelligence terminology and differentiate the concept of smart, meaningful data in radiology informatics. The value equation will be explored. 3) Examine practical applications of radiology insights that drive quality, efficiency, and collaboration.

URL

http://www.advbi.com/rsna15.html

RCA22

A Practical Introduction to Structured Reporting Tools and Resources

Monday, Nov. 30 10:30AM - 12:00PM Location: S401AB

IN

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 0

Participants
Justin Kirby, Bethesda, MD (*Presenter*) Stockholder, Myriad Genetics, Inc
Pattanasak Mongkolwat, PhD, Bangkok, Thailand, (pmongkolwat@gmail.com) (*Presenter*) Nothing to Disclose
Daniel L. Rubin, MD, MS, Palo Alto, CA (*Presenter*) Nothing to Disclose
David A. Clunie, MBBS, Bangor, PA (*Presenter*) Owner, PixelMed Publishing LLC
Andriy Fedorov, PhD, Boston, MA, (andrey.fedorov@gmail.com) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand the advantages of using structured data capture tools for research at your institution. 2) Learn how RSNA Radlex and other popular lexicons can help reduce ambiguity in your data. 3) Learn about tools leveraging the National Cancer Institute's Annotation Imaging and Markup (AIM) format for reporting radiologist observations and quantitative image analysis results. 4) Learn about tools leveraging DICOM for reporting quantitative image analysis results.

ABSTRACT

Institutions across the world are sitting on a potential gold mine of imaging-related information about their patients, but many are unable to make use of it. Structured reporting helps address this problem by leveraging standardized lexicons and case report forms to extract meaningful information from images and enable easy reuse of the resulting data. A number of initiatives have been developed by academic institutions, governments, and other organizations in order to help promote the broader use structured reporting in clinical imaging research. This course seeks to convey a basic understanding of structured reporting concepts and a summary of available tools and resources. Participants should leave the course with a knowledge of which tools/resources will best suit their needs and how to get started with using them.

Active Handout:Andriy Fedorov

http://abstract.rsna.org/uploads/2015/15002989/Active RCA22.pdf

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Daniel L. Rubin, MD, MS - 2012 Honored Educator
Daniel L. Rubin, MD, MS - 2013 Honored Educator

RCB22

Slicer: 3D Interactive Visualization of DICOM Images for Radiology Applications (Hands-on)

Monday, Nov. 30 10:30AM - 12:00PM Location: S401CD

IN

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
Sonia M. Pujol, PhD, Boston, MA (*Presenter*) Nothing to Disclose
Ron Kikinis, MD, Boston, MA (*Presenter*) Nothing to Disclose
Kitt Shaffer, MD, PhD, Boston, MA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Facilitate interpretation of DICOM images through the use of computer-assisted 3D visualization. 2) Increase the understanding of the correlation of the three dimensional relationships of the segments of the liver and lung with the surrounding vascular anatomy. 3) Introduce cutting-edge open-source computer graphics applications for Radiology.

ABSTRACT

Three-dimensional visualization of anatomy is emerging as a vital component of clinical imaging through the combined development of technological breakthroughs in Radiology hardware and increasingly sophisticated software tools for medical image analysis. For the past 10 years, the National Alliance for Medical Image Computing (NA-MIC), one of the seven National Centers for Biomedical Computing part of the NIH Roadmap for medical research, has converted some of the major scientific advances made by the biomedical imaging community into open-source software tools, contributing to increase the deployment of cutting-edge visualization techniques on a national and international scale.As part of the NA-MIC toolkit, the 3D Slicer open-source software has been developed as a technology delivery platform for clinical researchers. 3D Slicer has evolved into a multi-institution effort to share the latest advances in image analysis with the scientific and clinical community. This course is an introduction to the basics of viewing and interacting in 3D with DICOM volumes and anatomical models using 3D Slicer. The course is divided into three sections: the first part introduces the concepts of 3D visualization through an hands-on training session using an MR DICOM dataset of the brain and 3D reconstructed models of cerebral structures; the second section presents 3D models of the segments of the liver reconstructed from three clinical cases; and the third section guides the user through the exploration of the bronchopulmonary segments of the lung reconstructed from DICOM images. Interactions with 3D anatomical models are fostered by a series of radiological tasks for participants to complete for each clinical case. Detailed answers to the tasks are provided during the workshop as the instructors guide the audience through the 3D visualization settings to enhance the understanding of the complexity of the anatomical structures involved.

URL

RCC22

IHE Clinical Solutions for Interoperability - Imaging and Beyond: IHE and HIE does the Order Matter?

Monday, Nov. 30 10:30AM - 12:00PM Location: S501ABC

IN

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
David S. Mendelson, MD, Larchmont, NY (*Moderator*) Spouse, Employee, Novartis AG; Advisory Board, Nuance Communications, Inc; Advisory Board, General Electric Company; Advisory Board, Toshiba Corporation
David S. Mendelson, MD, Larchmont, NY (*Presenter*) Spouse, Employee, Novartis AG; Advisory Board, Nuance Communications, Inc; Advisory Board, General Electric Company; Advisory Board, Toshiba Corporation
Angela Lianos, MSc, Toronto, ON (*Presenter*) Nothing to Disclose
Mariann Yeager, MBA, Maclean, VA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand the importance of interoperability throughout healthcare 2) Understand the importance of standards to ensure interoperability 3) Understand the role of IHE profiles in defining workflows and the applicable standards including XDS and XDS-I 4) Learn about real world implementations including Health Information Exchanges (The Sequoia Project) and focused Radiology solutions (Canada HealthInfoway) including Personal Health Records (The RSNA Image Share) 5) Learn the status of the RSNA Image Share and the RSNA Image Share Validation Program (To be announced at this meeting)

ABSTRACT

This course will focuson HIT inteoperability and its importance in providing for the optimal care of patients. The session will start with a review of standards and the role of IHE. The discussion will then move to a discussion of HIEs via The Sequoia Project (Heatlheway and Carequality) and in Canada where the Canada HealthInfoway project is underway.

SSC06

Informatics (Image Processing and Analysis)

Monday, Nov. 30 10:30AM - 12:00PM Location: S402AB

IN

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 0

FDA Discussions may include off-label uses.

Participants
Asim F. Choudhri, MD, Memphis, TN (*Moderator*) Nothing to Disclose
Srini Tridandapani, MD, PhD, Atlanta, GA (*Moderator*) Nothing to Disclose

Sub-Events

SSC06-01 Radiogenomics Mapping of Non-Small Cell Lung Cancer Identifies Prognostic Relationships between Semantic Image Features and Metagenes Captured Using RNA Sequencing

Monday, Nov. 30 10:30AM - 10:40AM Location: S402AB

Participants
Olivier Gevaert, PhD, Stanford, CA (*Presenter*) Nothing to Disclose
Sandy Napel, PhD, Stanford, CA (*Abstract Co-Author*) Medical Advisory Board, Fovia, Inc; Consultant, Carestream Health, Inc; Scientific Advisor, EchoPixel, Inc
Sebastian Echegaray, MS, Stanford, CA (*Abstract Co-Author*) Nothing to Disclose
Amanda Khuong, Stanford, CA (*Abstract Co-Author*) Nothing to Disclose
Chuong D. Hoang, MD, Stanford, CA (*Abstract Co-Author*) Nothing to Disclose
Joseph Shrager, MD, Stanford, CA (*Abstract Co-Author*) Nothing to Disclose
Sylvia K. Plevritis, PhD, Stanford, CA (*Abstract Co-Author*) Nothing to Disclose
Ann N. Leung, MD, Stanford, CA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To build a radiogenomic map linking RNA sequencing data with semantic image features for non-small cell lung cancer patients for non-invasive precision medicine.

METHOD AND MATERIALS

Under IRB approval, we studied 81 cases of NSCLC who had preoperative CT scans and tumor tissue collected between 4/7/2008 and 09/15/2014 at two medical centers. A radiologist annotated the CT of each tumor with semantic image features using a template with a controlled vocabulary. Next, total RNA was extracted from these tissue samples and converted into a library for paired-end RNA sequencing on Illumina Hiseq. The RNA sequencing data were summarized into 56 high quality metagenes and filtered for metagene homogeneity in five external gene expression cohorts totaling 1227 NSCLC patients. We built a radiogenomics map between metagenes and semantic image features by using Significance Analysis of Microarrays (SAM) analysis including multiple testing corrections using the False Discovery Rate (FDR). We correlated the metagenes with clinical outcome using Cox proportional hazards modeling in the five external cohorts to establish the prognostic relationship of each metagene.

RESULTS

We focused on the top ten metagenes with the highest cluster homogeneity in five external cohorts and correlated them with 89 semantic image features. We found 48 significant associations (Q-value <0.05) defining a radiogenomics map between semantic features and molecular pathways. These metagenes capture intriguing pathways including early and late cell cycle, the T-cell immune response and hypoxic inflammation and link these with semantic image features capturing emphysema severity. Similarly the LRIG1-EGF pathway defines peripheral ground glass lesions that have a high proportion of airway abnormalities or an internal air bronchogram. Six of these metagenes are significantly correlated with prognosis in five external cohorts. The most prognostic metagene contains genes related to extra-cellular matrix processing and is significantly correlated with spiculated margins.

CONCLUSION

We defined ten high level metagenes capturing canonical pathways of NSCLC and linked them with a large collection of semantic image features realizing a radiogenomics map for NSCLC.

CLINICAL RELEVANCE/APPLICATION

Semantic image features mirror molecular properties of NSCLC with prognostic implications.

SSC06-02 Prenatal Computer-Aided Diagnosis of Craniosynostosis Using Shape Analysis

Monday, Nov. 30 10:40AM - 10:50AM Location: S402AB

Participants
Jie Ying Wu, Providence, RI (*Presenter*) Nothing to Disclose
Christopher A. DeFreitas, BA, Providence, RI (*Abstract Co-Author*) Nothing to Disclose
Stephen Carr, MD, Providence, RI (*Abstract Co-Author*) Nothing to Disclose
Derek Merck, Barrington, RI (*Abstract Co-Author*) Nothing to Disclose
Margaret M. Byrne, Providence, RI (*Abstract Co-Author*) Nothing to Disclose
Olivia E. Linden, BA, Providence, RI (*Abstract Co-Author*) Nothing to Disclose
Stephen R. Sullivan, MD,MPH, Providence, RI (*Abstract Co-Author*) Nothing to Disclose
Helena O. Taylor, MD,PhD, Providence, RI (*Abstract Co-Author*) Nothing to Disclose

Background

Craniosynostosis is the premature fusion of cranial sutures, affecting approximately 1/2500 births. Surgical correction within first year of life generally leads to the best outcomes, so early detection is helpful for treatment planning. It is typically diagnosed during post-natal clinical examination secondary to the abnormal head shape. Some studies show that craniosynostosis is detectable on prenatal ultrasound (US), but a systemic, clinical screening methodology remains elusive.

Evaluation

Our goal is to quantitatively evaluate prenatal US to determine whether children with craniosynostosis can be identified in utero. We collected prenatal US images from 22 children with a CT-confirmed post-natal diagnosis, as well as 22 age-matched controls. On the standard cross-sectional image used to measure biparietal diameter, we manually measured the vectors to the outer cortex at every 10°. We normalized the lengths to correct for overall skull size. Using principal component analysis, we found the 6 principal directions and discarded the rest to reduce measurement noise. We train two machine learning algorithms, support vector machine and random forest, with these 6 parameters and the known diagnosis. Testing with leave-one-out cross-validation, we obtained 89% and 84% accuracy, and 95% and 86% specificity respectively. Sensitivity was 82% for both. For comparison, two blinded craniofacial surgeons scored each image as normal, or synostotic.

Discussion

We present a reliable tool for quantitatively assessing prenatal US images for craniosynostosis. The surgeons' accuracies were 40-50%, compared to the program's 89%. Our program can identify suspected cases for more dedicated imaging, and prenatal counseling. Since we collected the images routinely, and reviewed them retrospectively, our methodology can easily be integrated into the current clinical pipeline.

Conclusion

Our results show that a formal shape analysis of prenatal US identifies craniosynostosis with high accuracy. With more training cases and further refinement of the procedure, we hope to include this as a standard routine in the clinic. Future work includes automatic detection of skull boundary and radii measurement.

SSC06-03 A Novel 3D User Interface with 6 Degrees of Freedom for Analysis of Volumetric Computed Tomographic Images: A Pilot Study Evaluating Feasibility and Efficiency in the Diagnosis of Pulmonary Embolism

Monday, Nov. 30 10:50AM - 11:00AM Location: S402AB

Participants
Jad M. Bou Ayache, MD, New York, NY (*Presenter*) Nothing to Disclose
Michael Teistler, PhD, Flensburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Pattanasak Mongkolwat, PhD, Bangkok, Thailand (*Abstract Co-Author*) Nothing to Disclose
Ian Murphy, MBBCh, MRCS, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Jeremy D. Collins, MD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose

Background

The aim of this pilot study is to evaluate the clinical utility of a novel 3D user interface approach that provides 6 degrees of freedom(6 DOF) input with the help of a motion sensitive game controller for evaluation of pulmonary embolism at computed tomography angiography(CTA).

Evaluation

Retrospective analysis of 36 patients (13M,23F;mean age 53+/-13 yrs) referred for CTA to rule out PE over one year. 11 of 36 patients had PE. The 6DOF tool was used to create on-the-fly oblique reformations and compared to conventional Radiology PACS with multiplanar reformatted images (MPR) and advanced visualization workstation with real-time MPR manipulation capabilities (Vitrea, Vital Images, Minneapolis, MN). Time to diagnosis and diagnostic confidence were recorded separately for each interface by a single observer starting with the 6 DOF tool. A second observer used the 6 DOF tool on two occasions 3 weeks apart. The final radiologic report was considered the gold standard. Time to diagnosis was compared using a Wilcoxon rank sum test comparing the 6 DOF tool, PACS, and 3D post-processing software(Vitrea). A two-tailed t-test was used to compare times recorded by the second observer.

Discussion

The 6 DOF tool enabled review of all datasets and detection of all PE. There was a temporal advantage of the 3D tool (41.7+/-15.6 s) over standard PACS (83.9+/-30.7 sec,$p<0.05$) and 3D post-processing software (66.6+/-17.7 s, $p<0.05$). There was a significant reduction in time to diagnosis by the second reviewer upon second attempt(46.26+/-27.1 s, improving to 36.47+/-18.8 s, $p<0.05$). Diagnostic confidence was similar among the different viewing interfaces.

Conclusion

The novel 6DOF technology has the ability to save time in CT diagnosis of PE without compromising diagnostic confidence. Time to diagnosis is further improved with repeated use of the tool. Applications of the new 3D user interface tool are not limited to CT angiography and include any volumetric cross-sectional data sets. This may be useful in reducing the burden of reformats on PACS and improve clinical throughput. Potential applications include teaching anatomy, procedural planning, and interrogation of large time-resolved volumetric data.

SSC06-04 A New Saliency Metric for Precise Denoising PET Images for Better Visualization and Accurate Segmentation

Monday, Nov. 30 11:00AM - 11:10AM Location: S402AB

Participants
Nasim Souly, Orlando, Fl (*Abstract Co-Author*) Nothing to Disclose
Georgios Z. Papadakis, MD, Bethesda, MD (*Abstract Co-Author*) Nothing to Disclose
Uygar Teomete, MD, Miami Beach, FL (*Abstract Co-Author*) Nothing to Disclose
Ulas Bagci, PhD, MSc, Orlando, FL (*Presenter*) Nothing to Disclose

Background

Our purpose in this study is to design an automated, accurate, robust, and efficient image denoising and algorithm for PET images in diagnostic tasks. For this purpose, we define a new metfic for saliency definition in PET imaging. Existing denoising methods take a few hours for a single PET volume if optimal results are desired. Briefly, saliency definition aims to detect the regions of an image that stands outs from the rest of the image. Hence, those regions are considered redundant. First, we build pyramids of the image with different resolution and contrast map. Then, we use a sliding window across the image and compute the Euclidean distance of each pixel from its neighbor in the window. Next, for each pixel, by accumulating the distances to all pixels in the neighborhood, a contrast value is obtained. Finally, all contrast maps are combined to form the denoised images. We retrospectively analyzed 20 PET-CT images of NEMA phantoms where ground truths are available as CT correspondence.

Evaluation

We compared our method with the state of the art non-local means based denoising method and have observed that there is no statistically significant difference (via t-test) in terms of SNR, relative contrast ratio, and measured SUV levels. On average, more than 30% improvement was observed in SNR, and 100% of SUVmax was preserved at the end of denoising. While the state of the art method produces a denoised PET image within 3-4 hours on average, our method produces the same/similar quality images only in seconds. Figure 1 shows improvement of the PET images for a given phantom image.

Discussion

Confounding factors such as noise should be removed from the PET images for (1) better visualization and (2) more accurate quantification. Our proposed method removes noise from PET images and simplifies the segmentation and quantification of radiotracer uptake regions only within seconds as opposed to standard methods that may take hours.

Conclusion

The proposed comprehensive automated algorithm helps to achieve better quantification of PET images in an efficient and robust manner. It provides an effective tool (saliency metric) for PET image enhancement.

SSC06-05 Applying Deep Machine Learning Algorithms for Automated Detection of Abnormalities on Chest Radiographs

Monday, Nov. 30 11:10AM - 11:20AM Location: S402AB

Participants
Mark D. Cicero, Toronto, ON (*Presenter*) Co-founder, 3BC Inc
Taha Bandukwala, MD, Toronto, ON (*Abstract Co-Author*) Nothing to Disclose
Timothy R. Dowdell, MD, Toronto, ON (*Abstract Co-Author*) Nothing to Disclose
Joe J. Barfett, MD, London, ON (*Abstract Co-Author*) Nothing to Disclose
Kuhan Perampaladas, Toronto, ON (*Abstract Co-Author*) Nothing to Disclose

Background

Since 2011, deep learning algorithms have been gaining more attention within the machine learning community, as their success rates on certain recognition tasks have been competitive with humans. In 2012, researchers from the University of Toronto trained a deep convolutional neural network (CNN) using the largest tagged dataset available, ImageNet, which consists of 15 million high-resolution images tagged in over 22,000 categories. They achieved object recognition top-1 and top-5 error rates of 37.5% and 15.3% respectively.

Evaluation

We trained a convolutional neural network with 10,000 chest radiographs which were tagged as either normal (absence of any clinically relevant pathology) or abnormal based on the final radiology report. This was performed using a single 2 GB nVidia GTX 770 graphics processing unit (GPU) and an open-source deep learning software package (convnet). The performance of the neural network was tested using an untrained dataset consisting of 500 radiographs and characterized using receiver-operating curve analysis at different output probability thresholds. It achieved a maximum sensitivity of 95% with a corresponding specificity of 85%.

Discussion

Advancements in machine learning have been possible due to improvements in computation power through the use of GPUs and the access to large quantities of data. The current success and future developments of these algorithms will have a profound effect on the interpretation of medical images. We have proven that with adequate data, these algorithms can be used to help automate and speed up medical diagnosis. With more data, we expect further improvement in performance. Furthermore, more experimentation is required to determine if diagnostic subcategories could be classified with this same approach.

Conclusion

Convolutional neural networks can be trained using a modestly sized medical dataset to screen chest radiographs as normal or abnormal. Deep learning will play an integral role in advancing computer-aided diagnosis which will enhance and speed up the workflow of the radiologist. Further experimentation is required using larger datasets as well as different types of imaging studies.

SSC06-06 Computer-aided Diagnosis of Ground Glass Opacity Lung Nodules: Quantitative Analysis of 248 Nodules

Monday, Nov. 30 11:20AM - 11:30AM Location: S402AB

Participants
Ming Li, MD, ShangHai, China (*Abstract Co-Author*) Nothing to Disclose
Vivek Narayan, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Maria F. Barile, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Ritu R. Gill, MBBS, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Raphael Bueno, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Clare M. Tempany-Afdhal, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Jayender Jagadeesan, PHD, Boston, MA (*Presenter*) Research Grant, Siemens AG

Background

Lung adenocarcinoma's new classification is based on histologic criteria. There is a need to develop image-based classification of GGNs into AAH, AIS, MIA and IAC. We propose a Support Vector Machine (SVM) algorithm with input as tumor heterogeneity metrics obtained from CT images to predict the lesion type.

Evaluation

Non-contrast CT (NonC) images were obtained for 248 lung nodules and loaded in 3D Slicer software, along with the corresponding pathology reports. An experienced radiologist segmented the lesions on 3D Slicer. Thereafter, using the open-source HeterogeneityCAD module in 3D Slicer, 58 quantitative metrics that describe the distribution statistics, shape, morphology, Renyi dimensions, geometrical measure and texture were obtained for each segmented lesion on the NonC. Statistical correlation of the metrics with the four classes of GGOs, determined by pathology, was performed using the Kruskal-Wallis test. A SVM based algorithm was also developed to train the algorithm and predict the lesion type based on the quantitative metrics. The accuracy of prediction of the lesion type by the SVM algorithm was compared to the classification done by two fellowship trained thoracic radiologists (Manual-class). The accuracy of differentiating between AIS and MIA, and indolent (AAH and AIS) and invasive (MIA and IAC) was determined.

Discussion

All 58 metrics showed significant difference ($p<0.05$) between the four groups on NonC. The accuracy of classifying AIS and MIA on NonC was: SVM = 88.24%, Manual-class = 38.07%, accuracy of classifying indolent and invasive lesions was: SVM = 90%, Manual-class = 64.75%, accuracy of classifying the lesions into the four groups was: SVM = 64%, Manual-class = 44.26%. The agreement between the two expert raters for classifying the lesions into the four categories was 38.52% with a kappa of 0.1376 corresponding to slight agreement.

Conclusion

In this preliminary study, the SVM based computerized algorithm appears to demonstrate significantly higher accuracy in classifying GGOs than manual classification. This may be a useful tool to determine the lesion type on CT images and could provide accurate guidance in determining the optimal therapeutic options.

SSC06-07 Automated Classification of Spectral Quality and Metabolic Abnormality in Volumetric MR Spectroscopic Imaging Using a Web-Based Evaluation Platform

Monday, Nov. 30 11:30AM - 11:40AM Location: S402AB

Awards
Trainee Research Prize - Medical Student

Participants
James S. Cordova, BS, Atlanta, GA (*Presenter*) Nothing to Disclose
Saumya Gurbani, MS, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose
Gaurav Verma, PhD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Eduard Schreibmann, PhD, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose
Peter B. Barker, DPhil, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Harish Poptani, PhD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Hui-Kuo G. Shu, MD, PhD, Atlanta, GA (*Abstract Co-Author*) Speakers Bureau, Varian Medical Systems, Inc; Stockholder, General ELectric Company; Stockholder, Medtronics, Inc; Stockholder, Mylan NV; Stockholder, Apple Inc
Chad A. Holder, MD, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose
Andrew Maudsley, PhD, Miami, FL (*Abstract Co-Author*) Nothing to Disclose
Hyunsuk Shim, PhD, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose
Lee Cooper, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose

Background

MR spectroscopic imaging (MRSI) is able to assess treatment response in gliomas by imaging metabolites without exogenous tracer. Whole-brain volumes can be constructed using spectral components, including choline (Cho), creatine (Cr), and N-acetylaspartate (NAA) signal. Accuracy of these volumes depends on spectral quality (SQ) with poor SQ leading to erroneous volumetry. We developed an automated method for determining SQ based on curve-fitting metrics using machine-learning methods to create a data-driven model for SQ filtering.

Evaluation

A 3D MRSI sequence at 3T was used to generate whole-brain volumetric maps with 108 mm^3 resolution. A spectral analysis tool was used to review and label each spectrum as having adequate (A) or inadequate (I) SQ. MRS curve-fitting measures describing 115 features (e.g. full-width, half max values) from each spectrum were used to train a random forest classifier to determine SQ and discriminate normal tissue vs. tumor in 6243 voxels (n=7 patients) as a pilot run by one reader. Strict cross-validation was performed by training a classifier on 6 patients and evaluating on the 7th in a rotating manner. Classifier performance was evaluated using ROC analysis and feature salience was evaluated by summing split criterion over all trees in each forest.

Discussion

Pilot-study area-under-the-curve (AUC) values for classifying SQ and tumor (in A voxels) were 0.94 and 0.79 respectively. The most salient features for SQ included the Cramer-Rao bounds for Cho peak frequency and area, and the Lorentzian and Gaussian components of the NAA peak. The most salient features for tumor classification included Cho/NAA, Cho/Cr, and NAA/Cr: ratios used for tumor evaluation clinically.

Conclusion

High AUCs for SQ and tumor classification suggests training random forests with curve-fit metrics results in an accurate classifier in a small sample. A web-based spectral evaluation tool to generate consensus measures between multiple experts (3 readers per spectrum) in a randomized, double-blinded fashion is currently being developed to mitigate bias in class labeling. We will report the outcomes using 20,000 voxels (n=20 patients) reviewed by ~ 10 MR spectroscopists and/or radiologists.

SSC06-08 Predictive Modeling of Microvascular Invasion Using Triphasic Quantitative Imaging of Hepatocellular

Carcinoma

Monday, Nov. 30 11:40AM - 11:50AM Location: S402AB

Participants
Olivier Gevaert, PhD, Stanford, CA (*Presenter*) Nothing to Disclose
Sebastian Echegaray, MS, Stanford, CA (*Abstract Co-Author*) Nothing to Disclose
Sandy Napel, PhD, Stanford, CA (*Abstract Co-Author*) Medical Advisory Board, Fovia, Inc; Consultant, Carestream Health, Inc; Scientific Advisor, EchoPixel, Inc
Nishita Kothary, MD, Stanford, CA (*Abstract Co-Author*) Scientific Advisor, Siemens AG Research Grant, Siemens AG Consultant, Cook Group Incorporated

PURPOSE

To predict microvascular invasion (mVI) in patients with HCC using quantitative image features extracted from contrast-enhanced, triphasic CTs.

METHOD AND MATERIALS

We selected 29 patients with HCC who underwent surgical resection, of which, 10 demonstrated microvascular invasion, undiagnosed on pre-operative cross-sectional imaging. All patients were chemo-naive and had no prior locoregional treatment. Four independent radiologists delineated tumor margins on each phase from which 470 computational features/phase were extracted including gray-value histogram statistics and textures, sharpness of lesion boundaries, and metrics of compactness and roughness. We also computed Delta features, i.e., the absolute difference and the ratio for each feature between all pairs of the three phases. We used concordance analysis to select only features robust to inter-reader variability using Lin's concordance correlation (LCC) coefficient with a correlation threshold of at least 0.8 between readers. We evaluated our model using a combined leave-one-reader and leave-one-patient out cross validation analysis (LOR-LOO-CV), whereby we train a model based on three readers on 28 patients and test on the fourth reader annotations of the left out patient. We used the area under the ROC curve (AUC) to evaluate our models.

RESULTS

170 arterial, 295 portal-venous and 135 delayed phase features were robust against inter-reader variability. 20-45 Delta features were similarly robust for all phase combinations. Texture features and gray-value histogram statistics provided the most robust features. LOR-LOO-CV analysis showed that delta features between the arterial and venous phase were sufficient and accurate predictors of mVI (AUC 0.77, std=0.05). The top features in this model were the absolute difference between two texture features and between two histogram intensity features.

CONCLUSION

Quantitative changes of texture and intensity features between the arterial and venous phases can be used to predict mVI in HCC.

CLINICAL RELEVANCE/APPLICATION

The presence of mVI, which indicates poor prognosis and survival for patients with HCC, is undetectable by the human eye on standard imaging, and hence only determined on pathological diagnosis. Quantitative image features could provide a non-invasive method of mVI detection.

SSC06-09 Identification of Molecular Phenotypes by Integrating Radiomics and Genomics

Monday, Nov. 30 11:50AM - 12:00PM Location: S402AB

Participants
Patrick Grossmann, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Olya Grove, Tampa, FL (*Abstract Co-Author*) Nothing to Disclose
Nehme El-Hachem, Montreal, QC (*Abstract Co-Author*) Nothing to Disclose
Chintan Parmar, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Emmanuel Rios Velazquez, PhD, Boston, MA (*Presenter*) Nothing to Disclose
Robert J. Gillies, PhD, Tampa, FL (*Abstract Co-Author*) Nothing to Disclose
Hugo Aerts, PhD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To uncover the mechanistic connections between radiomic features, molecular pathways, and clinical outcomes, to develop radiomic based predictors of pathway activation states in individual patients, and to assess whether combining radiomic with clinical and genomic data improves prognostication.

METHOD AND MATERIALS

We analyzed two independent lung cancer cohorts totaling 351 patients, for whom diagnostic computed tomography (CT) scans, gene-expression profiles, and clinical outcomes were available. The tumor phenotype was characterized based on 636 radiomic features describing tumor intensity, texture, shape and size. We performed an integrative analysis by developing and independently validating association modules of coherently expressed radiomic features and molecular pathways. These modules were statistically tested for significant associations to overall survival (OS), TNM stage, and pathologic histology.

RESULTS

We identified thirteen radiomic-pathway association modules ($p < 0.05$), the most prominent of which were associated with the immune system, p53 pathway, and other pathways involved in cell cycle regulation. Eleven modules were significantly associated with clinical outcomes ($p < 0.05$). Strong predictive power for pathway activation states in individual patients was observed using radiomics; the strongest per module predictions ranged from an intra-tumor heterogeneity feature predicting RNA III polymerase transcription (AUC 0.62, $p = 0.03$), to a tumor intensity dispersion feature predicting pyruvate metabolism and citric acid TCA cycle (AUC 0.72, $p < 1E-6$). Stepwise combinations of radiomic data with clinical outcomes and gene expression profiles resulted in consistent increases of prognostic power to predict OS (concordance index max = 0.73, $p < 1E-9$).

CONCLUSION

This study demonstrates that radiomic approaches permit a non-invasive assessment of molecular and clinical characteristics of tumors, and therefore have the unprecedented potential to cost-effectively advance clinical decision-making using routinely acquired, standard-of-care imaging data. We show that prognostic value complementary to clinical and genomic information can be obtained by radiomic strategies.

CLINICAL RELEVANCE/APPLICATION

Advance decision-making by radiomic predictions of tumor phenotype. These predictions are complementary to clinical and genomic data, and are generated based on existing standard-of-care images.

INS-MOA

Informatics Monday Poster Discussions

Monday, Nov. 30 12:15PM - 12:45PM Location: IN Community, Learning Center

IN

AMA PRA Category 1 Credit ™: .50

FDA Discussions may include off-label uses.

Participants
Luciano M. Prevedello, MD,MPH, Columbus, OH (*Moderator*) Nothing to Disclose

Sub-Events

IN214-SD-MOA1 Features and Benefits of an Investigational Tool for Computer-aided Evaluation (CAE) of Multiparametric MRI of the Prostate

Station #1

Participants
Harald F. Busse, PhD, Leipzig, Germany (*Presenter*) Nothing to Disclose
Josephin Otto, Leipzig, Germany (*Abstract Co-Author*) Nothing to Disclose
Alexander Schaudinn, MD, Leipzig, Germany (*Abstract Co-Author*) Nothing to Disclose
Nicolas Linder, Leipzig, Germany (*Abstract Co-Author*) Nothing to Disclose
Nikita Garnov, Leipzig, Germany (*Abstract Co-Author*) Nothing to Disclose
Thomas K. Kahn, MD, Leipzig, Germany (*Abstract Co-Author*) Nothing to Disclose
Michael Moche, MD, Leipzig, Germany (*Abstract Co-Author*) Nothing to Disclose

CONCLUSION

A stand-alone CAE tool for prostate mpMRI may assist the radiologist with the detection and discrimination between clinically significant cancer and benign findings.

Background

Multiparametric mpMRI has substantially improved the detection of clinically significant prostate cancer (PCa) and the confidence in benign and insignificant findings. The latest PI-RADS v2 guideline relies on T2-weighted, diffusion-weighted and dynamic contrast enhancement imaging (T2W, DWI, DCE). We report on features and benefits of an investigational CAE tool for mpMRI of the prostate.

Evaluation

Sample cases with histologically proven PCa were selected from over 150 mpMRI examinations at our institution. The custom-made software (developed under IDL, Exelis VIS, Boulder, CO) runs on any PC in a freely available VM environment. In addition to standard display features like zoom, windowing or ADC lens, the user interface allows the radiologist to easily interpret mpMRI data, automatically matched by slice location, in a single view.Site-specific parameters for data import, analysis and display can be conveniently configured in a text file. Semiquantitative DCE rate parameters 1/τ and m are derived from fits to the early arterial (sigmoid function) and delayed phase (linear fit) of the time-signal intensity (SI) curves. Automatic processing takes ˜ 45 s (18 slices) and can be adjusted to individual protocols of contrast administration (timing, amount and distribution) or imaging (temporal resolution).

IN215-SD-MOA2 From 2D MRI to 3D Models: A Workflow for Creating MRI-Based Educational and Clinical 3D Applications

Station #2

Participants
Mesa Schumacher, MA, BA, Baltimore, MD (*Presenter*) Nothing to Disclose
David Rini, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Jan Fritz, MD, Baltimore, MD (*Abstract Co-Author*) Research Grant, Siemens AG; Research Consultant, Siemens AG; Speaker, Siemens AG

CONCLUSION

We describe the concept and production workflow for creating MRI-based, interactive 3D models, which serve as the basis for building effective educational and clinical applications. A highly-detailed 3D learning application of the neuroanatomy of the knee exemplifies its use for learning neuroanatomical detail and potential for improving the practice of radiology and its clinical application.

Background

Isotropic 3D MRI enables resolution of sub-millimeter anatomy, such as small nerves; however, the interpretation and reporting of such high detail data sets require proportional depth of neuroanatomy knowledge. To facilitate this, we have developed a method for extraction and transfer of actual MRI patient data into computer-based interactive 3D Models with the ultimate goal of creating complex 3D learning applications.

Evaluation

High spatial resolution, isotropic MRI data are imported into OsiriX DICOM viewer (Pixmeo, Geneva, Switzerland) and exported as surface mesh elements as .OBJ files. 3D renderings are then imported into ZBrush digital sculpting software (Pixologic, Los Angeles, CA), cleaned, painted and transferred into 3D modeling and animation software Cinema 4D (Maxon, Friedrichsdorf, Germany). Cinema 4D is used to create 2D still images and 3D animations, which serve as components for a real time 3D, didactic, interactive

model created with the Unity 3D gaming engine (Unity Technologies, San Francisco, CA).

Discussion

Because the master model and all derivative media are based on real human MRI data, images are accurate and organic. This allows for seamless integration of MR images with multiple visualization solutions, for both guided linear and exploratory interactive educational resources. Initial evaluation of such a computer-based 3D application of the articular and cutaneous innervation of the knee by a small cohort of radiology fellows indicated that the model can facilitate effective acquisition of detailed neuroanatomy knowledge that is required for radiological subspecialty consultation.

IN216-SD-MOA3 Improving Radiology Customer Service: Patient Inquiries on the Patient Portal

Station #3

Participants
Benjamin Mervak, MD, Ann Arbor, MI (*Presenter*) Nothing to Disclose
Matthew S. Davenport, MD, Cincinnati, OH (*Abstract Co-Author*) Book contract, Wolters Kluwer nv; Book contract, Reed Elsevier;
Kelsey Flynt, MD, Ann Arbor, MI (*Abstract Co-Author*) Nothing to Disclose
Ella A. Kazerooni, MD, Ann Arbor, MI (*Abstract Co-Author*) Nothing to Disclose
William J. Weadock, MD, Ann Arbor, MI (*Abstract Co-Author*) Owner, Weadock Software, LLC

PURPOSE

To better understand radiology-specific patient desires through analysis of patient-initiated messages submitted through an online electronic medical record system.

METHOD AND MATERIALS

IRB approval was obtained and informed consent waived for this HIPAA-compliant retrospective cross-sectional study. All patient-initiated messages submitted to an institutional electronic medical record during the fourth quarter of 2014 were analyzed. Messages containing radiology-specific key terms ("X-ray," "xray," "xr," "CT," "CAT," "MRI," "scan," "ultrasound," "image," "radiology") were identified (n=3,248) and relevant messages were then categorized by content. Modality-specific examinations performed during the same period were tabulated. Proportions were compared with Chi Square tests.

RESULTS

Messages containing ≥1 radiology specific keywords were significantly more likely to originate from females than males (64% [1,019/1,597] vs 36% [578/1,597], p<0.0001). Patient interest was significantly discrepant (p<0.001) from the actual scan volume for some modalities (MRI: 38% [607/1,609] vs. 11% [13,932/123,873], CT: 25% [400/1,609] vs. 19% [23,697/123,873], plain radiography: 23% [368/1,609] vs. 55% [68,387/123,873]). The most common inquiry was for imaging results (33% [529/1,597], p<0.001); such messages were submitted a median of 5 days (range: 0-368) after the date of imaging. Other common requests included questions about management (12% [191/1,597]); questions about medical jargon (11% [168/1,597]); a desire for a radiologic study (10% [151/1,597]); and clarification about the need for a radiologic study (8% [124/1,597]). Patient-initiated comments about report structure (e.g., typographical errors) or the Radiology Department in general were rare (1% [13/1,597], and 1% [13/1,597], respectively).

CONCLUSION

Patients submitting radiology-specific messages through an electronic medical record system are most concerned about timely imaging results, particularly those pertaining to advanced imaging studies.

CLINICAL RELEVANCE/APPLICATION

A thorough understanding of patient-initiated inquiries can promote patient-centered care, lead to improved patient satisfaction, and increase efficiency for physicians. Population-level analysis of patient-initiated messages through an electronic medical record system can provide valuable insight into the functions of a radiology department.

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Ella A. Kazerooni, MD - 2014 Honored Educator

IN217-SD-MOA4 Three-Dimensional Bio-Inspired System for the Computer-Assisted Diagnosis of Pulmonary Nodules in Computed Tomography Scans

Station #4

Participants
Michael J. Skocik, BS, State College, PA (*Presenter*) Nothing to Disclose
Bradley P. Wyble, PhD, University Park, PA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To develop a three-dimensional bio-inspired and neuromorphic computer-assisted diagnosis (CAD) system for the detection of pulmonary nodules on computed tomographic (CT) scans. This system should have a low false-positive rate and be generalizable to novel CT scans.

METHOD AND MATERIALS

This study makes use of the Lung Image Database Consortium and Image Database Resource Initiative (LIDC-IDRI) archive, which contains 1018 pulmonary CT scans taken from 1010 patients on CT scanners with varying pitch, exposure, tube voltage, spatial resolution, and reconstruction algorithm. Through an unblinded process, 2669 pulmonary nodules were identified by at least one of

four radiologists. To generate a test bed from this archive, each CT scan was partitioned into partial scans each composed of 30 images of the transverse plane. To analyze these partial scans, a machine-learning algorithm was developed. This algorithm, which was inspired from the biophysically-meaningful and neuromorphic HMAX machine vision system, successively applies several three-dimensional mathematical convolution operations to an image, including thresholding, edge-detection and template-comparison. The operation of this algorithm is to determine whether a pulmonary nodule is likely to be present in a given partial scan. To prevent overfitting, the accuracy of this algorithm was evaluated with a ten-fold cross-validation technique. This technique, which is common in the machine-learning literature, randomly and repeatedly partitions the data into training and testing subsets so as to ensure that performance will not degrade when the system is exposed to new CT scans.

RESULTS

Preliminary results were obtained on 620 of the 1018 CT scans. With 2.23 ± 0.33 false positives per scan, a sensitivity of 75% ± 11% was achieved.

CONCLUSION

This CAD system is evaluated over a large and robust test bed with state-of-the-art statistical techniques, which suggests that it will perform comparably on novel CT scans. Its sensitivity and false-positive rate is competitive with previous algorithms in the literature.

CLINICAL RELEVANCE/APPLICATION

This CAD system can serve as a second-reader to radiologists in order to assist in detecting pulmonary nodules in CT scans.

IN218-SD-MOA5 Automated Delineation of Neural Foraminafrom Spine Images

Station #5

Participants
Xiaoxu He, London, ON (*Presenter*) Nothing to Disclose
Jaron Chong, MD, Montreal, QC (*Abstract Co-Author*) Nothing to Disclose
Said Osman, MD, London, ON (*Abstract Co-Author*) Nothing to Disclose
Manas Sharma, MBBS, MD, Toronto, ON (*Abstract Co-Author*) Nothing to Disclose
Mark Landis, MD, FRCPC, London, ON (*Abstract Co-Author*) Nothing to Disclose
Shuo Li, PhD, London, ON (*Abstract Co-Author*) Employee, General Electric Company

PURPOSE

Automated and accurate delineation neural foramina from spinal MR and CT images is of great significance for foraminal stenosis diagnosis and treatments. Existing clinical manual delineation is very tedious, inefficient, and inconsistent. Besides, accurate delineation is very challenging for neural foramina due to its complex composition, multivariate shape, and vague boundary. In this study, we developed and validated an automatic method to efficiently and accurately contour neural foramen from both MRI and CT modalities directly.

METHOD AND MATERIALS

A state-of-art machine learning algorithm-MSVR (multi-dimensional support vector regressor) was used to transfer the knowledge of human experts to computer, and then neural foramina contours were automatically extracted. Followed IRB approval, CT and MR (T1-weighted) images from 152 subjects (90 women, 62 men, 60 ±16 yrs) were collected to test using a leave-one-subject out strategy. The performance is evaluated via DSI (average dice similarity index) and BD (average boundary distance). DSI quantifies the region overlap between automatic and human experts' contour, and BD estimates their difference in shape.

RESULTS

The result of the developed automatic delineation is highly consistent with human experts with DSI as high as 0.8821±0.0186 (MR), 0.8936±0.0171 (CT) and BD as low as 0.8613±0.2416 mm (MR), 0.8263±0.1796 mm (CT).

CONCLUSION

Our study demonstrates that the developed automatic delineation has achieved a comparable result as human expert. These findings provide an effective way to relieve the heavy burden of radiologists, and offer an efficient and consistent clinical tool in evaluating neural foraminal stenosis.

CLINICAL RELEVANCE/APPLICATION

Machine learning algorithms offer an automated, consistent, and efficient method of neural foraminal stenosis, grading, and evaluation.

IN219-SD-MOA6 Characterization of Liver Lesions in Tri-phase CT Examinations using Bag of Visual Words Algorithm with Mutual Information Criterion

Station #6

Participants
Eyal Klang, Ramat Gan, Israel (*Presenter*) Nothing to Disclose
Idit Diamant, Ramat Gan, Israel (*Abstract Co-Author*) Nothing to Disclose
Jacob Goldberger, Ramat Gan, Israel (*Abstract Co-Author*) Nothing to Disclose
Avi Ben Cohen, Tel Aviv, Israel (*Abstract Co-Author*) Nothing to Disclose
Noa Rozendorn, Ramat Gan, Israel (*Abstract Co-Author*) Nothing to Disclose
Eli Konen, MD, Ramat Gan, Israel (*Abstract Co-Author*) Research Consultant, RadLogics Inc
Hayit Greenspan, PhD, Tel-Aviv, Israel (*Abstract Co-Author*) Nothing to Disclose
Michal M. Amitai, Ramat Gan, Israel (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the mutual information bag of visual words (MI-BOVW) model for automated classification of liver lesions in tri-phase

CT images and to evaluate the added value of tri-phase CT data to portal phase CT data in this classification.

METHOD AND MATERIALS

This study included tri-phase images of 85 liver lesions: 27 hemangiomas (HEM), 16 Focal Nodular Hyperplasia (FNH), 29 Hepatic Cellular Carcinoma (HCC) and 13 cholangiocarcinoma (CLG), collected from PACS system in the years 2011-2014. Radiologist circumscribed the lesions margins and provided the diagnosis for each lesion based on biopsy or clinical follow-up. MI-BOVW, which is a refinement of the typical BOVW (T-BOVW), selects relevant visual words from the dictionaries generated from each lesion type. The relevance of each visual word is calculated using mutual information criterion. Sensitivity and specificity values obtained using the MI-BOVW algorithm, were compared to that obtained using the T-BOVW algorithm. Sensitivity and specificity of the MI-BOVW using data derived from all phases of tri-phase were compared to results obtained using data derived from only portal phase CT.

RESULTS

The MI-BOVW classified liver lesions with a sensitivity of 82.4% (HEM: 92.6%, HCC: 82.2%, FNH: 87.5%, CLG: 53.9%) and specificity of 92.7% (HEM: 91.4%, HCC: 89.3%, FNH: 98.5%, CLG: 95.8%).T-BOVW classified liver lesions with a sensitivity of 75.3% (HEM: 85.2%, HCC: 82.8%, FNH: 87.5%, CLG: 23.1%) and specificity of 89.8% (HEM: 91.4%, HCC: 82.1%, FNH: 98.5%, CLG: 93.0%).Using MI-BOVW with data from all phases of tri-phase CT yielded a sensitivity of 82.4% and specificity of 92.7%, compared to sensitivity of 70.6% and specificity of 86.9% for MI-BOVW based on data from only portal phase CT.

CONCLUSION

Overall, the MI-BOVW improves the T-BOVW sensitivity by 7% and specificity by 3%. Best results were shown in the classification of CLG, with improvement of sensitivity by 30.8%. Additionally, the shift from portal phase CT data to tri-phase CT improved the sensitivity by 11.8% and specificity by 5.8%.

CLINICAL RELEVANCE/APPLICATION

The MI-BOVW, using the tri-phase CT data, shows good capacity in characterizing liver lesions, and could be implemented to differentiate other types of lesions.

IN220-SD-MOA7 Accuracy of 3D Printed Models of the Aortic Valve Complex for Transcatheter Aortic Valve Replacement (TAVR) Planning: Comparison to Computed Tomographic Angiography (CTA)

Station #7

Participants
Tianrun Cai, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Beth A. Ripley, MD, PhD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Michael Cheezum, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Ron Blankstein, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Michael L. Steigner, MD, Boston, MA (*Abstract Co-Author*) Speaker, Toshiba Corporation
Dimitris Mitsouras, PhD, Boston, MA (*Presenter*) Research Grant, Toshiba Corporation; Speakers Bureau, Toshiba Corporation
Frank J. Rybicki III, MD, PhD, Ottawa, ON (*Abstract Co-Author*) Research Grant, Toshiba Corporation;

PURPOSE

To determine the accuracy of 3D-printed models of the aortic valve (AV) complex for TAVR planning by comparison to CTA.

METHOD AND MATERIALS

10 patients with pre-TAVR contrast-enhanced CTA (320x0.5mm Toshiba AquilionOne) were randomly selected. The blood pool of the AV complex from proximal ascending aorta above the coronary arteries, to the AV annulus extending ~1cm into the left ventricle, was automatically segmented (Vitrea 6.7, Vital Images) in mid-systolic CTA images. A 3D-printable standard tessellation language (STL) model was exported using the workstation's built-in functionality (level of detail=4). Computer-Aided Design software (3matic, Materialise) was used to extrude a 1.5mm-thick arterial wall around the blood pool STL, trim coronary ostia, and limit the model from 1-2cm above the ostia to .5cm below the annulus. Models were printed with a material extrusion 3D printer. One reader blinded to CTA measured the maximum and minimum diameter of the AV annulus and coronary ostia takeoff height of the printed model with a digital caliper. Two independent readers performed these measurements in double-oblique CTA reformats, consistent with current clinical practice. Model measurements were compared to CTA findings by Pearson's correlation, and via the mean and 95% confidence interval (CI) of the absolute difference to CTA compared to CTA interobserver differences.

RESULTS

3D-printed model measurements had excellent correlation to CTA (Pearson r=0.86-0.97). Mean absolute difference in max diameter between 3D-printed model and CTA was 0.85mm (95%CI: [.43,1.28]), compared to 1.17mm (95%CI: [.59,1.75]) between CTA readers; for min diameter it was 0.49mm (95%CI: [.2,.78]) compared to 0.45mm (95%CI: [.17,.73]) between CTA readers. Mean absolute difference of height to left main ostium was 1.62mm (95%CI: [.93,2.3]) compared to 1.47mm (95%CI: [.78,2.16]) for CTA readers, and to right coronary ostium it was 1.0mm (95%CI: [0.53-1.46]) compared to 1.98mm (95%CI: [1.38,2.58]) for CTA readers.

CONCLUSION

3D-printed models of the AV complex derived from CTA provided excellent correlation to CTA measurements of the annulus and ostia height used for TAVR planning.

CLINICAL RELEVANCE/APPLICATION

Accurate 3D-printed models of the AV complex obtained from a standard radiology workstation are of interest for future application to plan TAVR sizing and minimize procedural complications such as paravalvular leak and coronary occlusion.

IN115-ED-MOA8 3D Printable Models for Anatomy Teaching

Station #8

Participants

Tuo Dong, BS, Washington, DC (*Presenter*) Nothing to Disclose
Keona Childs, Washington, DC (*Abstract Co-Author*) Nothing to Disclose
Matthew Clarke, Washington, DC (*Abstract Co-Author*) Nothing to Disclose
Bonnie C. Davis, MD, Washington, DC (*Abstract Co-Author*) Nothing to Disclose
Andre J. Duerinckx, MD, PhD, Washington, DC (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

At the end of this presentation, participants will be able to:Better understand how to incorporate 3d printing into anatomy teaching.Understand the steps in building 3D models for existing 3D printers from CT DICOM data sets.Know which free software packages are available to create 3D models and how to evaluate themUnderstand how 3D printed objects can be use in a single institution for anatomy teaching.

TABLE OF CONTENTS/OUTLINE

Background of application of 3D printing in medicine. Review of the steps to build 3D printable models from CT DICOM data: 1. Create a 3 D model (3D slicer), then use MeshLab to edit the model if needed, and then go into 3D printer. Review of the commercial (free and non-free) modeling software packages available. Review of the limitations and advantages of major 3D modeling software package. Discuss how 3D printed objects will be use in a single institution for anatomy teaching.

RCA23

3D Printing (Hands-on)

Monday, Nov. 30 12:30PM - 2:00PM Location: S401AB

IN

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants

Frank J. Rybicki III, MD, PhD, Ottawa, ON (*Moderator*) Research Grant, Toshiba Corporation;
Frank J. Rybicki III, MD, PhD, Ottawa, ON (*Presenter*) Research Grant, Toshiba Corporation;
Jane S. Matsumoto, MD, Rochester, MN (*Presenter*) Nothing to Disclose
Jonathan M. Morris, MD, Rochester, MN (*Presenter*) Nothing to Disclose
Dimitris Mitsouras, PhD, Boston, MA (*Presenter*) Research Grant, Toshiba Corporation; Speakers Bureau, Toshiba Corporation
Andreas Giannopoulos, MD, Boston, MA, (agiannopoulos1@partners.org) (*Presenter*) Nothing to Disclose
Nicole Wake, MS, New York, NY (*Presenter*) Nothing to Disclose
Peter C. Liacouras, PhD, Bethesda, MD (*Presenter*) Nothing to Disclose
Thomas A. Foley, MD, Rochester, MN (*Presenter*) Nothing to Disclose
Kiaran P. McGee, PhD, Rochester, MN (*Presenter*) Nothing to Disclose
Michael W. Itagaki, MD, MBA, Seattle, WA (*Presenter*) Owner, Embodi3D, LLC
Shannon N. Zingula, MD, Rochester, MN (*Presenter*) Nothing to Disclose
Leonid Chepelev, MD,PhD, Ottawa, ON (*Presenter*) Nothing to Disclose
Adnan M. Sheikh, MD, Ottawa, ON (*Presenter*) Nothing to Disclose
AiLi Wang, Ottawa, ON (*Presenter*) Nothing to Disclose
Wilfred Dang, BS, Ottawa, ON (*Presenter*) Nothing to Disclose
Ekin P. Akyuz, BSc, Ottawa, ON (*Presenter*) Nothing to Disclose
Taryn Hodgdon, MD, Ottawa, ON (*Presenter*) Nothing to Disclose
Carlos H. Torres, MD, Ottawa, ON (*Presenter*) Nothing to Disclose
Anji Tang, Boston, MA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Learn the Standard Tessellation Language (STL) file format that is used in 3D priting. 2) Be exposed to a software package to enable segmentation of DICOM images using semi-automated and manual segmentation algorithms, allowing the user to demarcate desired parts. The most commonly used tools are thresholding, region growing, and manual sculpting. 3) Learn refinement of an output STL output so that it can be optimized for accurate printing of the desired anatomy and pathology. This step uses Computer Aided Design (CAD) software is used to perform steps such as "wrapping" and "smoothing" to make the model more homogeneous.

ABSTRACT

"3D printing" refers to fabrication of a tangible object from a digital file by a 3D printer. Materials are deposited layer-by-layer and then fused to form the final object. There are several 3D printing technologies that share similarities but differ in speed, cost, and resolution of the product. Digital Imaging and Communications in Medicine (DICOM) image files cannot be used directly for 3D printing; further steps are necessary to make them readable by 3D printers. The purpose of this hands-on course is to convert a set of DICOM files into a 3D printed model through a series of simple steps. Some of the initial post-processing steps may be familiar to the radiologist, as they share common features with 3D visualization tools that are used for image post-processing tasks such as 3D volume rendering. However, some are relatively or completely new to radiologists, including the manipulation of files in Standard Tessellation Language (STL). It is the STL format that is read by the 3D printer and used to output the hand held part of the patient's anatomy. This 90 minute session will begin with a DICOM file and will proceed through the steps to create a printable STL file. An extensive training manual will be provided before the meeting. It is highly recommended that participants review the training manual to optimize the experience at the workstation.

URL

Active Handout:Frank John Rybicki

http://abstract.rsna.org/uploads/2015/14003456/Active RCA13.pdf

RCB23

Using Keynote: An Alternative to Power Point (Hands-on)

Monday, Nov. 30 12:30PM - 2:00PM Location: S401CD

ED IN

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
Shawn D. Teague, MD, Indianapolis, IN (*Presenter*) Stockholder, Apple Inc

LEARNING OBJECTIVES

1. Modify the master slides used in a template. 2. Change the aspect ratio for a presentation from 4:3 to 16:9. 3. Utilize movies in a presentation. 4. Utilize the remote control feature in Keynote with a mobile device.

RCC23

Structured Reporting and the RSNA Reporting Initiative

Monday, Nov. 30 12:30PM - 2:00PM Location: S501ABC

IN

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants

Sub-Events

RCC23A Herding the Cats: Successfully Implementing a Department-Wide Standardized Reporting Program

Participants
David B. Larson, MD, MBA, Los Altos, CA (*Presenter*) Intellectual property license agreement, Bayer AG; Potential royalties, Bayer AG

LEARNING OBJECTIVES

1) Understand critical interpersonal elements to consider in implementing and managing a department-wide standardized structured report program. 2) Understand the technical challenges associated with implementing and managing a department-wide standardized structured report program.

ABSTRACT

Modern voice recognition technology has made department-wide standardized structured reporting feasible. However, the most significant challenges often lie in the interpersonal and organizational aspects. The author will discuss his experience in implementing and maintaining department-wide standardized structured reporting programs at two academic institutions, highlighting critical steps, major pitfalls, and strategies for success. The session will focus on those who might wish to develop department-wide structured reporting programs at their own institutions.

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

David B. Larson, MD, MBA - 2014 Honored Educator

RCC23B RSNA's Reporting Initiative: Recent Progress and New Directions

Participants
Charles E. Kahn JR, MD, MS, Philadelphia, PA, (charles.kahn@uphs.upenn.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand the background and rationale for RSNA's reporting initiative. 2) Describe recent advances in the technologies for radiology reporting. 3) Explore how reporting can add augment radiology's value to the healthcare enterprise. 4) Envision the latest directions and opportunities for radiology reporting.

ABSTRACT

Since 2007, the RSNA has taken a leading role in developing tools and clinical content to help radiologists improve their reporting practices. RSNA's library of best-practice reporting templates (www.radreport.org) has seen more than 2 million views and downloads. The 'Management of Radiology Report Templates' (MRRT) profile and a DICOM standard for transmitting template-based reports into the electronic health record (EHR) have been recently developed. These standards, and a set of tools that use them, provide new opportunities for information from radiology reports to be integrated into the clnical enterprise. The 'Open Template Library' (open.radreport.org) allows any RSNA member to contribute report templates, and the open-source 'T-Rex' template editor simplifies the editing process. Through partnerships with other organizations, RSNA is seeking to improve and extend these approaches. This presentation will highlight recent advances and new directions in radiology reporting.

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Charles E. Kahn JR, MD, MS - 2012 Honored Educator

RCC23C radreport.org: Facing Challenges and Moving Forward

Participants
Marta E. Heilbrun, MD, Salt Lake City, UT, (marta.heilbrun@hsc.utah.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand how to share templates on open.radreport.org Know how templates from open.radreport.org are promoted to

1) Understand how to share templates on openradreporting.org 2) Know how templates from openradreporting.org are promoted to radreport.org 2) Describe the active collaborations with the European Society of Radiology (ESR) and other societies with the RSNA structured reporting effort.

ABSTRACT

As a component of the RSNA structured reporting initiative a select template library was created and is available at www.radreport.org. In order to facilitate the exchange of templates and to identify best practices, a resource for hosting templates created by RSNA members and affiliated societies has been created at the www.open.radreport.org site. This presentation will walk the audience through the process for sharing templates on open.radeport.org and using the T-Rex editor to create MRRT templates. Additionally, the activities of the Template Library Advisory Panel (TLAP), a joint collaboration between the RSNA and the ESR will be described. The TLAP is responsible for promoting the crowd-sourced templates to the the select template library will be described.

INS-MOB

Informatics Monday Poster Discussions

Monday, Nov. 30 12:45PM - 1:15PM Location: IN Community, Learning Center

IN

AMA PRA Category 1 Credit ™: .50

FDA Discussions may include off-label uses.

Participants
Luciano M. Prevedello, MD,MPH, Columbus, OH (*Moderator*) Nothing to Disclose

Sub-Events

IN221-SD-MOB1 Value of MRE Quantification of Small Bowel Motility for Assessment and Follow up of Crohn's Disease

Station #1

Participants
Juan Cerrolaza, PhD, Washington, DC (*Abstract Co-Author*) Nothing to Disclose
Laurie Conklin, MD, Washington, DC (*Abstract Co-Author*) Nothing to Disclose
Raymond W. Sze, MD, Washington, DC (*Abstract Co-Author*) Nothing to Disclose
Marius G. Linguraru, DPhil, MS, Washington, DC (*Presenter*) Nothing to Disclose

CONCLUSION

Image analysis allows the automated and precise quantification of SB motility and detection of abnormal areas affected by reduced motility. These reproducible biomarkers of CD activity allow more objective and quantitative follow up of disease progression and response to treatment.

Background

To evaluate the potential of an automated peristaltic activity map (PAM) to improve the diagnosis and follow up of Crohn's disease (CD) on MR enterography (MRE) by obtaining quantitative, reproducible motility information in the small bowel (SB).

Evaluation

This IRB approved study includes a dataset of 25 retrospective studies: 10 patients diagnosed with CD with clinical observations, 13- 20 years. Longitudinal MRE were obtained (Discovery MR750 3.0T GE, 512x512; 0.82 to 0.94mm resolution) using free-breathing Fast Imaging Employing Steady-State Acquisition sequences (18 locations-15 frames per location; 8mm thickness). A two-stage B-Spline registration was used to compensate for respiratory effects. SB peristalsis was quantified via optical flow analysis. The result was an intestinal PAM that provided quantitative information of the abdominal motility. The new PAMs were evaluated by a board certified radiologist in two ways: objective (tracking in-plane motion of segments in mm/s), and qualitative accuracy (agreement with an expert on a 5-point Likert scale).

Discussion

The objective and qualitative error of the system was 1.1+/- 0.6mm/s and 0.7+/-0.7, respectively. SB areas with wall thickening or luminal narrowing were successfully identified as regions with reduced motility (< 1.2mm/s) in all cases. Relative improvement in the motility (< 1mm/s to >1.5mm/s) was observed for 2 patients with positive response to treatment over time. A decrease in the overall motility (>2.7mm/s to < 1.6mm/s) was observed for 2 patients with interval progression of CD. No difference in the motility was observed for other patients in agreement with steady clinical evolution.

IN246-SD-MOB2 Evidence of a 'Tumor Signature' in Metastasis by Quantitative Texture Analysis of CT-Scan Images

Station #2

Participants
Laurent Dercle, MD, Villejuif, France (*Presenter*) Nothing to Disclose
Charles Ferte, Villejuif, France (*Abstract Co-Author*) Nothing to Disclose
Cyril Jaudet, PhD, Brussel, Belgium (*Abstract Co-Author*) Nothing to Disclose
Eva Haspinger, Villejuif, France (*Abstract Co-Author*) Nothing to Disclose
Jean-Charles Soria, Villejuif, France (*Abstract Co-Author*) Nothing to Disclose
Samy Ammari, Villejuif, France (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Every metastasis is unique: a significant intra-tumor and inter-tumor heterogeneity has been proved by multiple biopsy samples. This inhomogeneity leads to differences in response to chemotherapy and challenges the concept of personalized medicine. It also plays an important role in cancer evolution, progression and resistance. In daily clinical practice, a single biopsy is performed "randomly": the choice is based on the accessibility of the tumor sites. A non-invasive characterization of the metastasis by quantitative texture analysis on computed tomography (QTA-CT) might improve patient management. We investigated if a "tumor signature on texture" could be extracted from parameters measured on QTA-CT.

METHOD AND MATERIALS

Trained radiologists using TEXRAD software defined region of interest. Two malignant target lesions of similar size were measured for each patient during the same acquisition, using the same filter, in the same organ: 218 metastases in 109 patients were included. Seven parameters were measured: mean, standard deviation (SD), entropy, mean positive pixel (MPP), skewness, kurtosis and total using different filter size (SSF2, SSF3, SSF4, SSF5 and SSF6). In order to avoid decreasing the power of the statistical test by multiple statistical testing, we considered the mean value and the maximal value of those filters: SSFmean and SSFmax.

RESULTS

In the two malignant target lesions, several parameters were significantly correlated (r=SSFmean, SSFmax): Mean (r=.51, .51), SD (r=.59, .55), Entropy (r=.54, .47), MPP (.55, .46), and TOTAL (r=.73, .70; thus showing that ROI were comparable); mean values were not statistically different (p>.05) for Mean, SD, MPP, skewness and kurtosis. In addition, ROC curves analysis revealed that the texture of malignant target lesions was significantly different from benign target lesions (Aorta and muscle, AUC: up to 0.85 for SDmax and MPPmax).

CONCLUSION

These promising results highlight that we could achieve a "texture signature of the tumor": the texture of two metastases growing in the same environment is similar and different from benign lesions. New areas of investigation could be to determine whether a strong different in texture between two metastases requires to perform two biopsies and if it is associated with clonal heterogeneity or different resistance patterns.

CLINICAL RELEVANCE/APPLICATION

Radiomics. Image guided biopsy. Management of patients.

IN223-SD-MOB3 Quantitative Staging of Fibrosis by the Optimized Features of Liver: Shape vs Texture

Station #3

Participants
Xuejun Zhang, Nanning, China (*Presenter*) Nothing to Disclose
Bin Zhou, Nanning, China (*Abstract Co-Author*) Nothing to Disclose
Brent J. Liu, PhD, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose
Xiaomin Tan, Nanning, China (*Abstract Co-Author*) Nothing to Disclose
Xiang H. Qu, Nanning, China (*Abstract Co-Author*) Nothing to Disclose
Liling Long, MD, Nanning, China (*Abstract Co-Author*) Nothing to Disclose
Yan Wen, Nanning, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To investigate the role of shape and texture in the classification of hepatic fibrosis by selecting the optimal parameters for a better Computer-aided Diagnosis system.

METHOD AND MATERIALS

120 patients are scanned by MDCT and all the cases are verified by needle biopsies as the gold standard of our experiment, ranging from 0(no fibrosis) to 5(cirrhosis). In each equilibrium phase CT image, 10 surface shape features are extracted from a standardized profile of liver; while15 texture features calculated from gray level co-occurrence matrix (GLCM) are extracted within an ROI in liver. These two types of features are used as separated set of input vectors. Each combination of these input subsets is checked by using support vector machine (SVM) with leave-one-case-out method to differentiate fibrosis into two groups: normal or abnormal. The number of input items is selected from the combinations of 10 or 15 features exhaustively. Finally the best shape and texture features are mixed into an optimized number of inputs for fibrosis classification.

RESULTS

According to the accuracy rate (AR) calculated from each combination, the optimal number of texture features to classify liver fibrosis degree is from 4 to 7, while shape features is 2 to 5. The overall performance calculated by the average sum of maximum AR value of all 10/15 types number of features is 66.83% by texture, while 85.74% by shape features (Fig.1), respectively; among 15 texture features, mean gray value and entropy are in most common used, while the root mean square deviation of the profile and the maximum height of the profile irregularities are in top 2 ranks in shape features (Fig.2). AR value tends to decrease even though we combin most efficient 3 texture and 4 shape features, that reaches a performance of 80.3% in average .

CONCLUSION

Comparing the accuracy of classification on two types of features, we should reveal that the accuracy rate of shape feature have a considerably larger than texture feature; we can not improve the performance of CAD by combining texture into shape features.

CLINICAL RELEVANCE/APPLICATION

The irregularity of liver shape can demonstrate fibrotic grade efficiently and texture feature of CT image is not recommended to use with shape feature for interpretation of cirrhosis.

IN224-SD-MOB4 Correlate: A PACS and EMR-integrated Tool which Leverages Natural Language Processing (NLP)to Provide Automated Clinical Follow-up for the Radiologist

Station #4

Participants
Mark D. Kovacs, MD, San Francisco, CA (*Presenter*) Nothing to Disclose
Joseph Mesterhazy, BS, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
David E. Avrin, MD, PhD, San Francisco, CA (*Abstract Co-Author*) Stockholder, Reed Elsevier
Thomas H. Urbania, MD, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
John Mongan, MD, PhD, San Francisco, CA (*Abstract Co-Author*) Spouse, Employee, Thermo Fisher Scientific Inc

CONCLUSION

Correlate is a PACS-accessible, EMR-integrated program, which allows the radiologist to easily enter search queries regarding desired clinical follow-up information. The system uses NLP to automatically search for relevant results from the EMR. Early success using Correlate at our institution demonstrates how NLP can be leveraged to facilitate obtaining relevant clinical follow-up information.

Background

A major challenge for radiologists is obtaining relevant clinical follow-up for the cases they read. Methods such as keeping MRN lists for follow-up and discussing cases with rounding clinical teams are helpful, but labor-intensive and tend to have sporadic adherence. Simple, efficient automated systems are needed for radiologists to obtain maximum follow-up in minimum time. To this end, we developed a PACS-accessible, EMR-integrated system, Correlate, which automatically finds answers to follow-up questions entered by radiologists.

Evaluation

Since the beginning of 2014, a total of 102 queries were submitted through Correlate, of which 70 returned results from the EMR. The total number of searches yielding results which were relevant (defined as returned relevance score above 70%) was 56. By this estimate, 80% of returned results were clinically relevant. Regarding MIRTH connect statistics, searches were made on a total of 84 patients, and 1198 individual EMR records were parsed and analyzed through Metamap and the Correlate scoring algorithm.

Discussion

Correlate builds on prior work in EMR data searching by its novel use of NLP. The web-based application is launched from the PACS and a query is entered along with a set of criteria that help define relevant results. The system then searches the EMR each day, interfacing using MIRTH connect. The question and criteria, as well as the retrieved unstructured medical record results, are mapped to Unified Medical Language System (UMLS) concepts using the MetaMap program. The Correlate algorithm then ranks retrieved results in order of likely relevance. If a retrieved patient record meets criteria for relevance, Correlate sends an email alerting the user with a link to the result.

IN225-SD-MOB5 Resident Performance on Night Float: Analysis of Factors Contributing to Major Discrepancies in Preliminary Reads

Station #5

Participants
Thomas W. Loehfelm, MD, PhD, Atlanta, GA (*Presenter*) Nothing to Disclose
Tarek N. Hanna, MD, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose
Saurabh Rohatgi, MD, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose
Faisal Khosa, FFR(RCSI), FRCPC, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose
Jamlik-Omari Johnson, MD, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Identify factors that impact resident performance on night float, including number of consecutive night shifts worked, hour, study volume, modality, and trainee level.

METHOD AND MATERIALS

Preliminary reports for cross-sectional studies by residents between 11pm and 8am at a level-1 trauma center from July 1, 2013 - December 31, 2014 (n = 18,488) were included. Attendings scored the reports as Major Discrepancy, Minor Discrepancy, Agree, and Agree - Good Job. Total RVUs dictated per shift serve as an indicator of resident workload. Datasets containing anonymized resident identifier, trainee level, consecutive shift number, hour, modality, per-shift RVUs, and prelim score were generated.We fit a proportional odds logistic regression model with the attending score as the outcome variable, assuming that the order of performance is given by: Major Discrepancy < Minor Discrepancy < Agree < Agree - Good Job. We included four potential factors in the model: trainee level (R2-4), hour of the night, consecutive nights, and modality. One-tailed Z-test for pooled population means was used to compare major discrepancy rates between junior (R2 or R3) and senior (R4) residents. Chi-squared test was used to compare performance on shifts by RVU quartile.

RESULTS

There were 233 major discrepancies (1.26%). The discrepancy rate was significantly better for senior compared to junior residents (1.08% vs 1.38%; $p < 0.05$). Likewise, the "Agree - Good Job" rate was better for senior residents (4.2% vs 3.0%; $p < 0.05$). Proportional odds logistic regression analysis implies that trainee level and modality are significantly associated with performance level, while number of consecutive shifts and hour of the night do not show a strong association with performance (Table 1). R3 residents performed significantly worse on busier nights (Figure 1).

CONCLUSION

Trainee level and modality are significantly associated with resident performance level on independent night float. Junior residents perform worse on busier nights. Consecutive nights worked and hour of the day do not show a strong association with performance level. Residents in general perform better on Nuclear Medicine and Ultrasound studies than Computed Tomography.

CLINICAL RELEVANCE/APPLICATION

Graduated call responsibilities make sense. Lack of correlation with consecutive shifts and hour has wider applicability to ACGME work guidelines and implications for overnight attending staffing models.

IN226-SD-MOB6 Predicting Radioembolization Response Using Computational Image Analysis

Station #6

Participants
Yan Wu, PhD, New Brunswick, NJ (*Presenter*) Nothing to Disclose
Omar Hasan, MD, New Brunswick, NJ (*Abstract Co-Author*) Nothing to Disclose
Rebecca A. Moss, New Brunswick, NJ (*Abstract Co-Author*) Nothing to Disclose
Rebekah Gensure, PhD, Somerset, NJ (*Abstract Co-Author*) Nothing to Disclose
Salim Banbahji, MD, New Brunswick, NJ (*Abstract Co-Author*) Nothing to Disclose
John L. Nosher, MD, New Brunswick, NJ (*Abstract Co-Author*) Nothing to Disclose
David Foran, New Brunswick, NJ (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Selective Internal Radiation Therapy (SIRT) is a technique for performing hepatic artery radioembolization through the delivery of

Selective Internal Radiation Therapy (SIRT) is a technique for performing hepatic artery radioembolization through the delivery of Yttrium 90 microspheres. This approach has shown promising results in patients presenting with neuroendocrine liver metastases. Predicting post-therapy response is highly significant clinically since it provides decision support for determining the likelihood that intervention with SIRT will provide benefit to the patient. In this study, texture characteristics of neuroendocrine liver metastases were extracted from baseline CT images and used to predict time to progression (TTP).

METHOD AND MATERIALS

During these studies, representative tumors were first segmented in the arterial phase of baseline contrast-enhanced axial CT images. The Local Binary Pattern method was applied to each delineated lesion to measure local texture characteristics. Within the representative tumor area, the histogram of multi-scale local binary patterns for all pixels was collected and normalized, forming a 40-dimensional texture feature vector for each patient. Using the texture features and TTP data of all patients in the training set, a prediction model was established using a Support Vector Machine (SVM) approach. Patients were stratified into two groups depending on whether their TTP was longer than a preset threshold (median of all TTP). Principal Component Analysis was conducted to reduce the dimensionality of texture features and the leave-one-out strategy was applied. Predictions were made for the test set and compared with true clinical outcomes.

RESULTS

Using this strategy, one out of 14 patients was misclassified. The experiments showed an accuracy of 93%, sensitivity of 100%, and specificity of 86%.

CONCLUSION

Texture analysis and SVM classification methods appear promising in predicting post-therapy TTP for patients presenting with neuroendocrine liver metastases. Our team plans to expand this preliminary feasibility study with additional patients and tumor types.

CLINICAL RELEVANCE/APPLICATION

The proposed approach provides decision support for determining the likelihood that intervention with SIRT will provide benefit to the patient.

IN227-SD-MOB7 3D Printing of Life SizeThoracic Physical Models using CT and MR Data for Aid in Complex Oncology Surgery

Station #7

Participants
Jane S. Matsumoto, MD, Rochester, MN (*Presenter*) Nothing to Disclose
Shanda Blackmon, MD, MPH, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Stephen D. Cassivi, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Robert T. Shen, MSc, Taipei, Taiwan (*Abstract Co-Author*) Nothing to Disclose
Dennis Wigle, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Jonathan M. Morris, MD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Thomas A. Foley, MD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The purpose of this study was to evaluate the use of physical thoracic tumor models in pre-surgical planning by multidisciplinary teams and for resident and patient education.

METHOD AND MATERIALS

Thoracic surgeons requested anatomic models of 8 patients with pulmonary and mediastinal tumors. Life size physical models were 3D printed using CT and MR imaging data. CT images with IV contrast were acquired at 1.5 - 3mm increments. Contrast was injected in the arm opposite to the side of the tumor. The patients' arms were placed in an overhead position simulating the position for thoracotomy. MR images of the brachial plexus were obtained in similar position.DICOM imaging data was segmented to separate and color code the complex critical anatomy of the mediastinum, lower neck and lung apex. In most cases this included chest wall, mediastinal and neck vessels, trachea, and brachial plexus. Segmentation was performed using proprietary software (Materialize, Leuven, Belgium). The images were exported into 3matic software, processed and converted to an STL file. The STL file was sent to the 3D printer computer where material and colors were assigned. The models were printed on a poly jet Connex 350 printer (Stratasys, Eden Prairie MN).

RESULTS

Eight thoracic models were 3D printed using high resolution contrast enhanced CT images. These included four malignant Pancoast tumors, three of which had brachial plexus or nerve root involvement. There were two schwannomas, a large mediastinal paraganglioma and a hemangiosarcoma of the mediastinum. The thoracic surgeons found these models to be very helpfulfor discussing and planning surgical approach, to use as a guide in surgery and for education.

CONCLUSION

Accurate life size thoracic models created from CT and MR imaging data have contributed to presurgical planning in complex thoracic cases. These models contribute to understanding, comprehension of critical anatomic relationship, surgical planning by multispecialty surgical teams and are highly valued in resident and patient education.

CLINICAL RELEVANCE/APPLICATION

Life size anatomic models of complex pelvic tumors using CT and MR imaging data add value by contributing to patient care, safety and education.

IN116-ED-MOB8 Problems and Possible Solutions in 3D Registration Strategies for Multiphasic Abdominal CT Volumes

Station #8

Participants

Darryl Hwang, PhD, Los Angeles, CA (*Presenter*) Nothing to Disclose
Brian Quinn, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose
Wesley Yip, BA, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose
Megha Nayyar, BA, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose
Vinay A. Duddalwar, MD, FRCR, Aberdeen, United Kingdom (*Abstract Co-Author*) Research Grant, General Electric Company

TEACHING POINTS

Understand the rationale of currently applied registration techniques in 3D software. Examination of 3D registration examples obtained from clinical software. Examination of 3D registration examples obtained from customized workflow/software. Understand the current limitations of registration. Examination of strategies to improve abdominal organ centric registration.

TABLE OF CONTENTS/OUTLINE

PURPOSE/AIM To understand the limitations of whole torso registration. To illustrate the points of misregistration when examining single organs in the torso. To show examples of registration achieved with clinically available software. To discuss more spatially accurate registration strategy for individual organ analysis.CONTENT ORGANIZATIONI. Review of current software strategies for multi-volume registration.II. Overview of 3D registration results for commercial clinical software Fujifilm (Stamford, CT) Synapse 3D examples Vital Images (Minnetonka, MN) Vitrea examples III. Discussion of strategic fallacies of current approaches when applied to abdominal imagingIV. Discussion of alternative workflow for more accurate abdominal organ registration. Organ of interest isolation Affine co-registration with chosen target. Visible improvements in image registration in both 2D and 3D.

RCA24

National Library of Medicine: PubMed Tools: Save Searches and Create Personalized Search Options (Hands-on)

Monday, Nov. 30 2:30PM - 4:00PM Location: S401AB

IN

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
Wendy Wu, MS, Detroit, MI (*Presenter*) Nothing to Disclose
Holly Ann Burt, MLIS, Chicago, IL (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Personalize PubMed by saving search strategies and creating email alerts. 2) Use My NCBI filters to link to library full-text articles and to focus PubMed searches. 3) Save collections of citations including a personal bibliography.

ABSTRACT

In this hands-on workshop session, explore the free My NCBI tool in PubMed. Discover how to develop and save search strategies, create email alerts on your research topics, and build permanent online bibliographies. With your My NCBI account, add permanent library filters and evidence-based filters to PubMed, use My Bibliography to create an online list of personal publications, limit searches to high impact journals, and utilize the link between the NIH Manuscript Submission System and PubMed. The National Library of Medicine (NLM) provides free web access to nearly 25 million citations for biomedical and clinical medical articles through PubMed.gov; MEDLINE is a subset of PubMed.

Handout:Holly Ann Burt

http://abstract.rsna.org/uploads/2015/15004106/2015myncbiRSNA.pdf

RCB24

3D Printing and 3D Modeling with Free and Open-Source Software (Hands-on)

Monday, Nov. 30 2:30PM - 4:00PM Location: S401CD

IN

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
Michael W. Itagaki, MD, MBA, Seattle, WA (*Presenter*) Owner, Embodi3D, LLC
Tatiana Kelil, MD, Boston, MA (*Presenter*) Nothing to Disclose
Beth A. Ripley, MD, PhD, Boston, MA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To become familiar with the steps of converting a medical imaging scan in standard Digital Imaging and Communications in Medicine (DICOM) format into a 3D printable medical model. 2) to obtain hands-on experience using free, open-source software packages to perform each step.

ABSTRACT

This presentation will provide hands-on training for converting a medical imaging scan into a 3D printed medical model using free, open-source software. Participants will convert a real computed tomography image data set in Digital Imaging and Communications in Medicine (DICOM) format to stereolithography (STL) file format using the open-source software package 3D Slicer. Participants will then further manipulation the STL file in preparation for 3D printing using the open-source software package Blender. By the end of the session participants should have a medical model that is 3D printable. Additional free learning resources for more advanced medical 3D printing will be provided. Techniques and software packages discussed will work on Windows, Macintosh, and Linux platforms.

Active Handout:Michael Ward Itagaki

http://abstract.rsna.org/uploads/2015/15003497/Active RCB24.pdf

RCC24

Overview of RSNA's Teaching File Software (MIRC®)

Monday, Nov. 30 2:30PM - 4:00PM Location: S501ABC

ED IN

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
William J. Weadock, MD, Ann Arbor, MI (*Presenter*) Owner, Weadock Software, LLC
Stacy D. O'Connor, MD, Boston, MA (*Presenter*) Nothing to Disclose
Andre M. Pereira, MD, Toronto, ON (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Learn the features of the RSNA's MIRC software for teaching files. 2) Learn how to download and install the software. 3) Learn to use the RSNA MIRC Wiki to obtain documentation on the software.

ABSTRACT

Background:MIRC (Medical Imaging Resource Center) or TFS (Teaching File System) is a component of RSNA's CTP (Clinical Trials Processor), a suite of tools developed by RSNA to optimize research in radiology mainly with emphasis on:workflow and security of patient information. It is offered free of charge by RSNA.Simply put, MIRC can be:used to build a radiology teaching file, be it for an individual of for an institution with many simultaneous users.Development started in 2000 and the project has been kept alive along the years, funded by RSNA, with great support both from RSNA and from the community of users.Installation is very streamlined and available for virtually all plataforms and operational systems. All files necessary for installation are available at the download session of RSNA's own MIRC server (http://mirc.rsna.org).This course is aimed to cover the basics of installation and administration of MIRC and also basic and advanced authoring tools.After finishing this course the attendee will be proficient in authoring and uploading cases, and also be familiar with the resources for installation and administration of MIRC.Course outline:The following topics will be covered:1) MIRC overview2) Options of hardware3) MIRC Installation4) MIRC administration: setting up libraries.5):MIRC administration: adding users6) Authoring a case using the basic authoring tool.7) Authoring a case using the advanced authoring tool.8) Advanced authoring tools: image annotation, quizzes, adding documents.9) Other user-level tools: conferences, migrating cases stored in local folders10) Sending cases to MIRC straight from the Dicom viewer.After the talk the attendees will be granted access to an educational MIRC server which will be open for a full month after the conference, to practice authoring and uploading of cases.

SSE13

Informatics (3D Printing)

Monday, Nov. 30 3:00PM - 4:00PM Location: S404CD

IN

AMA PRA Category 1 Credit ™: 1.00
ARRT Category A+ Credit: 1.00

Participants
Rasu B. Shrestha, MD, MBA, Pittsburgh, PA (*Moderator*) Advisory Board, General Electric Company; Medical Advisory Board, Nuance Communications, Inc; Editorial Advisory Board, Anderson Publishing, Ltd; Advisory Board, KLAS Enterprises LLC; Advisory Board, Peer60; Board, Omnyx, LLC; Board, Health Fidelity, Inc
Safwan Halabi, MD, Stanford, CA (*Moderator*) Nothing to Disclose
David J. Harvey, MBBCh, Swansea, United Kingdom (*Moderator*) Shareholder, Medical Connections Ltd; Managing Director, Medical Connections Ltd

Sub-Events

SSE13-01 Using Computed Tomography and 3D Printing (Additive Manufacturing) to Aid Construction of Custom Prosthetics and Attachment Devices for Our Wounded Warriors

Monday, Nov. 30 3:00PM - 3:10PM Location: S404CD

Participants
Peter C. Liacouras, PhD, Bethesda, MD (*Presenter*) Nothing to Disclose
Gerald T. Grant, MD, MS, Louisville, KY (*Abstract Co-Author*) Nothing to Disclose
John P. Lichtenberger III, MD, Bethesda, MD (*Abstract Co-Author*) Author, Reed Elsevier
Vincent B. Ho, MD, MBA, Bethesda, MD (*Abstract Co-Author*) In-kind support, General Electric Company

PURPOSE

The technology in the design and function of the prosthetics the military uses to restore function and mobility to our wounded warriors is highly advanced and in many instances not yet available to the general public. These typically young patients are extremely active and desire to take part in numerous complex activities such as kayaking, skiing, and scuba. While prosthetists can accommodate and manufacture numerous devices with standard materials and limb assemblies currently on the market, patients often may require individualized prosthetic design and/or modification to enable them to participate fully in more complex activities.

METHOD AND MATERIALS

Prosthetists, Rehabilitation Therapists, and Assistive Technologists work in collaboration to digitally design the necessary equipment or prosthetic modification necessary for their wounded warrior's rehabilitation needs. These designs are then produced using additive manufacturing from an array of materials. Many of these designs need to be form fitting to a particular prosthetic socket, impression, or thermoplastic mold. These sockets, impressions, and specialty items can be scanned using computed tomography and digitally reconstructed to produce a virtual three-dimensional model the engineer can use to design the necessary complementary features of the desired prosthetic, device, or attachment. Completed devices are tested for fit and function. Some of these designs and devices require multiple interactions to achieve the overall objective(s).

RESULTS

Over 20 unique custom prosthetic and attachments were successfully completed, which featured the use of computed tomography (CT) reconstructions. These included: two sets of Bilateral Hockey Skates; multiple wheel chair mushroom adapters, allowing patients to push their wheel chair without changing their terminal device; and a custom weight lifting prosthetic hand.

CONCLUSION

Additive Manufacturing is the most flexible and applicable solution to aid in these limited quantity production needs. CT imaging can be successfully used to provide proper design of custom attachments and assistive technology devices. Even though some these prosthetics attachments may be relatively simple in design to an engineer, they make a world of difference in the lives of our wounded warriors.

CLINICAL RELEVANCE/APPLICATION

Using Computed Tomography and 3D Printing (Additive Manufacturing) to Aid Construction of Custom Prosthetics.

SSE13-02 The Remnant Standard Tessellation Language (STL) Volume is a Novel Metric for 3D Printing Quality and the Remnant STL Volume Used to Validate 3D Printing from CT Images of Bone at Reduced Radiation Dose

Monday, Nov. 30 3:10PM - 3:20PM Location: S404CD

Participants
Tianrun Cai, MD, Boston, MA (*Presenter*) Nothing to Disclose
Kurt Schultz, RT, Vernon Hills, IL (*Abstract Co-Author*) Employee, Toshiba Corporation
Kanako K. Kumamaru, MD, PhD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Amir Imanzadeh, MD, Cambridge, MA (*Abstract Co-Author*) Nothing to Disclose
Frank J. Rybicki III, MD, PhD, Ottawa, ON (*Abstract Co-Author*) Research Grant, Toshiba Corporation;
Dimitris Mitsouras, PhD, Boston, MA (*Abstract Co-Author*) Research Grant, Toshiba Corporation; Speakers Bureau, Toshiba Corporation

PURPOSE

Most 3D-Printed (3DP) medical models use CT for its high spatial resolution and signal to noise ratio (SNR). To date, there is no

published data regarding 3DP quality and CT radiation dose. This study (a) defines the remnant Standard Tessellation Language (STL) volume (STLv) as a metric of 3DP quality and, (b) uses it to evaluate simulated tube current reduction and iterative reconstruction for 3DP bone models.

METHOD AND MATERIALS

Raw CT data (1st gen 320x0.5mm, 80kV, 0.5s rot) from 2 pts underwent noise addition (Poisson, photon stats plus Gaussian, electronic) to simulate 50%, 40%, 30%, and 20% of the clinical ref tube current (155 mAs). For all 10 recons per pt (ref mAs + 4 reduced doses, using both FBP and IR), image SNR was calculated from mean and SD regions of interest. Bone segmentation (Mimics, Materialise) was used (HU>226 threshold) to produce 3D-printable STL files. The remnant STL volume (STLv) was defined by topologic subtraction (union subtracted from intersection: Remnant STLv= [(Configuration U Reference) - (Configuration n Reference)]). Reference standard STLv was obtained from the clinical mAs IR recon.

RESULTS

Pt 1: FBP SNR range was 1.23 (20% dose) to 2.83 (100% dose). Remnant STLv was 2.84% of reference STLv at 30% dose (20% dose STL could not be produced) and reduced to 1.43% at 100% dose. With IR, SNR range was 3.38 (20%) to 4.54 (100%); the remnant STLv was 2.65% of reference at 20% dose, and reduced to 1.31% at 50% dose. Pt 2: FBP SNR range was 1.92 (20%) to 4.21 (100%); Remnant STLv ranged from 2.84% at 40% dose (STLs could not be produced at lower doses) to 1.54% at 100% dose. With IR, SNR range was 4.4 (20%) to 6.36 (100%) and remnant STLv range was 3.86% at 20% dose to 1.8% at 50% dose. In all cases, remnant STLv morphology was a 0.08-0.04mm layer at the outer bone surface. For example, 3DP models at 40% dose differ from full dose models by <2.2% by vol and <0.5mm in thickness.

CONCLUSION

The remnant volume is a novel metric for 3DP quality. High inherent SNR of bone supports 3DP at reduced CT radiation doses, particularly with IR. Further testing on soft tissue structures is warranted, given the different noise properties.

CLINICAL RELEVANCE/APPLICATION

This initial study relating 3DP models and patient radiation exposure introduces a novel metric for 3DP quality and supports reduced radiation dose images for high-quality 3DP of bone.

SSE13-03 3D Printing of Complex Oncologic Pelvic Models Using CT and MRI Data for Pre-operative Surgical Planning

Monday, Nov. 30 3:20PM - 3:30PM Location: S404CD

Participants
Jonathan M. Morris, MD, Rochester, MN (*Presenter*) Nothing to Disclose
Peter S. Rose, MD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Doris E. Wenger, MD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Franklin Sim, MD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Michael Yaszemski, MD, PhD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Jane S. Matsumoto, MD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To share our experience creating 3D printed individual life size pelvic models to aid in surgical planning for patients with pelvic tumors undergoing resection and reconstruction or revision from previous surgery and radiation.

METHOD AND MATERIALS

After institution IRB approval a retrospective review of our 3D printing experience in complex pelvic oncologic models was reviewed. DICOM imaging data from CT and/or MR was transferred to a dedicated server. Utilizing Mimics software, (Materialize, Leuven, Belgium) the DICOM data was segmented using a combination of thresholding and hand segmentation tools separating and color coding critical anatomy such as bone, vasculature, bladder and ureters, lumbosacral plexus and tumor. Images were converted into STL files and exported into 3matic software. The STL files, was sent to the 3D printer software where materials and colors were assigned. The models were printed on poly jet Connex 350 printer (Stratasys, Eden Prairie MN).

RESULTS

Sixteen 3D printed individualized pelvic models were printed from patient's imaging data. Cases included six chondrosarcomas and single cases each of Ewings, Chondroblastic OGS, Myeloma, Schwannoma, Giant Cell tumor and Synovial Chondromatosis. In addition, two models of the pelvis and two models of the pelvis and lumbar spine, were created in patients needing revision following previous surgery and radiation therapy. All models were created using high resolution CT images. In 10 cases there was contrast enhancement for aid in segmentation of vessels. In 8 cases additional MR imaging data was used and co-registered on the CT data. In 6 cases only CT data was used. MR imaging is essential in evaluating tumor involvement and demonstrating the relationship of the lumbosacral plexus to the tumor.

CONCLUSION

Accurate life size physical models created from CT and MR imaging data aid in surgical planning in complex cases. These models improve comprehension of critical anatomic relationship, focus surgical decision making by multispecialty surgical teams and enhance resident and family education.

CLINICAL RELEVANCE/APPLICATION

Life size anatomic models of complex pelvic tumors using CT and MR imaging data add value by contributing to patient care, safety and education.

SSE13-04 3D Printing in Radiology Using Low Cost 3D Printers and Open-Source Software

Monday, Nov. 30 3:30PM - 3:40PM Location: S404CD

Participants

Artur Salmaslioglu, MD, Istanbul, Turkey (*Presenter*) Nothing to Disclose
Kubilay Aydin, Istanbul, Turkey (*Abstract Co-Author*) Nothing to Disclose
Arzu Poyanli, MD, Istanbul, Turkey (*Abstract Co-Author*) Nothing to Disclose
Baris Bakir, Dipl Phys, Istanbul, Turkey (*Abstract Co-Author*) Nothing to Disclose
Mehmet Barbur, Istanbul, Turkey (*Abstract Co-Author*) Nothing to Disclose
Gulden Acunas, MD, Istanbul, Turkey (*Abstract Co-Author*) Nothing to Disclose
Bulent Acunas, MD, Istanbul, Turkey (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The introduction of cheap 3D printers and open source software decreased the costs associated with owning and using a 3D printer considerably. The purpose of our presentation is to describe a workflow using a cheap 3D printer and free or open source software for 3D printing in radiologic patients.

METHOD AND MATERIALS

A locally manufactured 3D printer kit and a roll of 3D printing filament (made from polylactic acid (PLA)) were bought for approximately 540 USD. Patients with pathological findings in enhanced Computed Tomography (CT) or rotational angiography were selected from the archives. DICOM images were imported and processed with Slicer software (www.slicer.org)) for segmentation and 3D object creation. The created objects were post-processed with MeshLab (MeshLab -Visual Computing Lab, meshlab.sourceforge.net) to correct possible segmentation errors or to remove unwanted segments. The objects were then imported to Meshmixer (Autodesk, www.meshmixer.com) to check for printability and to create supports for overhanging parts. The final object was then loaded to Cura (software.ultimaker.com/), which generated printing instructions (called g-code) and sent them to the printer. All of the used software were free or open source.

RESULTS

Following a short training period, it was possible to segment and postprocess DICOM data to obtain 3D printable objects representing pathologic structures. The material cost per object was very low (1-7 USD per object) compared to professional printers or professional printing services. The printed parts could be used for patient education and training residents. It was also possible to use water soluble filaments (like Polyvinyl Alcohol - PVA) to create dissolvable models, which could be embedded in silicone molds or covered with silicone and then dissolved to create hollow silicone models for training purposes.

CONCLUSION

3D Printing is an important technology which is now accessible and affordable thanks to the lower costs associated with the use of cheaper printers and open source software. This affordability and the ability to create patient or pathology specific models could be beneficial for patient education and resident training.

CLINICAL RELEVANCE/APPLICATION

Thanks to the advances in 3D printing and open source software, it is possible to create patient specific, imaging derived pathologic models with very low initial investment and low running cost.

SSE13-05 Realistic Fabrication of Patient-Specific Tracheo-Bronchial Model with 3D Printing for Pre-interventional Planning

Monday, Nov. 30 3:40PM - 3:50PM Location: S404CD

Participants
Haekang Kim, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Mi Young Kim, MD, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Guk-Bae Kim, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Namkug Kim, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Stockholder, Coreline Soft, Inc
Hyun Jung Koo, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Tai Sun Park, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
So Jung Park, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Chang Min Choi, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

Background

3D volumetric tracheobronchial MDCT might not be adequate enough to explain the disease extent and planning the bronchoscopic intervention of the tracheobronchial tree. For obtaining the comprehensive image for tracheobronchial stenosis, this study investigates patient-specific tracheobronchial object using a 3D printing, which has widely used to create fabricated replicas of anatomical structures. To estimate 3D printing application, a patient-specific airway stent model with a formation of tailored side hole for the second airway in geometry is also developed.

Evaluation

We fabricated the 3D models of the 6 patients with tracheobronchial narrowing by a stoma stenosis (n=1), central bronchogenic/adenoid cystic cancers (n=2), endobronchial metastasis (n=2), and trachea-esophageal fistula after radiation (n=1) involving trachea/main stem bronchus based on pre-interventional tracheobronchial MDCT. The airway lumen was segmented by a seeded region growing method in MDCT images without gap (< 1mm reconstruction, conventional kernel). For the 3D modeling from mask images by a marching cubes algorithm and the STL (Standard Tesselation Language) converting, the in-house software was developed. The airway model was generated by the airway lumen model by outside offsetting function of Magics (Materialise Inc., Leuven, Belgium). For 3D printing, we used Object 500 Connex 3 (Stratasys Inc., Eden Prairie, MN). Two radiologists and a bronchoscopy specialist evaluated an optimum condition of material hardness in consensus. In addition, we fabricated a patient-specific modeling having a realistic airway model equipped with cartilage features, which were artificially made by computer-aided design method

Discussion

By mixing soft and hard materials, we could figure out the optimum softness-to-hardness ratio between 4:5 and 3:7 (Fig. 1). Airway phantom with cartilage features was fabricated for more a realistic phantom study (Fig. 2).

Conclusion

This patient-specific 3D printing is practical application of pre-interventional planning in a variety of complicated patients who have central airway stenosis and subsequent stent developing. Simulation is also promising using the fabricated 3D replica.

SSE13-06 Quality Control and Spatial Accuracy in Anatomic Modeling Using 3D Printing Techniques

Monday, Nov. 30 3:50PM - 4:00PM Location: S404CD

Participants
Shuai Leng, PhD, Rochester, MN (*Presenter*) Nothing to Disclose
Jane S. Matsumoto, MD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Jonathan M. Morris, MD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Kiaran P. McGee, PhD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Joel L. Kuhlmann, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Cynthia H. McCollough, PhD, Rochester, MN (*Abstract Co-Author*) Research Grant, Siemens AG

PURPOSE

To establish a quality control (QC) program for the 3D printing used in clinical practice and to assess the accuracy and precision of each step of the 3D printing procedure.

METHOD AND MATERIALS

A systematic QC program was established to assess each step of the 3D printing: 1) Scan and reconstruction techniques were optimized to meet the need of 3D modeling. All imaging equipment were accredited by American College of Radiology and routinely tested. 2) Image segmentation and modeling were performed by experienced technologists and radiologists using FDA approved software (Mimics, Materialize). The contour of segmented objects was overlaid with original images and the agreement checked in all 3 planes over the whole model. 3) Annual maintenance of the printer was performed by the manufacturer. To assess the accuracy of the whole procedure, a QC phantom was developed that contained 11 groups of line-pairs with different sized air openings. This phantom was 3D printed using the same procedure as clinical models to generate a printed QC phantom. The size of the air opening for each group of bar patterns was then measured with a caliper for both the original phantom and its printed 3D model. After fabricated using the 3D printer, the clinical models were scanned on a CT scanner using a high resolution mode. The images were then registered to the segmented model, and distance between them was calculated on a point-by-point base. The same process was repeated for a radial-ulna clinical data set to compare 3D model scan and the original patient scan.

RESULTS

The imaging system provided high geometrical accuracy and spatial resolution (<1mm). For the QC phantom, the size of bar pattern on the 3D model agreed well with that of the original resolution phantom, with the measured differences ranged from -0.32 mm to 0.13 mm. For a radial-ulna clinical data set, the mean distance between the original data set and the scanned printed model was -0.12 mm, with a standard deviation of 0.17 mm. Differences ranged from -0.57 to 0.34 mm.

CONCLUSION

A comprehensive QC program has been established to access each step in the 3D printing procedure to ensure the printed anatomic models fulfill quality requirements in medical practice.

CLINICAL RELEVANCE/APPLICATION

Quality control is essential in 3D printing to ensure the printed model accurately represents the human anatomy and pathology so that they can be used in medical practice, research and education.

RCA25

National Library of Medicine: Online Images and Datasets: Options for Research and Presentations (Hands-on)

Monday, Nov. 30 4:30PM - 6:00PM Location: S401AB

IN

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
Holly Ann Burt, MLIS, Chicago, IL (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Identify freely available online image databases and data archives including those with online case studies. 2) Use basic searching skills across a variety of databases. 3) Locate copyright options for literature images and radiology datasets .

ABSTRACT

In this hands-on workshop, explore radiographic images and data available online. The National Library of Medicine (NLM) is only one of many agencies which support freely available online image databases and data archives. Topics include searching for journal images, identifying copyright options, and finding case studies or images specifically for patients and families. Use search engines and portals offering a radiology option; discover public data archives and how to search and access datasets; and identify available imaging tools. Learn which databases may be the best starting point for your research.

Handout:Holly Ann Burt

http://abstract.rsna.org/uploads/2015/15004108/2015onlinedatabasesRSNA.pdf

RCB25

Basic DICOM with Horos/Ostrix and dcm4che (Hands-on)

Monday, Nov. 30 4:30PM - 6:00PM Location: S401CD

IN

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
Marc D. Kohli, MD, San Francisco, CA (*Presenter*) Research Grant, Siemens AG
Simon Rascovsky, MD, MSc, Bogota, Colombia (*Presenter*) Officer, eDx Tecnologia en Salud SAS

LEARNING OBJECTIVES

1) Describe basic DICOM object metadata structure. 2) Demonstrate familiarity with Osirix/Horos DICOM viewer functions including image display, and measurements. 3) Use Osirix/Horos to send/receive DICOM objects. 4) Name several common dcm4che toolkit tools, and describe their purpose.

RCC25

Technologies for Creating Educational Content and Teaching Files

Monday, Nov. 30 4:30PM - 6:00PM Location: S501ABC

ED IN

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants

LEARNING OBJECTIVES

Sub-Events

RCC25A Podcasting and Screencasting for Teaching

Participants
Mahesh M. Thapa, MD, Seattle, WA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Identify the utility of podcasts and screencasts. 2) List major software packages available for creating podcasts and screencasts. 3) Understand the steps required to create a podcast or screencast.

RCC25B e-Publishing: Why and How to Do It

Participants
Michael L. Richardson, MD, Seattle, WA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Know the pros and cons of publishing electronic books. 2) Know the two main formats for publishing electronic books. 3) Be aware of several strategies for converting one's book to electronic form. 4) Know the pros and cons of several software packages used for electronic book conversion.

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Michael L. Richardson, MD - 2013 Honored Educator
Michael L. Richardson, MD - 2015 Honored Educator

RCC25C Lecturing 2.0: Innovative Tools and Techniques to Improve the Way We Teach and Learn

Participants
Harprit S. Bedi, MD, Boston, MA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Identify techniques to incorporate mobile technology into your teaching program. 2) Appraise your current teaching practices in light of the new pedagogical approaches introduced in the lecture.

MSAS31

The Emperor's Wearing a Speedo! Clinical Challenges with Electronic Health Records (Sponsored by the Associated Sciences Consortium) (An Interactive Session)

Tuesday, Dec. 1 8:30AM - 10:00AM Location: S105AB

IN

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
Dana Aragon, RT, Albuquerque, NM (*Moderator*) Nothing to Disclose
Patricia Kroken, Albuquerque, NM (*Moderator*) Nothing to Disclose
Rena Zimmerman, MD, Sequim, WA, (rzimmerman@olympicmedical.org) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Lack of interoperability of systems. 2) Necessity of creating a useful database. 3) Training of personnel and communication with the Information Technology department. 4) Data entry. 5) Copy/Paste - Document bloat - Meaningful Use. 6) Therapeutic relationship with the patient.

ABSTRACT

With the passage of the Patient Protection and Affordable Healthcare Act, electronic health records (EHR) are being widely adopted in all healthcare settings. While there are many possible benefits to widespread adoption of EHRs, there are inherent clinical challenges that must be addressed to improve outcomes. These will be illustrated using examples from my personal experience with different systems as a practicing radiation oncologist and surveyor for the American College of Radiology.

RC353

Tools and Use Cases for Text Information Extraction in Radiology

Tuesday, Dec. 1 8:30AM - 10:00AM Location: S403B

IN

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
Paras Lakhani, MD, Philadelphia, PA, (Paras.lakhani@jefferson.edu) (*Moderator*) Nothing to Disclose

LEARNING OBJECTIVES

1) Place natural language processing (NLP) in context of the history of radiology reporting. 2) Review how NLP is used in disciplines outside of radiology. 3) Understand basic NLP methods. 4) Assess the applicability of NLP to radiology reports.

ABSTRACT

Natural Language Processing (NLP) refers to the automated extraction of meaningful information from narrative text. Some NLP systems use simple rules to categorize text according to whether a particular concept may be present. More sophisticated systems use part-of-speech tagging and grammatical parsing to extract concepts and relationships from text. Some NLP systems use statistical approaches that can learn to categorize text automatically based on a test set of positive and negative examples. When applied to radiology reports, NLP systems are most frequently used to identify and retrieve reports of interest, such as reports containing a critical result, an incidental finding, or a recommendation for follow up. NLP systems are simpler to construct and more accurate when the structure of the analyzed text is constrained in some manner. Several real-world examples of both simple and sophisticated NLP systems in radiology will illustrate the spectrum of applicable techniques and the potential benefit to radiology practice.

Sub-Events

RC353A Natural Language Processing to Solve Problems in Clinical Practice

Participants
Michael E. Zalis, MD, Boston, MA (*Presenter*) Co-founder, QPID Health Inc; Chief Medical Officer, QPID Health Inc; Stockholder, QPID Health Inc

LEARNING OBJECTIVES

View learning objectives under main course title. In greater detail: 1) demonstrate gaps of function that exist with current EHR and PACS approaches to handling unstructured data 2) describe general approaches to NLP and assisted reasoning in addressing these gaps, 3) provide some specific examples of novel solutions that address these gaps and improve clinical efficiency.

RC353B The Good, The Bad, and The Ugly: Using Natural Language Processing to Understand Information Content in Radiology Reports

Participants
Brian E. Chapman, PhD, Salt Lake City, UT (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Become familiar with programming tools that can be used to build simple NLP applications. 2) Understand how the similarities and differences between medical and natural langauge affect natural language processing applications. 3) Understand how these tools can be used to estimate information content and clarity in radiology reports.

RC353C Use Cases in Radiology: Extracting Critical Results and Structured Reporting Using Natural Language

Participants
Paras Lakhani, MD, Philadelphia, PA, (Paras.lakhani@jefferson.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) See a real-world example of an NLP solution used to identify critical radiology results and documentation of communication. 2) Understand logic of text-mining algorithms designed to identify critical test results, and how they can be applied to large databases. 3) Demonstrate results of an NLP system used to identify critical radiology results. 4) Demonstrate how NLP can be used to make structured radiology reports.

ABSTRACT

The Joint Commission requires timely communication of critical results to an appropriate healthcare provider, and the American College of Radiology's Practice Guideline for Communication recommends documentation of communication of critical results in the radiology report. NLP techniques can be used identify radiology reports containing critical results and documentation of communication with high accuracy. Such algorithms may be used for Joint Commission compliance, performance monitoring, and quality assurance initiatives. Examples of specific text-mining algorithms that identify critical results will be provided. Also, the process of validating and determining the effectiveness of such algorithms using precision and recall will be discussed.Structured reporting is felt to have many advantages over free-text reporting, including that it is preferred by clinicians, facilitates data-mining, business analytics, retrospective research, and quantitative imaging. However, traditional SR reporting applications are found to be time-consuming by some radiologists, resulting in decreased productivity. Thus, an NLP solution to automatically create standardized reports from free-text radiology dictations will be demonstrated. Such a solution may provide the benefits of structured reporting with without loss in productivity.

RC353D Navigating the Available Tools and Methods for Natural Language Processing

Participants
Wendy Chapman, PhD, Salt Lake City, UT (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Review information extraction methods for building rule-based, grammar-based, and machine-learning NLP systems with examples of when to use each. 2) Demonstrate the creation of manually created reference standards against which to measure NLP systems. 3) Present a survey of open-source tools for NLP and manual chart review and how these can be built upon.

ABSTRACT

Natural language processing (NLP) is a term that describes a range of techniques for identifying, understanding, and analyzing information from text. Some of the earliest applications of NLP in medicine were on imaging reports. Attendees will be walked through both simple and complex NLP methods with examples of how and when they are best used in imaging. Several open-source tools will be demonstrated with information provided on how these tools can easily be built upon for customized needs.

RC354

Meaningful Use for Radiology: Pros and Cons

Tuesday, Dec. 1 8:30AM - 10:00AM Location: S404CD

IN

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
Ramin Khorasani, MD, Roxbury Crossing, MA (*Moderator*) Consultant, Medicalis Corp
Ramin Khorasani, MD, Roxbury Crossing, MA (*Presenter*) Consultant, Medicalis Corp
Alberto F. Goldszal, PhD, MBA, East Brunswick, NJ, (AGoldszal@UniversityRadiology.com) (*Presenter*) Advisory Board, FUJIFILM Holdings Corporation; Advisory Board, MedInformatix, Inc
Keith D. Hentel, MD, MS, New York, NY, (keh9003@med.cornell.edu) (*Presenter*) Nothing to Disclose
James Whitfill, MD, Scottsdale, AZ (*Presenter*) President, Lumetis, LLC; Co-author, Hitachi, Ltd

LEARNING OBJECTIVES

1) Understand how a radiology practice that was a later adopter of meeting meaningful use criteria has achieved successful results for two years running. 2) Learn about CMS MU audits and the audit process 3) Learn about challenges for meaningful use stage 2 and radiology.

ABSTRACT

RCA31

Learn Image Segmentation Basics with Hands-on Introduction to ITK-SNAP (Hands-on)

Tuesday, Dec. 1 8:30AM - 10:00AM Location: S401AB

IN

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

FDA Discussions may include off-label uses.

Participants
Paul Yushkevich, PhD, Philadelphia, PA, (pauly2@upenn.edu) (*Presenter*) Nothing to Disclose
Guido Gerig, Brooklyn, NY (*Presenter*) Nothing to Disclose
Jeffrey Ware, MD, Philadelphia, PA, (jeffrey.ware2@uphs.upenn.edu) (*Presenter*) Nothing to Disclose
Philipose G. Mulugeta, MD, Philadelphia, PA, (philipose.mulugeta@uphs.upenn.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To use a free interactive software tool ITK-SNAP to view and manipulate 3D medical image volumes such as multi-parametric MRI, CT and ultrasound. 2) To label anatomical structures in medical images using a combination of manual and user-guided automatic segmentation tools.

ABSTRACT

Quantitative analysis of medical imaging data is increasingly relevant in a growing number of radiological applications. Almost invariably, such quantitative analysis requires some structures of interest (organs, tumors, lesions, etc.) to be labeled in the image. Labeling anatomical structures is a complex task, particularly when the imaging data is complex, such as in the case of multi-parametric MRI or fusion of different imaging modalities. ITK-SNAP is a free, open-source, and easy to use interactive software tool that allows users to view multiple image volumes of the same anatomy and label structures using information from all volumes concurrently. For example, ITK-SNAP allows users to label tumors (core, edema, necrosis) using a combination of T1-weighted, contrast-enhanced T2-weighted, T2-weighted and FLAIR MRI. ITK-SNAP provides easy to use user-guided automatic segmentation functionality rooted in statistical machine learning and deformable modeling algorithms, as well as built in tools for manual editing and correction of segmentations. ITK-SNAP runs on Windows, MacOS and Linux platforms. During this hands-on course, the participants will use ITK-SNAP to label organs and tumors in various imaging modalities. After completing the course, participants will be well equipped for performing quantitative analyses of medical image data using ITK-SNAP and other compatible free software tools.

Handout:Paul Yushkevich

http://abstract.rsna.org/uploads/2015/15003102/handout_exercises.pdf

RCB31

Creating Radiology eBooks for the iPad (Hands-on)

Tuesday, Dec. 1 8:30AM - 10:00AM Location: S401CD

ED IN

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
Henry J. Baskin JR, MD, Salt Lake Cty, UT (*Presenter*) Nothing to Disclose
Justin Cramer, MD, Salt Lake City, UT (*Presenter*) Nothing to Disclose
Justin La Plante, MD, Sayre, PA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Become familiar with Apple's free ebook authoring tool, iBooks Author. 2) Create a sample radiology ebook during the course. 3) Learn how to freely share your ebook with others.

ABSTRACT

The iPad is rapidly becoming the de facto learning tool used by radiology residents and fellows. iBooks Author, a free authoring tool from Apple, enables the creation of ebooks with a near-limitless number of high-resolution images, movies, and other interactive elements. Unfortunately, most radiologists lack the expertise to leverage the advantages of this application. This hands-on workshop will cover the basics of iBooks Author. During the course, attendees will create their own interactive radiology ebook and learn how to freely share it with anyone who has an iPad.iBooks author is only available for Mac OS and bringing your own Mac is required for the hands-on portion of the course. Attendees are encouraged to download iBooks Author prior to attending; the link is provided below. Attendees are also encouraged to come with an idea for their own iBook, ideally with a text file and folder of images they would like to turn into an ebook during the course. Sample text and images will be provided for those who do not bring their own material.

URL

RCC31

The RSNA Image Share Network - How It Operates and How to Put It into Your Office

Tuesday, Dec. 1 8:30AM - 10:00AM Location: S501ABC

IN

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
David S. Mendelson, MD, Larchmont, NY (*Moderator*) Spouse, Employee, Novartis AG; Advisory Board, Nuance Communications, Inc; Advisory Board, General Electric Company; Advisory Board, Toshiba Corporation
Wyatt M. Tellis, PhD, San Francisco, CA (*Presenter*) Officer, EyePACS, LLC

LEARNING OBJECTIVES

1) Understand the goals of the RSNA Image Share project. 2) Understand the technical architecture of the RSNA Image Share. 3) Learn the steps necessary to implement in your local environment.

URL

RCA32

Productive Tools and Technology for the Academic Radiologist (Hands-on)

Tuesday, Dec. 1 10:30AM - 12:00PM Location: S401AB

ED IN

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
Mahesh M. Thapa, MD, Seattle, WA (*Moderator*) Nothing to Disclose
Mahesh M. Thapa, MD, Seattle, WA (*Presenter*) Nothing to Disclose
Jonelle M. Petscavage-Thomas, MD, MPH, Hummelstown, PA (*Presenter*) Consultant, Medical Metrics, Inc
Michael L. Richardson, MD, Seattle, WA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Know some of the latest technology for text processing. 2) Learn some of the latest technology for health in the workplace. 3) Be aware of technology that can make the RSNA meeting more pleasant and productive.

ABSTRACT

Honored Educators

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Michael L. Richardson, MD - 2013 Honored Educator
Michael L. Richardson, MD - 2015 Honored Educator

RCB32

Making the Most of Google Docs: Docs, Slides, Forms, and Sheets (Hands-on)

Tuesday, Dec. 1 10:30AM - 12:00PM Location: S401CD

IN

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
Marc D. Kohli, MD, San Francisco, CA (*Moderator*) Research Grant, Siemens AG
Marc D. Kohli, MD, San Francisco, CA (*Presenter*) Research Grant, Siemens AG
Ross W. Filice, MD, Washington, DC, (ross.w.filice@gunet.georgetown.edu) (*Presenter*) Nothing to Disclose
Aaron P. Kamer, MD, Indianapolis, IN, (apkamer@iupui.edu) (*Presenter*) Nothing to Disclose
Andrew B. Lemmon, MD, Atlanta, GA (*Presenter*) Nothing to Disclose
Thomas W. Loehfelm, MD, PhD, Atlanta, GA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Describe the benefits and drawbacks of using Google tools for collaborative editing. 2) Explain issues related to storing protected health information in Google Drive. 3) Demonstrate the ability to use the Google productivity applications for collaboration on document, spreadsheet, online form and presentation creation.

ABSTRACT

Note: Attendees should have or create a Google account prior to coming to the session.In today's busy environment, we need tools to work smarter, not harder. Google's suite of productivity applications provides a platform for collaboration that can be used across and within institutions to produce documents and presentations and to obtain and work-up data with ease. However, with increased sharing, security concerns need to be addressed. At the end of the session, learners should be able to demonstrate creating, sharing, and editing a document as a group.

RCC32

Clinical Applications of 3D Printing

Tuesday, Dec. 1 10:30AM - 12:00PM Location: S501ABC

CA NR ED IN

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
Shi-Joon Yoo, MD, Toronto, ON (*Moderator*) Owner, 3D HOPE Medical; CEO, IMIB-CHD;
Vincent B. Ho, MD, MBA, Bethesda, MD (*Moderator*) In-kind support, General Electric Company

Sub-Events

RCC32A Role of 3D Printing in Congenital Heart Disease

Participants
Shi-Joon Yoo, MD, Toronto, ON (*Presenter*) Owner, 3D HOPE Medical; CEO, IMIB-CHD;

LEARNING OBJECTIVES

1) Understand 3D printing process for heart models. 2) Know how 3D printing helps pediatric cardiac surgery, with case examples. 3) Know the future directions of 3D printing for cardiac surgery.

ABSTRACT

Using rapid prototyping or 3D printing, physical replicas of the hearts can be provided to surgeons before their surgical decision and procedure. The replicas fill the gap between the imagination from the medical images and the reality. By having the replicas in hands, the surgeons can make optimum surgical decision and simulate the intended procedures on the replica prior to the procedure. This allows precise surgical procedures with reduced procedure and anasthesia time. In canses in the grey zone for biventricular versus univentricular repair, the replicas are of tremendous help in a binary decision. The presentation will include a few clincal cases where 3D printing played a crucial role in surgical decision making.

RCC32B 3D Surgical Planning Using Printed Models: The Surgeon's Perspective

Participants
Edward J. Caterson, MD, PhD, Boston, MA (*Presenter*) Nothing to Disclose

RCC32C 3D Surgical and Treatment Planning Using Printed Models

Participants
Frederik L. Giesel, MD, MBA, Heidelberg, Germany (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) History of 3D-Printing. 2) Imaging modalities and post-processing procedures to provide data surrogates for 3D-printing. 3) Concept of 3D-printing for improved clinical services. 4) Limitations and challanges of 3D-printing in surgical planning.

ABSTRACT

This presentation outlines the impact of 3D-printing in the imaging environment. Applications in the medical field are reviewed and growing clinical applications are discussed. Starting with an overview of current 3D-printing technologies including fused deposition modelling (FDM), selective laser sintering (SLS), and stereolithography (SLA) common techniques for generating 3D object models based on medical imaging are illustrated. Typically, imaging source data from different modalities are post-processed using dedicated algorithms and software in order to generate triangle mesh surface data. These surface data are usually exported to STL-files that are commonly understood by current 3D printing machines. 3D-printed objects are most often made from plastic, such as ABS, PA, or PLA, but metal or other material is even possible. Finally the presentation will demonstrate how 3D-printed objects are valuable for treatment planning, treatment procedures in several clinical subspecialties, intra-operative surgical navigation, or for prosthesis production. However, medical applications of 3D-printing are still in a very early phase but the growing awareness in the medical and non-medical field nowadays support the promising utilization and development in the very near future.

RCC32D Validation of Coronary Contrast Gradients Using 3D Coronary Phantoms

Participants
Dimitris Mitsouras, PhD, Boston, MA (*Presenter*) Research Grant, Toshiba Corporation; Speakers Bureau, Toshiba Corporation

LEARNING OBJECTIVES

1) Learn about which 3D printing technologies can produce physiological compliant vascular phantoms. 2) Recognize those in vivo imaging techniques that can be translated into vascular models that can be 3D printed. 3) Be able to describe the steps required in developing an in silico plus in vitro experiment to explain an imaging finding. 4) Be able to explain the reason for the coronary contrast enhancement gradient seen in standard coronary CT angiography.

ABSTRACT

3D-printed cardiovascular models are poised to become a disruptive force in the development of novel functional CT and MR imaging techniques. With 3D printing, patient-specific models can be produced for physiologically accurate - with respect to both pathophysiology and underlying physics - validation studies that are not otherwise feasible due to e.g., radiation burden, scan time,

and cost. Multiple 3D printing technologies are key for such applications, particularly regarding vascular compliance and incorporation of hard materials for e.g., calcifications. Similarly, multiple imaging techniques such as rotational DSA, CT and MRI can be used to produce such models. A particularly important application is validation of in silico computational fluid dynamics (CFD) simulations that have been used to advance our understanding of cardiovascular disease and imaging methods developed to diagnose it in the last two decades. A given patient-specific model simulated with CFD can now concurrently be realized for identical in vitro flow experiments to validate conclusions drawn from the numerical model. Two examples are the coronary Transluminal Attenuation Gradient (TAG) and simulated fractional flow reserve (FFR) being developed for the non-invasive detection of significant coronary artery disease from standard CT angiography. We will showcase in vitro CTA experiments to elucidate the intra-luminal kinetics of iodinated contrast that give rise to TAG as an example of the steps from in vivo image acquisition, to lumen segmentation and preparation for 3D printing, and in vitro experimentation. Just as numerical 3D modeling has been a disruptive application of computational fluid dynamics methods with the potential to bridge the gap between understanding anatomy and function, 3D printing is poised to be a disruptive application of in vivo imaging and additive manufacturing to advance our understanding of pathophysiology, and new imaging techniques and devices.

RCC32E Blood Flow in the Thoracic Aorta Elucidated with 3D Models

Participants
Michael Markl, PhD, Chicago, IL (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Describe the use of 3D models of the aorta for the in-vitro simulation of aortic hemodynamics. 2) Explain the potential of in-vitro 4D flow MRI for the modeling and systematic analysis of the influence of common aortic pathologies on local and global 3D flow patterns in the aorta.

ABSTRACT

Flow sensitive MRI offers the ability to assess anatomy as well as flow characteristics in healthy and pathological blood vessels and is therefore an attractive tool for the diagnosis of vascular diseases. However, in-vivo studies do not allow the prediction of hemodynamic changes due to vascular modifications. Realistic vascular in-vitro 3D phantoms in combination with MRI flow measurements allow to model different vascular deformations and evaluate their effect on blood flow dynamics. This presentation will provide a review of the methods for the in-vitro simulation of aortic 3D blood flow with realistic boundary conditions and review previously reported application for the simulation of common aortic pathologies and their impact on aortic hemodynamics.

SSG08

Informatics (Results and Reporting)

Tuesday, Dec. 1 10:30AM - 12:00PM Location: S402AB

IN

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
David S. Hirschorn, MD, Staten Island, NY (*Moderator*) Nothing to Disclose
Arnon Makori, MD, Chicago, IL (*Moderator*) Medical Advisory Board, Carestream Health, Inc

Sub-Events

SSG08-01 Follow that Patient! Follow-up of Patients with Abdominal Imaging Findings of Possible Cancer

Tuesday, Dec. 1 10:30AM - 10:40AM Location: S402AB

Participants
Hanna M. Zafar, MD, Philadelphia, PA (*Presenter*) Nothing to Disclose
Philipose G. Mulugeta, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Caroline Sloan, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Denise Petersen, BSN, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Darco Lalevic, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Tessa S. Cook, MD, PhD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose

Background

Focal masses potentially representing cancer are commonly discovered in patients referred for abdominal imaging. Failure to properly follow-up patients with imaging findings of possible cancer can result in missed or delayed cancer diagnoses. Yet the proportion of patients in whom follow-up is not completed, but clinically appropriate, is poorly understood

Evaluation

In July 2013 our radiology department implemented a mandatory coding scheme for reporting the malignant likelihood of focal masses in the adrenals, kidneys, pancreas and liver on all CT, MRI and ultrasound examinations. Focal masses with codes correlating to imaging findings of possible cancer were detected in 675 unique patients between 7/1/13 and 9/31/13 of whom 24% (164/675) expired within 30 days. Chart review within 15 months revealed that 40% of patients (268/675) received imaging follow-up, 7% (50/675) pathology follow up, 5% (35/675) other methods of follow-up (e.g. specialist referral, change in therapy), 5% (37/675) had documented reasons for the lack of follow-up, and 17% (118/675) had no reason for lack of follow-up documented in the chart.

Discussion

Over half of patients with abdominal imaging findings possibly representing cancer receive imaging, pathology or clinical follow-up within 15 months of initial detection; most commonly through imaging (40%). Yet, nearly one fifth of patients receive no follow-up and have no reason for the lack of follow-up documented in the medical record. These patients are at risk for missed or delayed cancer diagnoses.

Conclusion

Reliable methods of monitoring patients with abdominal imaging findings of possible cancer are needed to identify the nearly one fifth of patients with no documented reason for lack of follow-up in the clinical chart. Providers caring for these patients should be contacted to determine the reason for no follow-up in order to improve the quality and safety of patient care.

SSG08-03 Lexical Disparities between Reports Authored by Residents and Reports Authored by Attending Radiologists Using Natural Language Processing

Tuesday, Dec. 1 10:50AM - 11:00AM Location: S402AB

Participants
Brian E. Chapman, PhD, Salt Lake City, UT (*Presenter*) Nothing to Disclose
Amilcare Gentili, MD, San Diego, CA (*Abstract Co-Author*) Nothing to Disclose
Stuart L. Schulthies, Salt Lake City, UT (*Abstract Co-Author*) Nothing to Disclose
Marta E. Heilbrun, MD, Salt Lake City, UT (*Abstract Co-Author*) Nothing to Disclose

Background

We explored using simple natural language processing tools to characterize radiology reports and identify lexical features that differed between reports generated by residents and reports generated by attending radiologists. In this initial exploration, we limited ourselves to the Impression section (IS) of the reports. Reports generated from October through December 2013 were analyzed. From the IS we extracted the following features: 1) the number of words in the IS, 2) the number of RadLex concepts in the IS divided by the number of words, 3) the number of uncertainty phrases in the IS divided by the number of words in the IS, 4) the polarity of the IS (whether the concepts were expressed in a negative, neutral, or positive manner), and 5) the subjectivity of the IS. RadLex concepts consisted of all preferred names and synonyms defined in the RadLex ontology. Uncertainty terms were identified using pyConTextNLP using a lexical knowledge base defined previously. Polarity and subjectivity were measured using the textblob Python package. A logistic regression model determined the statistical relationships between lexical features and report authorship.

Evaluation

61705 impression sections were analyzed, of these 35352 were generated by an attending without a resident and 26353 were

generated by a resident supervied by an attending. On average, resident impression sections were longer, more subjective, less positive, used fewer RadLex terms and used fewer uncertainty terms. All features were significant in the logistic regression model ($p<0.000$).

Discussion

Our results indicate that there are measurable lexical differences between resident and attending reports. Attending reports are shorter, use more standard terms, express more positive sentiment, as well as use more uncertain expressions. It is somewhat surpring that the residents expressed less uncertainty and warrants further investigation.

Conclusion

Our study has several limitations. We have not analyzed the results by service or experience level of the residents. Also, the distribution of authorship was not uniform across services. Mammography and nuclear medicine had significantly fewer resident reports than other services.

SSG08-04 Structured Reporting vs. Free Text Reporting of MRI Examinations of the Shoulder: Potential Impact on Durgical Planning

Tuesday, Dec. 1 11:00AM - 11:10AM Location: S402AB

Participants
Marco Armbruster, Munich, Germany (*Presenter*) Co-Founder of medical software company.
Sebastian Gassenmaier, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose
Florian Haasters, MD, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose
Tobias Helfen, MD, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose
Thomas Henzler, MD, Mannheim, Germany (*Abstract Co-Author*) Nothing to Disclose
Maximilian F. Reiser, MD, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose
Wieland H. Sommer, MD, Munich, Germany (*Abstract Co-Author*) Founder, QMedify GmbH
Nora N. Kammer, MD, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To compare structured reports vs. standard free text reports of MRI examinations of the shoulder and to evaluate quality of reports, satisfaction of referring physicians and potential effects for surgical planning.

METHOD AND MATERIALS

We included 30 patients who underwent MRI of the shoulder for one of the following reasons: trauma, luxation or a possible tendon tear. Exclusion criteria were known tumors, previous shoulder operations or inflammatory diseases. We acquired both standard free text reports and structured reports, which were performed with an online software with dedicated templates and clickable decision trees with concomitant generation of semantic structured reports. The template was specific for MRI of the shoulder after trauma and/or degenerative lesions and included specific information relevant for surgical planning. All reports were evaluated with regard to their impact on clinical decision making, sufficiency for surgical planning, convenience of information extraction, linguistic quality, and referring physicians' satisfaction.

RESULTS

Overall 30 structured and 30 free-text reports were reviewed by two orthopedic surgeons with long lasting experience in surgery of the shoulder (9 yrs, 6 yrs respectively). Decision making regarding surgery vs. conservative therapy was possible without further consultations in 87% of structured and 73% of free text reports. In case of surgery the provided information was considered to be sufficient for surgical planning in 87% of structured and 60% of non-structured reports. Overall, 17% of structured and 47% of free text reports were considered to be incomplete. The effort of information extraction from the reports was considered to be time-consuming in 17% of structured and 54% of free text reports ($p<0.001$). The linguistic quality was not rated different between structured and non-structured reports ($p=0.1745$).

CONCLUSION

Structured reporting of MRI of the shoulder facilitates clinical decision making and surgical planning and potentially leads to a higher satisfaction of referring physicians.

CLINICAL RELEVANCE/APPLICATION

Structured reporting of musculoskeletal MRI examinations with dedicated and specific templates is a valuable tool to provide standardized information to referring physicians.

SSG08-05 Pilot Study of a Global Radiology Report Categorization (RADCAT) System in the Emergency Department

Tuesday, Dec. 1 11:10AM - 11:20AM Location: S402AB

Participants
David W. Swenson, MD, Brooklyn, CT (*Presenter*) Nothing to Disclose
Martha B. Mainiero, MD, Providence, RI (*Abstract Co-Author*) Nothing to Disclose
Grayson L. Baird, MS, Providence, RI (*Abstract Co-Author*) Nothing to Disclose
David C. Portelli, MD, Providence, RI (*Abstract Co-Author*) Nothing to Disclose
Jonathan S. Movson, MBChB, Providence, RI (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To develop a global categorization system for radiology reports in the emergency department, and to evaluate the inter-observer variation of the system as a first step in establishing its clinical utility.

METHOD AND MATERIALS

In collaboration, members from the departments of diagnostic imaging and emergency medicine developed a report categorization

system with 5 grades for characterizing the urgency of findings: RADCAT 1=Normal, 2=Routine, 3=Non-Urgent imaging follow-up recommended, 4=Priority (likely to affect treatment during the ongoing care episode), and 5=Critical (requiring immediate direct physician-to-physician communication). Four radiologists interpreted a minimum of 400 studies in the ED setting, assigning each report a RADCAT designation. 58 of these 1600 reports (without images) were selected as a representative sample, and re-categorized by 6 radiologists and 6 emergency medicine physicians, all blinded to the original RADCAT designation. Inter-observer agreement was assessed using Cohen's Kappa statistic.

RESULTS

Inter-observer agreement was interpreted according to the guidelines of Landis and Koch. Among radiologists, agreement was excellent for RADCAT 1 (k=0.83), substantial for RADCATs 2, 3, and 5 (k=0.73, k=0.68, and k=0.71, respectively), and moderate for RADCAT 4 (k=0.54). Among emergency physicians, agreement was excellent for RADCAT 1 (k=0.85), substantial for RADCATs 2 and 5 (k=0.70, k=0.77, respectively), and moderate for RADCATs 3 and 4 (k=0.51, k=0.52, respectively). Among both groups combined, agreement was excellent for RADCAT 1 (k=0.85), substantial for RADCATs 2, 3, and 5 (k=0.74, k=0.61, and k=0.74, respectively), and moderate for RADCAT 4 (k=0.54). Overall agreement for RADCAT designations of all physicians was substantial (k=0.65).

CONCLUSION

The RADCAT system for globally characterizing radiology reports may provide a valuable shorthand for communication between radiologists and emergency medicine physicians interacting through the electronic medical record, with substantial interobserver agreement demonstrated on this initial pilot study.

CLINICAL RELEVANCE/APPLICATION

We demonstrate a system for improving efficiency and fidelity of communicating information through radiology reports.

SSG08-06 Use of Conditional Statements in Radiology Follow-Recommendation Sentences: Relationship to Follow Up Compliance

Tuesday, Dec. 1 11:20AM - 11:30AM Location: S402AB

Participants
Martin L. Gunn, MBChB, Seattle, WA (*Presenter*) Research support, Koninklijke Philips NV; Spouse, Consultant, Wolters Kluwer NV; Medical Advisor, TransformativeMed, Inc;
Bruce E. Lehnert, MD, Seattle, WA (*Abstract Co-Author*) Research support, Koninklijke Philips NV
Christopher Hall, PhD, Briarcliff Manor, NY (*Abstract Co-Author*) Employee, Koninklijke Philips NV
Meliha Yetisgen, PhD, Seattle, WA (*Abstract Co-Author*) Nothing to Disclose
Norman J. Beauchamp JR, MD, Seattle, WA (*Abstract Co-Author*) Research Grant, Koninklijke Philips NV
Karen Trovato, PhD, Briaircliff Manor, NY (*Abstract Co-Author*) Employee, Koninklijke Philips NV
Sandeep Dalal, Briarcliff Manor, NY (*Abstract Co-Author*) Employee, Koninklijke Philips NV

PURPOSE

A significant proportion of patients do not receive timely follow-up (F/U) investigations that are recommended in radiology reports. Automated tools to detect, flag, and communicate F/U recommendations may increase the rate of follow-up, but risk alert-fatigue or over-reliance. The purpose of this study is to determine the correlation between conditional statements (CS) (hedge statements) in follow-up recommendation sentences (FURS) of radiology reports and the rate of F/U.

METHOD AND MATERIALS

A regular expression automated natural language processing (NLP) technique was developed to detect FURS in all radiology reports (1.6m) from 2010 to 2014 at a large multi-hospital academic radiology department. The NLP algorithm was validated using a sample of radiology reports. A representative cohort (n=355) of records containing FURS was extracted and a single expert reader (blinded to whether F/U occurred) evaluated full reports for the presence of CS; F/U timeframe, modality, and expectation of whether F/U was necessary/probable based on the entire text of the report (E=0,1,2 where 0=little, 1=moderate, and 2=high/definite). In a second phase, the expert reader determined whether the F/U occurred. A Chi-squared test was used with $p < 0.05$ considered statistically significant.

RESULTS

In the sample, CS's occurred in 125/355 reports with FURS (35.2%). Appropriate F/U rate was 55.5%. CS's occurred more in ED patients (46.3%) vs inpatient (43.1%, $p<0.02$) and outpatient settings (26.2%, $p<0.001$). FURS containing CS had lower follow-up compliance than FURS without CS (36% vs. 66%, $p<0.001$). The rate of CS dropped with expectation of follow up (59.4, 36.7, 16.7% with E=0, 1,2; $p<0.001$). However, in cases with high/definite expectation of follow-up (E=2), the rate dropped from 78.8% for no CS to 43.8% where CS's were present ($p<0.001$).

CONCLUSION

This study confirms low follow-up compliance. Conditional statements in FURS are associated with a significantly lower rate of follow-up than FURS without CS.

CLINICAL RELEVANCE/APPLICATION

Radiologists may use conditional statements in recommendaiton sentences for less clinically important F/U recommendations. However, these CS are associated with a lower overall rate of F/U. When developing automated tools for to detect F/U compliance, the presence of CS could be incorporated into an NLP algorithm, potentially improving specificy of the system for the detection of important failures to F/U.

SSG08-07 Enabling Real-time Epidemiological Statistics Through Structured Reporting: Single-center Experience for the Incidence of Pulmonary Embolism

Tuesday, Dec. 1 11:30AM - 11:40AM Location: S402AB

Participants
Daniel Pinto dos Santos, MD, Mainz, Germany (*Presenter*) Nothing to Disclose
Gordon Klos, Mainz, Germany (*Abstract Co-Author*) Nothing to Disclose

Sonja Scheibl, Mainz, Germany (*Abstract Co-Author*) Nothing to Disclose
Roman Kloeckner, MD, Mainz, Germany (*Abstract Co-Author*) Nothing to Disclose
Peter Mildenberger, MD, Mainz, Germany (*Abstract Co-Author*) Stockholder, GeSIT GmbH

PURPOSE

To explore the possibilities for real-time epidemiological metrics using data from a database of structured reports created using IHE MRRT-compliant templates.

METHOD AND MATERIALS

After the implementation of a browser-based tool for structured reporting we analyzed all patients from 2013 to 2015 referred from the emergency department to our department for CT because of clinically suspected pulmonary embolism. Radiological reports were read and reformatted using a dedicated MRRT-compliant template for structured reporting. All structured reports were stored in a dedicated MySQL database and various epidemiological metrics were calculated.

RESULTS

All relevant data was easily accessible from the MySQL database and was automatically recalculated when more patients were added to the database. After evaluating 521 cases, the calculated incidence of pulmonary embolism was 0.24 for this collective. Mean age for patients with pulmonary embolism was 61.6 and for those without 62.4. Patients with pulmonary embolism had a mean D-Dimer of 13.25 mg/l FEU whereas those without had 2.5 mg/l FEU.

CONCLUSION

This proof-of-concept demonstrates that when using structured reporting with meaningful templates and storing results in an accessible database any desired metric can be easily calculated in real time.

CLINICAL RELEVANCE/APPLICATION

We demonstrate the benefits of structured reporting. If radiologists adopt structured reporting, analyses can be easily performed in real-time for any desired metric that is included in a respective reporting template.

SSG08-08 Support-Vector Machine Classification of Indexed Keyword Search Results: Providing Context to Keywords

Tuesday, Dec. 1 11:40AM - 11:50AM Location: S402AB

Participants
Jaron Chong, MD, Montreal, QC (*Presenter*) Nothing to Disclose
Benoit P. Gallix, MD, PhD, Montpellier, France (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Keyword-indexed based retrospective searches of full-text radiology reports provide a powerful tool for the interactive identification of case series and population cohorts from large databases. While keyword searches are effective for rare terms, diseases, or keywords, keywords alone prove particularly limited in circumstances where a condition is used very frequently with heterogeneous meanings and contexts. We propose a support-vector machine learning workflow to improve the specificity of full-text keyword searches.

METHOD AND MATERIALS

This proposal outlines and explores an approach drawn from natural-language processing research used in informatics and linguistics by utilizing a statistically-based machine learning technique to infer associations in words frequencies from labeled examples. In our specific, we attempt to classify sentences containing the word 'appendicitis' into multiple contexts of meaning, specifically: 1-Positive, 2-Negative, 3-Clinical History, 4-Atypical and report upon both the classification performance characteristics of such a system, potential pitfalls and limitations to the technique, as well as the relationship between performance and a progressively expanded training set.

RESULTS

1000 CT Abdomen/Pelvis full-text reports narrative reports were parsed and analyzed. Classification performance began 86.5% and steadily rose to 95.3% after 500 examples of tagged reports were provided at which point classification performance ranged between 93.8 - 96.8% successful classification. Classifications of both 1-Positive or 2-Negative appendicitis were generally highly reliable as were classification of 3-Clinical History. Classifications of 4-Atypical sentences had the greatest relative unreliability with only 13 re-classifications out of 1000 reports. Performance and generation of the SVM models were instanteous on standard commodity computer hardware.

CONCLUSION

The application of support-vector machines is a reliable and successful method for narrative text classification and paired with a full-text indexed search engine allows for powerful contextual language analysis.

CLINICAL RELEVANCE/APPLICATION

Support-vector machines provide a novel and practical method of labeling and inferring context of keywords which can be used to increase the specificity of full-text indexed searches.

SSG08-09 Initial Experience with Multi-Media and Quantitative Tumor Reporting Appears to Improve Oncologist Efficiency in Assessing Tumor Burden

Tuesday, Dec. 1 11:50AM - 12:00PM Location: S402AB

Participants
Les R. Folio, DO, MPH, Bethesda, MD (*Presenter*) Research agreement, Carestream Health, Inc
Alireza Asary Yazdi, MD,MPH, Bethesda, MD (*Abstract Co-Author*) Research agreement, Carestream Health, Inc
Melinda Merchant, Bethesda, MD (*Abstract Co-Author*) Nothing to Disclose

Elizabeth C. Jones, MD, Bethesda, MD (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Tumor assessment by Computed Tomography (CT) has become essential to oncologists in determining the therapeutic response of the metastatic tumor burden in cancer patients on therapeutic trials. This is done by measurement of a subset of "target" metastatic lesions on baseline and follow-up CTs. From these measurements a quantitative assessment of the change in tumor burden over time is calculated. Traditionally, radiologists' CT reports do not consistently include these measurements. One major reason is the time and effort needed to identify target tumors on follow-up scans and making measurements. Instead, the measurements are commonly obtained from images by the oncologists themselves or with the radiologist in a tumor measurement session/consultation.A recent survey we performed at our institution demonstrated that 1) oncologists spend an excessive amount of time making measurements or searching for measurements buried in our reports and matching them to the images in PACS, and 2) oncologists and radiologists prefer measurements in reports be hyperlinked to annotated images.In an effort to improve the content and utility of CT reports for oncologists, we embarked on a collaboration with our PACS vendor (Carestream Health, Rochester, NY) to explore the addition of capacities to PACS that would facilitate the generation of tumor measurement data by the radiologist and presentation in a Multi-media (MM) report with hyperlinks to images that would enable efficient use by oncologists. The recent PACS upgrade we helped develop (v 12.0 Vue PACS) includes the hyperlink capacity and tables and graphs as part of the report, and tools that facilitate lesion identification and quantification (temporal image registration, lesion segmentation and serial 3D localization of measurements; measurement on current exam is automatically related to measurements on prior exams).In this pilot study, we assessed the impact of the PACS upgrade on the timing of radiologists in generating and of oncologists in using MM reports on cancer patients.

RESULTS

Radiologists' average dictation times were 11.9 (±5.6) and 12.6 (±4) minutes, before and after PACS upgrade, respectively. Although the reporting time has increased after PACS upgrade, the observed difference was not statistically significant in our study (P value = 0.53). This timing is on par with an average day on CT service in that it takes about 6 hours to dictate and measure 25 complex cancer follow up cases at our institution. Average time for an oncologist to assess tumor burden initially (text-only reports) was 15.4 (±5.9) minutes. Average time for oncologist to assess tumor burden using the multimedia reports was 6.2 (±2.9) minutes for a mean time savings of 8.9 minutes (Range 5 -14 minutes per study) when used the MM report to enter data into study forms ($P<0.001$).

CONCLUSION

Our pilot study results demonstrate that multimedia reports with data tables and hyperlinks to measurements on key images of target lesions facilitate analysis of tumor response by oncologists resulting in a significant time savings. These MM reports may be generated by radiologists without significant increase in reporting times. We anticipate in our facility alone up to 6-10 hours work by each team of oncologists and research staff could be saved using MM presentation. Although we measured time to complete the work by radiologists and oncologists, time is not the only domain that will be impacted by this innovation.With time saved and more straightforward presentation of data through quantitative MM reports, further studies in larger, more controlled settings can further test if MM reports are a more effective provision of care by improving oncologist's decisions and patient outcomes. Leveraging technology that provides professional-appearing content and media-rich reporting including links to images, reports, and the images may also become increasingly important to patients with the more widespread use of patient portals.

METHODS

Two radiologists recorded the times it took them to dictate CT exams (of the Chest, Abdomen and Pelvis) in which they measured target lesions on 20 consecutive cancer patients on therapeutic trials before and after the PACS upgrade. The difference between the average times was tested using permutation test. Additionally, an oncologist recorded the times to extract and tabulate target lesion measurements on 10 CT studies of five synovial sarcoma patients that had been reported prior to the PACS upgrade. The timing was also recorded for the same process on the MM reports of the same patients after these reports became available. The permutation test of paired samples was used to compare the mean time differences between extracting the needed data from traditional text only and MM reports by the oncologist.

INS-TUA

Informatics Tuesday Poster Discussions

Tuesday, Dec. 1 12:15PM - 12:45PM Location: IN Community, Learning Center

IN

AMA PRA Category 1 Credit ™: .50

Participants
Rasu B. Shrestha, MD, MBA, Pittsburgh, PA (*Moderator*) Advisory Board, General Electric Company; Medical Advisory Board, Nuance Communications, Inc; Editorial Advisory Board, Anderson Publishing, Ltd; Advisory Board, KLAS Enterprises LLC; Advisory Board, Peer60; Board, Omnyx, LLC; Board, Health Fidelity, Inc

Sub-Events

IN228-SD-TUA1 Automated Evaluation of the Alveolar Bone Loss in Dental Panoramic Radiographs

Station #1

Participants
Ryo Takahashi, Gifu, Japan (*Abstract Co-Author*) Nothing to Disclose
Akitoshi Katsumata, DDS, PhD, Mizuho, Japan (*Presenter*) Nothing to Disclose
Chisako Muramatsu, PhD, Gifu, Japan (*Abstract Co-Author*) Nothing to Disclose
Tatsuro Hayashi, PhD, Tokyo, Japan (*Abstract Co-Author*) Nothing to Disclose
Takeshi Hara, PhD, Gifu, Japan (*Abstract Co-Author*) Nothing to Disclose
Hiroshi Fujita, PhD, Gifu City, Japan (*Abstract Co-Author*) Nothing to Disclose

CONCLUSION

Quantitative measurement of alveolar bone loss may help dentists in consistent and timely diagnosis of periodontitis. The CAD system can be useful for prevention of the disease progress.

Background

One expected use of computer-aided detection/diagnosis (CAD) in dentistry is to evaluate the degree of alveolar ridge bone loss due to periodontitis. Alveolar bone loss, which can be observed on dental designed a CAD procedure to evaluate the degree of alveolar bone loss in dental panoramic radiograph quantitatively.

Evaluation

A dental panoramic radiography system (QR-Master-P, Telesystems co., Japan) was used to obtain images. To measure alveolar bone loss (ABL), we designed a CAD program to define reference points and lines as follows: (1) pre-processing for an original image; (2) selection of a region of interest (ROI) for three lines detection; (3) detection of the occlusion line with the selected Gabor filter; (4) detection of the alveolar crest line by using phase congruency (PC) map, template matching and black-hat transform; (5) detection of the tooth root apex line with Gabor filter; (6) curve fitting with detected feature points for each line. Based on approval from ethics committee, the proposed method was applied to 89 panoramic images. The success rates of line detection by subjective assessment were 92.1%, 83.1% and 88.8% for occlusion line, alveolar crest line and root apex line, respectively. Furthermore, a mean absolute error (MAE) of alveolar crest line was calculated with the gap between the fitted line and the gold standard line created by a dental radiologist. The minimum, median and maximum of MAE were 0.1, 1.1 and 12.5 mm, respectively.

Discussion

Dentists diagnose the progress of periodontal disease by means of the subjective evaluation of periodontal bone loss. However it was difficult for conventional image interpretation to evaluate the status of periodontal tissue quantitatively. Results from this study indicate the potential effectiveness of proposed scheme for automated evaluation of alveolar bone loss.

IN229-SD-TUA2 Neural Network based Automatic Segmentation of Liver Tissue and Tumors from 3D CT Images

Station #2

Participants
Yi Wang, Hong Kong, Hong Kong (*Presenter*) Nothing to Disclose
Dong Ni, BEng, MPH, Hongkong, China (*Abstract Co-Author*) Nothing to Disclose
Kun Huang, Guangzhou, China (*Abstract Co-Author*) Nothing to Disclose
Yanji Luo, Guangzhou, China (*Abstract Co-Author*) Nothing to Disclose
Shiting Feng, MD, Guangzhou, China (*Abstract Co-Author*) Nothing to Disclose
Pheng Ann Heng, PhD, Shatin, Hong Kong (*Abstract Co-Author*) Nothing to Disclose

CONCLUSION

The use of neural network with salient intensity and texture features shows promise for automatic segmentation of liver tissue and tumors from CT volumes. The automatic segmentation results benefit the further cancer staging and assessing for hepatic tumor response to therapy.

Background

Automatic segmentation of liver and its tumors are of clinical importance in cancer staging and treatment response assessment. Furthermore, segmentation of liver is the basis of subsequent analyses such as 3D visualization, liver shape morphometry, etc.

Evaluation

We proposed a neural network based approach to automatically and robustly segment the liver tissue and tumors from 3D CT

images. Spatial gray level dependence matrix (SGLDM) was constructed from wavelet transformation on original CT images, and a series of co-occurrence features and statistical features were extracted to represent images. The selected group of features was employed to train the back propagation neural network (BPNN) for classifying the liver tissue and tumor. A database containing 4 CT volumes was used for the evaluation. The volumes were of 190 - 250 slices. The liver, as well as each tumor, were manually segmented from each volume by an experienced doctor to obtain the reference standard. Five evaluation metrics, relative absolute volume difference (RAVD), volumetric overlap error (VOE), sensitivity, specificity, and accuracy, were computed based on our automatically computerized segmentations and reference standard.

Discussion

Our neural network based approach obtained mean RAVD and VOE of 8.16% and 15.47% for liver segmentation. The sensitivity, specificity and accuracy for tumor segmentation were 89.67%, 88.31%, and 88.72%, respectively, which demonstrate the proposed approach differentiates the tumor with satisfactory accuracy. Moreover, all the tumors (107 - 128 tumors for each volume) were identified and segmented automatically, which further reveal the clinical application of the proposed approach. Fig. 1 visualizes the automatic segmentation output of one CT slice.

IN230-SD-TUA3 Computer Aided Diagnosis of Spleen Lesions Due to Abdominal Trauma in CT Scans

Station #3

Participants
Uygar Teomete, MD, Miami Beach, FL (*Presenter*) Nothing to Disclose
Ozgur Dandin, MD, Bursa, Turkey (*Abstract Co-Author*) Nothing to Disclose
Onur Osman, PhD, Istanbul, Turkey (*Abstract Co-Author*) Nothing to Disclose
Gokalp Tulum, Istanbul, Turkey (*Abstract Co-Author*) Nothing to Disclose
Tuncer Ergin, MD, Ankara, Turkey (*Abstract Co-Author*) Nothing to Disclose
Mehmet Z. Sabuncuoglu, Isparta, Turkey (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Best of our knowledge computer-aided diagnosis (CADx) of spleen lesions due to abdominal trauma in computed tomography (CT) scans has not been studied that is useful for emergency conditions. In this study, our aim is to develop a novel automated method for detecting injured spleen lesions and types of the pathologies using morphological and intensity properties following abdominal trauma. In clinical applications, timely assessment of the severity and extent of the injury is of vital importance in the setting of trauma.

METHOD AND MATERIALS

The CADx system operates as an image search engine exploiting texture analysis of traumatic spleen lesion image data for the lesions from a database. After segmentation of spleens, lesions were detected referring to the morphological changes and the densities of the interested regions. The system's performance was evaluated lesions on randomly selected 20 CT scans from 20 patients with traumatic spleen lesions (laceration, contusion, pseudoaneurysm, subcapsular hematoma, active bleeding) and 10 patients with normal spleens. Sensitivity, specificity, and positive and negative predictive values of the CADx system was managed and compared to that of two radiologists who were provided with the same amount of image information to which the CADx system had access.

RESULTS

Sensitivity, specificity, positive and negative predictive values were calculated. High statistical relevance is obtained between radiologists and CADx for detecting lesions in CT.

CONCLUSION

The CADx system is successful for detecting traumatic spleen lesions and has promising potential acting as a second eye for the radiologist. Furthermore, in emergency conditions, when the radiologist cannot be reached in a required time, CADx can be a guide for trauma surgeon.

CLINICAL RELEVANCE/APPLICATION

The CADx system is successful for detecting traumatic spleen lesions. Also in emergency conditions, when the radiologist cannot be reached in a required time, CADx can be a guide for trauma surgeon.

IN231-SD-TUA4 Structured Reporting of Multiphasic CT for Hepatocellular Carcinoma: Effect on Staging and Suitability for Transplant

Station #4

Participants
Peter D. Poullos, MD, Stanford, CA (*Presenter*) Nothing to Disclose
Michael L. Chiou, MD, Stanford, CA (*Abstract Co-Author*) Nothing to Disclose
Lauren Chan, MD, Stanford, CA (*Abstract Co-Author*) Nothing to Disclose
Daniel L. Rubin, MD, MS, Palo Alto, CA (*Abstract Co-Author*) Nothing to Disclose
Waldo Concepcion, Stanford, CA (*Abstract Co-Author*) Nothing to Disclose
Juergen K. Willmann, MD, Stanford, CA (*Abstract Co-Author*) Research Consultant, Bracco Group; Research Consultant, Triple Ring Technologies, Inc; Research Grant, Siemens AG; Research Grant, Bracco Group; Research Grant, Koninklijke Philips NV; Research Grant, General Electric Company

PURPOSE

Screening for hepatocellular carcinoma (HCC) in patients with chronic liver disease diagnoses HCC at an earlier stage and improves survival. Orthotopic liver transplantation (OLT) is a treatment option for patients with cirrhosis and HCC. Under the United Network for Organ Sharing (UNOS) policy, patients with stage T2 HCC receive priority MELD (Model for End-Stage Liver Disease) points for OLT. Nodules found on cirrhotic livers must be classified according to OPTN (Organ Procurement and Transplantation Network) criteria. However, determination of stage T2 disease, as well as suitability for transplant using Milan Criteria, are not consistently communicated in reports. Our goal was to assess how standardized reporting improves OPTN classification and assessment for OLT.

METHOD AND MATERIALS

A standardized reporting template was devised by radiologists and liver transplant physicians. Educational materials about OPTN and Milan criteria were disseminated to radiologists, after which use of the template was mandated for CT exams of cirrhotic patients with lesions greater than 1 cm in size. A transplant surgeon then retrospectively analyzed 100 radiology reports before and after implementation for inclusion of relevant information. This included the presence of cirrhosis and portal hypertension, size and enhancement characteristics of the HCC, vessel patency and OPTN class. Also, the surgeon evaluated suitability for OLT using the Milan criteria. Overall satisfaction with the report was also assessed.

RESULTS

The average age of the patients evaluated was 71 years. After implementation, there was a significant increase in the percentage of reports documenting the number of lesions, their enhancement characteristics and the OPTN class. The transplant surgeon was significantly more likely to be able to assess T2 disease and qualifications for exception points. Level of satisfaction with the reports also improved significantly.

CONCLUSION

Implementation of a standard reporting template improves completeness of information required for application for automatic exception points, as well as determination of suitability for transplant under the Milan Criteria.

CLINICAL RELEVANCE/APPLICATION

We can help our referring clinicians by consistently providing the information they need to assess HCC stage and qualification for exception points and liver transplant. Radiologists should consider using such templates.

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Daniel L. Rubin, MD, MS - 2012 Honored Educator
Daniel L. Rubin, MD, MS - 2013 Honored Educator

IN232-SD-TUA5 Personalized Characterization of Nodule Cancer Risk Beyond Lung-Rads 1.0 with NLST Data

Station #5

Participants
Michael A. Morris, MD, MS, Baltimore, MD (*Presenter*) Nothing to Disclose
Jason M. Hostetter, MD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Babak Saboury, MD, MPH, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
James J. Morrison, MD, Novi, MI (*Abstract Co-Author*) Nothing to Disclose
Kenneth C. Wang, MD, PhD, Ellicott City, MD (*Abstract Co-Author*) Co-founder, DexNote, LLC;
Jean Jeudy JR, MD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Eliot L. Siegel, MD, Severna Park, MD (*Abstract Co-Author*) Research Grant, General Electric Company; Speakers Bureau, Siemens AG; Board of Directors, Carestream Health, Inc; Research Grant, XYBIX Systems, Inc; Research Grant, Steelcase, Inc; Research Grant, Anthro Corp; Research Grant, RedRick Technologies Inc; Research Grant, Evolved Technologies Corporation; Research Grant, Barco nv; Research Grant, Intel Corporation; Research Grant, Dell Inc; Research Grant, Herman Miller, Inc; Research Grant, Virtual Radiology; Research Grant, Anatomical Travelogue, Inc; Medical Advisory Board, Fovia, Inc; Medical Advisory Board, Toshiba Corporation; Medical Advisory Board, McKesson Corporation; Medical Advisory Board, Carestream Health, Inc; Medical Advisory Board, Bayer AG; Research, TeraRecon, Inc ; Medical Advisory Board, Bracco Group; Researcher, Bracco Group; Medical Advisory Board, Merge Healthcare Incorporated; Medical Advisory Board, Microsoft Corporation; Researcher, Microsoft Corporation

CONCLUSION

Lung cancer risk within Lung-RADS categories is modified by additional nodule characteristics and patient historical information. A convenient interface for clinicians to interact with large datasets may aid in evaluating additional characteristics affecting the risk of lung cancer compared to a matched cohort in real time.

Background

Lung-RADS 1.0 was developed as a criteria to modernize and standardize recommendations for lung nodule follow-up for patients eligible for lung cancer screening which builds on the Fleischner Society recommendations. A custom web interface previously showed additional patient characteristics from the NLST clinical dataset could provide a more personalized prediction of cancer risk. In this follow-up study, the authors use the same approach if additional characteristics could improve the Lung-RADS prediction from matched cohorts.

Evaluation

A custom web based interface to allow the user to interact with the NLST clinical dataset in real time was created. The largest nodule in each lobe for each patient was organized by slice number and location. These nodules were tracked until cancer was diagnosed or until the last screening study available. If cancer originated in the same lobe as a nodule, the nodule was considered malignant. Lung-RADS categories predict cancer risks that range from <1% for category 2 nodules to >15% for category 4B and 4X nodules. The occurrence of cancer diagnosis was compared to the Lung-RADS predicted rate across matched cohorts with similar personal histories and nodule characteristics. The web interface allows users to compute a personalized cancer risk based on these additional discriminators by querying the NLST dataset for matched cohorts in real time.

Discussion

Lung-RADS characterizes nodules with greater detail than the Fleischner Criteria, however features that increase suspicion for malignancy are not clearly defined and additional factors that may significantly modify cancer risk such as a patient's personal history are excluded. Harnessing large datasets such as the NLST could aid in comparing matched cohorts to identify additional important factors in further personalizing the prediction for a nodule's cancer risk.

IN121-ED-TUA6 **3D Printing in Radiology**

Station #6

Participants
Leonid Chepelev, MD,PhD, Ottawa, ON (*Presenter*) Nothing to Disclose
Amir Imanzadeh, MD, Cambridge, MA (*Abstract Co-Author*) Nothing to Disclose
Andreas Giannopoulos, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Tatiana Kelil, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Peter C. Liacouras, PhD, Bethesda, MD (*Abstract Co-Author*) Nothing to Disclose
Beth A. Ripley, MD, PhD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Tianrun Cai, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Kanako K. Kumamaru, MD, PhD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Frank J. Rybicki III, MD, PhD, Ottawa, ON (*Abstract Co-Author*) Research Grant, Toshiba Corporation;
Gerald T. Grant, MD, MS, Louisville, KY (*Abstract Co-Author*) Nothing to Disclose
Dimitris Mitsouras, PhD, Boston, MA (*Abstract Co-Author*) Research Grant, Toshiba Corporation; Speakers Bureau, Toshiba Corporation

TEACHING POINTS

The purpose of this exhibit is to: 1. Review 3D printing technologies that are and will be important to radiology practice 2. Describe the steps to create a Standard Tessellation Language (STL) file from DICOM images 3. Illustrate uses of 3D printing in radiology, organized by organ section

TABLE OF CONTENTS/OUTLINE

1. Review of 3D visualization in radiology, the common practice of viewing a 3D structure on a 2D screen2. Briefly review the history of 3D printing, focusing on medical applications 3. Define and describe STL, the file format recognized by 3D printers4. Describe and illustrate the conversion of a DICOM image to an STL file 5. Define novel metrics of quality in 3D printing that will be used for standardization6. Define and describe a nomenclature to describe 3D printing in the radiology literature7. Comprehensively review the peer-review literature in 3D printing as it relates to radiology8. Illustrate a collection of 3D printed models based on radiology images, organized by organ section, and drawn from the authors' experience of printing over 8000 3D models from radiology images over the last decade

RCA33

3D Printing (Hands-on)

Tuesday, Dec. 1 12:30PM - 2:00PM Location: S401AB

IN

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants

Frank J. Rybicki III, MD, PhD, Ottawa, ON (*Moderator*) Research Grant, Toshiba Corporation;
Frank J. Rybicki III, MD, PhD, Ottawa, ON (*Presenter*) Research Grant, Toshiba Corporation;
Jane S. Matsumoto, MD, Rochester, MN (*Presenter*) Nothing to Disclose
Jonathan M. Morris, MD, Rochester, MN (*Presenter*) Nothing to Disclose
Dimitris Mitsouras, PhD, Boston, MA (*Presenter*) Research Grant, Toshiba Corporation; Speakers Bureau, Toshiba Corporation
Andreas Giannopoulos, MD, Boston, MA (*Presenter*) Nothing to Disclose
Nicole Wake, MS, New York, NY (*Presenter*) Nothing to Disclose
Peter C. Liacouras, PhD, Bethesda, MD (*Presenter*) Nothing to Disclose
Thomas A. Foley, MD, Rochester, MN (*Presenter*) Nothing to Disclose
Kiaran P. McGee, PhD, Rochester, MN (*Presenter*) Nothing to Disclose
Michael W. Itagaki, MD, MBA, Seattle, WA (*Presenter*) Owner, Embodi3D, LLC
Shannon N. Zingula, MD, Rochester, MN (*Presenter*) Nothing to Disclose
Leonid Chepelev, MD,PhD, Ottawa, ON (*Presenter*) Nothing to Disclose
Adnan M. Sheikh, MD, Ottawa, ON (*Presenter*) Nothing to Disclose
AiLi Wang, Ottawa, ON (*Presenter*) Nothing to Disclose
Wilfred Dang, BS, Ottawa, ON (*Presenter*) Nothing to Disclose
Ekin P. Akyuz, BSc, Ottawa, ON (*Presenter*) Nothing to Disclose
Taryn Hodgdon, MD, Ottawa, ON (*Presenter*) Nothing to Disclose
Carlos H. Torres, MD, Ottawa, ON (*Presenter*) Nothing to Disclose
Anji Tang, Boston, MA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Learn the Standard Tessellation Language (STL) file format that is used in 3D priting. 2) Be exposed to a software package to enable segmentation of DICOM images using semi-automated and manual segmentation algorithms, allowing the user to demarcate desired parts. The most commonly used tools are thresholding, region growing, and manual sculpting. 3) Learn refinement of an output STL output so that it can be optimized for accurate printing of the desired anatomy and pathology. This step uses Computer Aided Design (CAD) software is used to perform steps such as "wrapping" and "smoothing" to make the model more homogeneous.

ABSTRACT

"3D printing" refers to fabrication of a tangible object from a digital file by a 3D printer. Materials are deposited layer-by-layer and then fused to form the final object. There are several 3D printing technologies that share similarities but differ in speed, cost, and resolution of the product. Digital Imaging and Communications in Medicine (DICOM) image files cannot be used directly for 3D printing; further steps are necessary to make them readable by 3D printers. The purpose of this hands-on course is to convert a set of DICOM files into a 3D printed model through a series of simple steps. Some of the initial post-processing steps may be familiar to the radiologist, as they share common features with 3D visualization tools that are used for image post-processing tasks such as 3D volume rendering. However, some are relatively or completely new to radiologists, including the manipulation of files in Standard Tessellation Language (STL). It is the STL format that is read by the 3D printer and used to output the hand held part of the patient's anatomy. This 90 minute session will begin with a DICOM file and will proceed through the steps to create a printable STL file. An extensive training manual will be provided before the meeting. It is highly recommended that participants review the training manual to optimize the experience at the workstation.

URL

Active Handout:Frank John Rybicki

http://abstract.rsna.org/uploads/2015/14003457/Active RCA13.pdf

RCB33

Creating and Delivering Online and Mobile Education Content: From Online Courses to Interactive iBooks (Hands-on)

Tuesday, Dec. 1 12:30PM - 2:00PM Location: S401CD

ED IN

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
George L. Shih, MD, MS, New York, NY, (george@cornellradiology.org) (*Moderator*) Consultant, Image Safely, Inc; Stockholder, Image Safely, Inc; Consultant, Angular Health, Inc; Stockholder, Angular Health, Inc;

LEARNING OBJECTIVES

1) Assess the potential of online and mobile e-learning innovations to augment your residents', medical students', and staff's educational curricula. 2) Acquire the domain knowledge to use already available content (eg, PowerPoint presentations) to both create video content and deploy e-learning courses on modern web-based and mobile platforms. 3) Acquire the domain knowledge to create an interactive Apple iBook (electronic books) with text, images, video, and interactive questions.

ABSTRACT

1. From OpenCourseWare to the Khan Academy, and now to Coursera and edX, e-learning has been dramatically improved over the last decade, changing education from the normal classroom into learning done at convenience, and also allows for more creative and engaging content during the typical lecture. Stanford Med published positive initial findings in utilizing video-based lectures in an interactive class setting. Leveraging this new way of learning, requires knowledge about the types of technology and platforms for these courses.2. The workflow required to host an e-learning course can be summarized in 3 steps: (a) creating the educational content, (b) hosting the materials, and (c) making the materials available to the intended audience. E-content today typically consists of lecture slides along with video recordings captured by technology like TechSmith Camtasia (non-free) and Apple Quicktime (free). Once the materials are created and edited, one must choose a suitable hosting platform realistic to the skills and goals of the instructor with options that include coursesites.com, iTunes U, and YouTube / Google Hangouts. Students can then be invited to view the material or the content can be made available to the public.3. Creating and publishing e-books is a great way to share your teaching material as an engaging interactive tool. Publishing in e-book format solves many logistical problems of conventional publishing and the e-book format has interactive features that paper books can't match. We will review the process of creating your own e-book from assembling material to layout design to submitting for e-publication. Specifically Apple iBooks Author software will be used to demonstrate converting an existing Powerpoint presentation or journal publication into an e-book. In addition, the course will go over how to publish with or without DRM (copy-protection) and ways to obtain an ISBN for publishing for sale. Online resources will also be reviewed.

Sub-Events

RCB33A Screencasting Basics on the Desktop and on the iPad

Participants
Ian R. Drexler, MD, MBA, New York, NY (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

RCB33B Massive Open Online Course (MOOC) Creation and Hosting

Participants
Kurt T. Teichman, BSc, MEng, New York, NY (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

RCB33C Interactive iBooks to Supplement your Online Course

Participants
Alan C. Legasto, MD, New York, NY (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

RCC33

Imaging 3.0: Informatics Tools to Improve Radiologists' Productivity, Quality and Value

Tuesday, Dec. 1 12:30PM - 2:00PM Location: S501ABC

IN

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

FDA Discussions may include off-label uses.

Participants
J. R. Geis, MD, Fort Collins, CO (*Moderator*) Advisor, Nuance Communications, Inc; Investor, Montage Healthcare Solutions; Vice Chair, ACR IT Informatics Commission

Sub-Events

RCC33A ACRSelect - Using Informatics to Complying with PAMA: CDS Image Ordering Legislation

Participants
Keith J. Dreyer, MD,PhD, Boston, MA (*Presenter*) Co-Chairman, Medical Advisory Board, Merge/IBM

LEARNING OBJECTIVES

1) Be informed of the new federal legislation requiring the use of Clinical Decision Support (CDS) for the ordering of medical imaging required by CMS in 2017. 2) Understand the challenges of implementing CDS in the hospital and imaging center environments. 3) Learn the value of embedding CDS into the EHR and CPOE ordering process. 4) Learn methods to use CDS to manage the utilization of medical image appropriateness. 5) Become familiar with methods to implement CDS in an ACO environment.

RCC33B Radiology Assist: Informatics Tools to Produce a More Valuable Report and Still Report Fast

Participants
Tarik K. Alkasab, MD, PhD, Boston, MA, (talkasab@mgh.harvard.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand the motivations for integrating clinical decision support (CDS) into the clinical practice of radiologists. 2) Understand how CDS modules can be defined for use in radiologist reporting. 3) Understand what it looks like for a CDS system to be integrated with radiologist reporting. 4) Understand the challenges associated with deploying CDS for radiologists.

ABSTRACT

URL

RCC33C Use Your Data to Reduce Costs and Demonstrate Your Value to the Hospital

Participants
Woojin Kim, MD, Philadelphia, PA, (woojinrad@gmail.com) (*Presenter*) Co-founder, Montage Healthcare Solutions, Inc; Shareholder, Montage Healthcare Solutions, Inc; Board of Directors, Montage Healthcare Solutions, Inc; Advisory Board, Zebra Medical Vision Ltd

LEARNING OBJECTIVES

1) Understand the role of business intelligence (BI) tools in providing value-based care. 2) Understand how BI can provide effective monitoring of various components of the imaging value chain, including imaging appropriateness, modality operations, image interpretation and reporting, and report communication. 3) Learn how data mining can improve report quality by ensuring proper documentation and reducing errors. 4) Learn how one should implement a BI system and learn about potential problems to consider.

ABSTRACT

The goals of improving population health at a lower cost and higher quality are placing increased emphasis on value-based care over volume-based approach. Imaging 3.0™ is ACR's call to action for radiologists to take a leadership role in shaping America's future healthcare system through 5 key pillars, which are imaging appropriateness, quality, safety, efficiency and satisfaction. With the aims of delivering better value to patients, Imaging 3.0 has outlined what it calls "imaging value chain" where each link of this chain represents a discrete number of unique value opportunity activities. The imaging value chain includes following components: imaging appropriateness and patient scheduling, imaging protocols, modality operations, image interpretation and reporting, and report communication and referring physician interaction. In the center of the imaging value chain, inter-connected with every link, lie data mining and business intelligence (BI). Timely analysis and appropriate modification using data mining and BI tools are critical to the effective monitoring of all components of the imaging value chain. As a result, it is a critical component of your Imaging 3.0 informatics toolkit. Effective use of BI will allow access to right information at the right time for right decision. This presentation will discuss the basics of BI and its benefits. Specifically, attendees will learn how data mining and BI can monitor adherence to imaging appropriateness guidelines, modality capacity, patient throughput, radiation dose exposure, report standardization and quality including detection of errors and compliance with various reporting requirements including documentation of proper report communication. In addition, attendees will learn how one should implement a BI system, what are some potential problems to consider, and various tips for getting BI right.

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at:

https://www.rsna.org/Honored-Educator-Award/

Woojin Kim, MD - 2012 Honored Educator

RCC33D Using Workflow Software to Improve Efficiency and Profitability

Participants
Bradley J. Erickson, MD, PhD, Rochester, MN (*Presenter*) Stockholder, Evidentia Health, Inc; Stockholder, OneMedNet Corporation; Stockholder, VoiceIt Technologies, LLC

LEARNING OBJECTIVES

1) Become familiar with workflow technologies that are available and being used in other industries. 2) See how workflow terminologies can be applied in practice. 3) See how workflow engines have been applied in radiology.

ABSTRACT

Workflow is a critical element of safe and efficient practices. Workflow is usually supported by using relational databases, which tends to force a linear workflow into practice. SQL queries are also not optimal for detecting and handling error conditions.Workflow engines are used in other industries for exactly those reasons--they help enforce an agreed upon optimal pathway of events, and make it easy and clear how to deal with error and exception conditions. While they have been applied in healthcare, those experiments have usually failed because the implementation did not handle error conditions well, and did not completely model the richness and complexity of healthcare. Radiology tends to be more straightforward, and may be a good area to use workflow engines. In this session, we will describe one implementation in a clinical practice, as well as use in research and clinical trials.As we have begun to use workflow engines, it became apparent that agreeing on the names for key steps in the workflow would be helpful. Such a common lexicon would help us to assure that workflow was done in the same way in different locations. It could also allow us to measure the efficiency of workflows. This latter aspect was perceived to be of great value to practices accross the world, and led to the creation of the SIIM Workflow Initiative in Medicine (SWIM) lexicon, which is now a part of RadLEX. The basic concepts of SWIM and its connection toe IHE and the practice will be described.

INS-TUB

Informatics Tuesday Poster Discussions

Tuesday, Dec. 1 12:45PM - 1:15PM Location: IN Community, Learning Center

IN

AMA PRA Category 1 Credit ™: .50

Participants
Rasu B. Shrestha, MD, MBA, Pittsburgh, PA (*Moderator*) Advisory Board, General Electric Company; Medical Advisory Board, Nuance Communications, Inc; Editorial Advisory Board, Anderson Publishing, Ltd; Advisory Board, KLAS Enterprises LLC; Advisory Board, Peer60; Board, Omnyx, LLC; Board, Health Fidelity, Inc

Sub-Events

IN233-SD-TUB1 Automatic Extraction of Patient History from Prior Radiology Reports Using a PACS Integrated Tool

Station #1

Participants
Richard J. Gorniak, MD, Philadelphia, PA (*Abstract Co-Author*) Speaker, Koninklijke Philips NV
Adam E. Flanders, MD, Penn Valley, PA (*Abstract Co-Author*) Nothing to Disclose
Merlijn Sevenster, PhD, Briarcliff Manor, NY (*Presenter*) Employee, Koninklijke Philips NV
Gabriel Mankovich, BSC, Briarcliff Manor, NY (*Abstract Co-Author*) Employee, Koninklijke Philips NV
Ranjith Tellis, Briarcliff Manor, NY (*Abstract Co-Author*) Nothing to Disclose
Yuechen Qian, Briarcliff Manor, NY (*Abstract Co-Author*) Employee, Koninklijke Philips NV
Sandeep P. Deshmukh, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Raja Gali, MS, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Johannes Buurman, PhD, Best, Netherlands (*Abstract Co-Author*) Employee, Koninklijke Philips NV
Gregory L. Katzman, MD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Robert W. Ford, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Ryan L. Lo, MD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Paul J. Chang, MD, Chicago, IL (*Abstract Co-Author*) Co-founder, Stentor/Koninklijke Philips NV; Researcher, Koninklijke Philips NV; Medical Advisory Board, lifeIMAGE Inc; Medical Advisory Board, Merge Healthcare Incorporated

CONCLUSION

CCI provides a rapid, automatic summary of the history provided in prior radiology reports, augmenting information readily available at the time of reporting.

Background

While clinical history is frequently necessary to accurately interpret radiologic studies, the information most readily available to the radiologist, the indication supplied in the study order, is typically limited. The Clinical Context Indicator(CCI) was developed to rapidly and automatically summarize the history provided in the reports of prior studies and make this summary available directly on PACS.

Evaluation

The CCI was developed as a PACS plugin. It automatically collects the patient's prior radiology reports upon opening a new study. Using natural language processing it detects the history section in each report based on knowledge of the local reporting templates and parses out the section's sentences for presentation as snippets in a vertical timeline display. The section elements in the timeline can be selected to open the original source report. A filter suppresses sentences that are duplicates between two sections on the timeline.10 trainees (residents or fellows) used the CCI during typical clinical workflow on 150 consecutive body or neuro CT or MRI cases opened for interpretation. The user determined if the CCI history summary added pertinent history and their determination was recorded. Of 113 neuro cases additional information was obtained on 45 cases (40%). For the 37 body cases additional information was obtained on 21 cases (57%). Overall, CCI added information in 44% of cases.

Discussion

Frequently radiologists are provided with limited patient history. To glean the needed information typically it is necessary to review prior reports, interrogate the EMR, evaluate the patient or discuss the case with the referrer. When patients have had prior studies many times this information has already been captured in prior reports, as occurred in 44% of these cases. While reading the prior reports is routinely performed, this can be time consuming. This method reduces the effort needed to gain this information, potentially reducing the time a radiologist would need to discovery the pertinent history.

IN234-SD-TUB2 Extraction and Integration of Knowledge from Clinical Images and Reports

Station #2

Participants
Luis E. Selva, PhD, Boston, MA (*Presenter*) Nothing to Disclose
Saiju Pyarajan, PhD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To provide a framework to extract, integrate, annotate and query clinical reports and image-based phenotype using digital free text documents and medical images.

METHOD AND MATERIALS

Numerous initiatives are underway for developing clinical informatics infrastructures that support discovery of biomarkers for targeted therapy. The electronic medical records (EMR) provide a rich source of both structured and unstructured data. Currently,

to obtain all the relevant information about a patient, clinicians must coalesce information from multiple systems and sources. Obtaining all the relevant information on individual patients or clinical features across similar patients quickly is thus cumbersome or nearly impossible.Using standard informatics tools we have developed a framework for extracting sets of features from medical images, annotating such features and organizing them to be integrated with related structured and unstructured clinical data. Our framework consists of four main components:1. Extraction of relevant information from clinical reports (pathology and radiology) that are related to a patient's images available as structured data or as free text (unstructured data) using NLP,2. Quantitative information extracted from medical images,3. A database to annotate and store the extracted information and the metadata associated with the information for easy query and4. A query system.Our framwork was validated using the CT 'FDA Phantom' dataset and via well-defiened gold standard reports.

RESULTS

Information from four (4) mock subjects under 2 different treatment arms (i.e., A, B) was analyzed at 3 time points (i.e., baseline, 90 and 180 days, results are shown in Table 1. The tumor phenotype of interest in this case was volume, but other quantitative parameters could have been selected for this query.Treatment A, one subject (34567), had a significant decrease in volume (6 µl) between baseline and treatment time of 180 days. Under a comparable timeframe, one subject (56789) in treatment B, showed an increase in volume of 4 µl.

CONCLUSION

We have demonstrated that quantitative clinical information can be extracted and augmented with information from associated clinical reports.

CLINICAL RELEVANCE/APPLICATION

By combining NLP and quantitative Medical Imaging Informatics we were able to integrate clinical information from multiple sources and data types and provide a quantitative clinical status.

IN235-SD-TUB3 Can a Computer Aided Diagnosis System Developed by a Single Institution Work Sufficiently in Other Institutions?

Station #3

Participants
Masami Kawagishi, Kyoto, Japan (*Presenter*) Employee, Canon Inc
Takeshi Kubo, MD, Kyoto, Japan (*Abstract Co-Author*) Nothing to Disclose
Masahiro Yakami, MD, PhD, Kyoto, Japan (*Abstract Co-Author*) Nothing to Disclose
Koji Fujimoto, MD, PhD, Kyoto, Japan (*Abstract Co-Author*) Nothing to Disclose
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Kaori Togashi, MD, PhD, Kyoto, Japan (*Abstract Co-Author*) Research Grant, Bayer AG Research Grant, DAIICHI SANKYO Group Research Grant, Eisai Co, Ltd Research Grant, FUJIFILM Holdings Corporation Research Grant, Nihon Medi-Physics Co, Ltd Research Grant, Shimadzu Corporation Research Grant, Toshiba Corporation Research Grant, Covidien AG
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Koji Sakai, Kyoto, Japan (*Abstract Co-Author*) Nothing to Disclose
Gakuto Aoyama, Tokyo, Japan (*Abstract Co-Author*) Employee, Canon Inc
Keita Nakagomi, MSc, Kyoto, Japan (*Abstract Co-Author*) Employee, Canon Inc
Hiroyuki Yamamoto, Tokyo, Japan (*Abstract Co-Author*) Employee, Canon Inc

CONCLUSION

By collecting large number of data, a CAD system which is developed in a single institution works sufficiently in the other institution.

Background

A CAD system is generally developed based on data from a single institution (α). However, other institutional data (β) might have a different trend against α, thus the system might not work sufficiently in other institutions. In this study, we considered the different trend as follows; data quality is same but diagnosis distribution is different. We studied the relationship between the difference of diagnosis distributions and the performance of a CAD system by simulating the situation.

Evaluation

With the approval of the IRB, 700 cases with chest CT scans were collected retrospectively. Each case has at least one nodule and the representative nodule was chosen. In addition, a confirmed diagnosis was assigned pathologically or clinically to primary lung cancer (365 cases), lung metastasis (117 cases) or benign (218 cases) and 38 types of clinical information (e.g. age) were collected from the electronic medical records. Furthermore, 39 types of imaging findings (e.g. shape) for each representative nodule were scored by consensus of two board-certified radiologists based on pre-defined criteria. To create various diagnosis distributions, α (N1 cases) and β (N2 cases) were selected from 700 cases randomly without overlap (N1 and N2 are multiples of 50; $N1 + N2 \leq 700$). This selection was done 10,000 times for each combination of N1 and N2. We defined diagnosis distribution α and β as coordinates on triangle A and B, and we defined the difference of diagnosis distribution between α and β as the distance from A to B. A CAD system was developed by training a Naïve Bayesian classifier using α and tested by β. The system performance was evaluated by an accuracy ratio.

Discussion

When N1 increased, the accuracies were almost same irrespective of the distances. It suggests the difference of diagnosis distribution hardly affected the system performance when N1 is large. In addition, increasing of N1 led to the high system performance. In this simulation, we considered that data quality is same, but it might be different in general. To examine the issue is our future work.

IN236-SD-TUB4 Semi-automated Quantification of Lung Density on Chest CT Used as a Predictive Biomarker of Pulmonary Venous Hypertension

Station #4

Participants
Kathryn E. Dean, MD, New York, NY (*Presenter*) Nothing to Disclose
Fay Lin, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Poloydoros Kampaktsis, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Adrienne Coya, MS, RRA, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Marjorie P. George, Pittsburgh, PA (*Abstract Co-Author*) Nothing to Disclose
Ashley E. Giambrone, PhD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Krishna Juluru, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The primary objective of this pilot study was to assess the ability of automated mean lung density (mLD) measurement in identifying subjects with pulmonary venous hypertension (Group II PH). The secondary objective was to compare the diagnostic ability of mLD with previously published measures of pulmonary artery (mPa) and aortic (mAo) diameters in the detection of Group II PH.

METHOD AND MATERIALS

Subjects were included from a pre-existing single-center cohort of patients with severe aortic stenosis being evaluated for transcatheter aortic valve replacement (TAVR) from April 2009 to July 2014. Inclusion criteria were all subjects with non-contrast CTs of the chest within 2 months of catheterization-based pulmonary arterial pressure (PAP) and pulmonary capillary wedge pressure (PCWP) measurements. Subjects with clinically-documented COPD were excluded. Scans were loaded into a publicly-available software package (EmphylxJ, Vancouver, BC, Canada) that calculated lung density based on published techniques. mPA and mAo were manually measured.

RESULTS

54 subjects met inclusion / exclusion criteria. The average time between right heart catheterization and CT chest was 5.63 +/- 10.39 days. Of the 54 subjects, 32 had Group II PH (PCWP ≥ 15 mmHg). The average mLD in the cohorts with elevated and normal PCWP were 0.27 ± 0.05 g/ml and 0.23 ± 0.06 g/ml, respectively (p=0.0060). A statistically significant correlation was demonstrated between mLD and PCWP (R=0.45, 95% CI [0.20, 0.64], p=0.0006). Area under the curve (AUC) of ROC of mLD in diagnosing elevated PCWP was 0.7053. No statistically significant differences were evident in mPA or mPA/mAo between the cohort with elevated and normal PCWP. AUCs of ROC of mPA and mPA/mAo in diagnosing elevated PCWP were 0.5760 and 0.5625, respectively.

CONCLUSION

mLD measured from non-contrast computed tomography scans is significantly higher in patients with elevated PCWP than in patients with normal PCWP. This may be the first parameter derived from CT scan that can be used to noninvasively identify elevated PCWP, the marker for Group II PH. mLD performed better than previously identified tools in the detection of Group II PH.

CLINICAL RELEVANCE/APPLICATION

In subjects without COPD, automated measurement of mLD serves to differentiate patients with elevated PCWP from those with normal PCWP. mLD can be one factor in a multi-parametric model that serves as a non-invasive biomarker of Group II pulmonary hypertension.

IN237-SD-TUB5 Impact of Patient Location and Radiology Subspeciality on Imaging Follow-up Recommendation Rate

Station #5

Participants
Martin L. Gunn, MBChB, Seattle, WA (*Presenter*) Research support, Koninklijke Philips NV; Spouse, Consultant, Wolters Kluwer NV; Medical Advisor, TransformativeMed, Inc;
Bruce E. Lehnert, MD, Seattle, WA (*Abstract Co-Author*) Research support, Koninklijke Philips NV
Christopher Hall, PhD, Briarcliff Manor, NY (*Abstract Co-Author*) Employee, Koninklijke Philips NV
Meliha Yetisgen, PhD, Seattle, WA (*Abstract Co-Author*) Nothing to Disclose
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Gabriel Mankovich, BSC, Briarcliff Manor, NY (*Abstract Co-Author*) Employee, Koninklijke Philips NV
Norman J. Beauchamp JR, MD, Seattle, WA (*Abstract Co-Author*) Research Grant, Koninklijke Philips NV

PURPOSE

Radiologists make important follow-up recommendations (FUR) to improve diagnostic certainty and monitor disease activity. The purposes of this study were to determine the accuracy of a natural language processing (NLP) technique for FUR sentence detection, and to examine variance in the FUR rate with patient location, radiology subspeciality and body region.

METHOD AND MATERIALS

We developed a NLP-based algorithm to detect and extract follow-up recommendation sentences (FURS) from radiology reports. FURS were classified as recommendations for further imaging or clinical procedures. In the F/U imaging group, the F/U modality and time period were automatically extracted. The study comprised two parts (a) validation of the NLP algorithm, in which a subset of radiology reports containing FURS were manually marked-up by a radiologist and if present, the characteristics of the FURS and (b) application of the NLP algorithm to a deidentified subset of the radiology information system (RIS) containing 899,242 reports from 2010 to 2014.

RESULTS

During the validation phase, 534 radiology reports were extracted and manually classified. Application of the NLP algorithm to this subset yielded a sensitivity of 95.6% and specificity of 98.7%. Applying the NLP algorithm to the RIS, we detected 135,026/899,242 (15 %) reports containing FURS. Of those, 50,910/135,026 (37.7%) were for imaging and the rest for other follow-up. Mammography was excluded as nearly all reports contained FURS. FURS occurred in 12.3% emergency, 15.7% inpatient, and 15.6% outpatient settings. The subspeciality with most FURS was abdominal imaging (n=21,151) and the section with the highest FUR rate was nuclear medicine (23.3%). The rate of FURS by modality was highest in ultrasound (20.5%) and lowest for MRI (10.1%) The rate of imaging-specific FURS by modality was highest in CT (9.0%) and lowest in fluoroscopy (0.9%). These

differences were statistically significant (p<0.001).

CONCLUSION

There are significant variances in recommendation rates between patient settings, subspecialties, and imaging modalities. Automated detection and classification of follow-up recommendation sentences is accurate using NLP.

CLINICAL RELEVANCE/APPLICATION

Recommendation detection extraction from radiology reports is useful for automated reminder systems, practice quality improvement (e.g. guideline compliance) and practice management (e.g. critical results reporting).

IN238-SD-TUB6 Measuring Diagnostic Certainty in Radiology Reports of Mammography Studies with BIRADS Classification

Station #6

Participants
Ranjith Tellis, Briarcliff Manor, NY (*Presenter*) Nothing to Disclose
Merlijn Sevenster, PhD, Briarcliff Manor, NY (*Abstract Co-Author*) Employee, Koninklijke Philips NV
Yuechen Qian, Briarcliff Manor, NY (*Abstract Co-Author*) Employee, Koninklijke Philips NV
Paul J. Chang, MD, Chicago, IL (*Abstract Co-Author*) Co-founder, Stentor/Koninklijke Philips NV; Researcher, Koninklijke Philips NV; Medical Advisory Board, lifeIMAGE Inc; Medical Advisory Board, Merge Healthcare Incorporated
Gabriel Mankovich, BSC, Briarcliff Manor, NY (*Abstract Co-Author*) Employee, Koninklijke Philips NV

CONCLUSION

A metric was proposed that objectively determines the certainty level in radiological narrative. It correlates with BIRADS scores and may find applications as an objective analytics statistic or predictor of downstream utilization.

Background

Diagnostic certainty in a radiology report has direct effect on follow-up care, and as a result, patient outcome. We propose an objective metric driven by natural language processing methods that quantifies the certainty level expressed in a radiology report based on earlier work. We correlate this certainty metric against the BIRADS score of breast exams, which express various levels of certainty for findings being benign/malignant and mandate follow imaging or testing.

Evaluation

In earlier work (Acad Radiol, 10:685-8), certainty phrases were ranked by radiologists, ranging from low ("possibly" - average rank 12.0) to high ("evidence of" - average rank 1.1) certainty. For each phrase we construe an engine that detects the phrase or lexical variants thereof in the impression section of a narrative radiology report.We applied the engines on 17,411 breast reports with known BIRADS score and collected the set of certainty phrases grouped by BIRADS score. The average certainty rank of the certainty phrases found in BIRADS 1 reports was 1.1. The average certainty rank of BIRADS 2 to 5 was 1.4, 4.6, 6.3 and 5.8, respectively.

Discussion

The proposed certainty metric correlates with the certainty incurred by the BIRADS categorization scheme, except for BIRADS 5 reports, which have average rank 5.8. This is considerably higher than BIRADS classes 1 and 2 expressing high certainty. We hypothesize that this is due to secondary findings reported with less certainty than the primary malignant finding.Using equivocal certainty expressions is considered bad reporting style ("hedging"). There are various causes (e.g., lack of confidence and incomplete clinical history), which may be addressed by appropriate improvement programs. The certainty metric can be used as an objective metric to track efficacy of these programs. In future research, we plan to correlate downstream utilization patterns with the certainty metric.

IN007-EC-TUB7 Machine-learning Electronic Cleansing for CT Colonography

Custom Application Computer Demonstration

Participants
Rie Tachibana, Boston, MA (*Presenter*) Nothing to Disclose
Janne J. Nappi, PhD, Boston, MA (*Abstract Co-Author*) Royalties, Hologic, Inc; Royalties, MEDIAN Technologies;
Nadja Kohlhase, Niederaula, Germany (*Abstract Co-Author*) Nothing to Disclose
Se Hyung Kim, Seoul, Korea, Republic Of (*Abstract Co-Author*) Research Grant, Mallinckrodt plc; Research Grant, Samsung Electronics Co Ltd
Daniele Regge, MD, Candiolo, Italy (*Abstract Co-Author*) Speakers Bureau, General Electric Company
Hiroyuki Yoshida, PhD, Boston, MA (*Abstract Co-Author*) Patent holder, Hologic, Inc; Patent holder, MEDIAN Technologies;
Toru Hironaka, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Junko Ota, Suita, Japan (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

Electronic cleansing has become a standard technique in the interpretation of CT colonography examinations. The recent trend of performing reduced- or non-cathartic bowel preparations, along with ultra-low-dose CT scanning, makes existing EC methods produce severe image artifacts. The teaching points of this exhibit are to (1) review how the existing EC schemes work, (2) understand the causes of the EC artifacts present in the current schemes and the pitfalls in the interpretation of CTC images, (3) learn about the emerging machine-learning EC (ML-EC) methods, and (4) demonstrate how ML-EC improves image quality in ultra-low-dose non-cathartic dual energy CTC.

TABLE OF CONTENTS/OUTLINE

1. Introduction and background: Review the role of EC in CTC and the principles of existing EC schemes.2. EC artifacts and pitfalls: Review the artifacts generated by existing EC schemes, and diagnostic pitfalls due to the artifacts.3. Machine-learning EC (ML-EC): Describe principles of the emerging machine-learning-based EC schemes including ensemble random forest EC and deep learning EC.4. Image quality improvement by ML-EC: Describe the effect of ML-EC on identifying and remove image artifacts, in comparison

with existing EC schemes.5. ML-EC in action: Showcase the examples of ML-EC results in standard- and ultra-low-dose non-cathartic dual energy CTC cases

RCA34

Using RSNA Clinical Trial Processing (CTP) Software for De-identification and Data Sharing (Hands-on)

Tuesday, Dec. 1 2:30PM - 4:00PM Location: S401AB

IN RS

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
Justin Kirby, Bethesda, MD (*Presenter*) Stockholder, Myriad Genetics, Inc
Bradley J. Erickson, MD, PhD, Rochester, MN (*Presenter*) Stockholder, Evidentia Health, Inc; Stockholder, OneMedNet Corporation; Stockholder, VoiceIt Technologies, LLC
Kirk E. Smith, BS, Saint Louis, MO (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Learn about CTP's capabilities and the unique challenges associated with de-identifying DICOM images 2) Learn how to install the CTP software 3) Learn how to use Pipelines to quickly configure CTP for data sharing and clinical trial use cases 4) Learn how to customize de-identification scripts for advanced use cases

ABSTRACT

The RSNA Clinical Trials Processor (CTP) is free software that enables researchers to share data for imaging clinical trials and research projects. CTP provides a secure end-to-end solution for efficiently de-identifying and moving images and related data between clinical trial sites or research teams. CTP is designed to support industry-standard Digital Imaging and Communications in Medicine (DICOM) transport protocols, so it is easy to configure CTP to work with commercial PACS systems as well as research databases such as DCM4CHEE, NBIA, MIDAS or XNAT. Built-in compliance with DICOM de-identification standards enables easy and effective removal of protected health information while preserving key attributes necessary to maintain usability of the data. In this course participants will be provided with an overview of CTP's functionality and the unique challenges associated with de-identifying DICOM images. They will then perform hands-on image processing of sample data based on common research and clinical trial scenarios.

URL

RCC34

3D Printing with Viable Tissues - Bioprinting

Tuesday, Dec. 1 2:30PM - 4:00PM Location: S501ABC

IN

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 0

Participants
Dimitris Mitsouras, PhD, Boston, MA (*Moderator*) Research Grant, Toshiba Corporation; Speakers Bureau, Toshiba Corporation
Roger R. Markwald, PhD, Charleston, SC (*Moderator*) Nothing to Disclose

Sub-Events

RCC34A 3D Printing of Viable Tissues

Participants
Roger R. Markwald, PhD, Charleston, SC (*Presenter*) Nothing to Disclose

RCC34B 3D Printing and Regenerative Medicine in Congenital Heart Disease

Participants
Richard G. Ohye, MD, Ann Arbor, MI (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To understand the current role for 3-D printing and regenerative medicine in congenital heart disease.

RCC34C Intellectual Property

Participants
Bruce Kline, BS, Rochester, MN (*Presenter*) Nothing to Disclose

RCC34D Quality Control

Participants
Shuai Leng, PhD, Rochester, MN (*Presenter*) Nothing to Disclose

SSJ13

Informatics (Enterprise Integration and Business Analytics)

Tuesday, Dec. 1 3:00PM - 4:00PM Location: S402AB

IN

AMA PRA Category 1 Credit ™: 1.00
ARRT Category A+ Credit: 1.00

FDA Discussions may include off-label uses.

Participants
William W. Boonn, MD, Penn Valley, PA (*Moderator*) Founder, Montage Healthcare Solutions, Inc; President, Montage Healthcare Solutions, Inc; Shareholder, Montage Healthcare Solutions, Inc; Shareholder, Nuance Communications, Inc; Shareholder, Merge Healthcare Incorporated
Bhavya Rehani, MD, San Francisco, CA (*Moderator*) Nothing to Disclose
Gary J. Wendt, MD, MBA, Middleton, WI (*Moderator*) Medical Advisory Board, McKesson Corporation; Medical Advisory Board, HealthMyne; Owner, WITS(MD), LLC; ;

Sub-Events

SSJ13-01 The Clinical Decision Support Mandate: A Pilot Project Using Epic's Best Practice Alerts for PE-CTA Study Orders to Prepare the Hospital Staff

Tuesday, Dec. 1 3:00PM - 3:10PM Location: S402AB

Participants
Alexander Goehler, MD,PhD, New Haven, CT (*Presenter*) Nothing to Disclose
Jeffrey C. Weinreb, MD, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose
Howard P. Forman, MD, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose
Christopher Moore, MD, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose
Allen Hsiao, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose
Dan Wismer, Verona, WI (*Abstract Co-Author*) Employee, Epic Systems Corporation
Jennifer Arango, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose
Linda D'Amato, Shelton, CT (*Abstract Co-Author*) Nothing to Disclose

Background

The Protecting Access to Medicare Act (2014) mandates that starting in Jan 2017, physicians ordering advanced diagnostic imaging exams must consult appropriate-use criteria through a Clinical Decision Support (CDS) system. We aimed to evaluate obstacles to broader application through a pilot.

Evaluation

We chose the Emergency Department (ED) as a closed, controlled but scalable environment. Based on a survey of 191 ED providers, PE-CTA studies were considered to be over-utilized by 78% of the respondents. An interdisciplinary committee developed a diagnostic pathway that combined established risk scores and local practice patterns. We then developed a Best Practice Alerts (BPA) within the Epic RIS ordering system (Epic Radiant, 2014) to provide guidance to healthcare providers based on the algorithm. This allowed us to incorporate data from the EHR and direct interactions with the ordering party via a check list. We also developed an automated reporting structure for quality performance measurement that allows for direct provider feedback and is scalable as CDS indications increase.

Discussion

The algorithm is integrated as a mandated questionnaire in every CTA-PE study order in the ED (figure). If answers are concordant with the clinical pathway, the study order will be placed without further interaction. If answers are discordant with the pathway, alternative scenarios are recommended. If the user agrees, orders are automatically adjusted. If they are rejected, a reason is required. From 01/2012 until 03/2015, 6,472 PE studies were performed in our EDs among which 8.3% were positive. 39% never had a d-dimer and 4% were conducted despite a negative d-dimer. Within 5 days of our BPA roll-out, 33 PE-CTAs were conducted. 73% were concordant with the recommendation, 6% were positive. In Nov 2015, we expect to have 1,400 studies with detailed analyses on appropriate use, study yield and user feedback.

Conclusion

Successful implementation of CDS requires broad awareness among the majority of hospital staff. Epic's BPA provides an approach to quickly establish a local foundation while "off-the-shelf" applications are being reviewed.

SSJ13-02 An Investigation of Radiologist EMR Usage at a Large Multi-Facility Payer-Provider Healthcare Organization

Tuesday, Dec. 1 3:10PM - 3:20PM Location: S402AB

Participants
Brian J. Kolowitz, DSc,MBA, Pittsburgh, PA (*Presenter*) Nothing to Disclose
Christopher R. Deible, MD, PhD, Pittsburgh, PA (*Abstract Co-Author*) Nothing to Disclose
Anna L. von Reden, MA, BEng, Pittsburgh, PA (*Abstract Co-Author*) Nothing to Disclose
Michael Lichtenstein, MBA, MSc, Pittsburgh, PA (*Abstract Co-Author*) Nothing to Disclose
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Wenbang Wang, Pittsburgh, PA (*Abstract Co-Author*) Employee, General Electric Company
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Kashyap Patel, Pittsburgh, PA (*Abstract Co-Author*) Nothing to Disclose
Varalakshmi Anantharaman, Pittsburgh, PA (*Abstract Co-Author*) Nothing to Disclose

Benjamin J. Wilson, Durham, NC (*Abstract Co-Author*) Nothing to Disclose

Background

This investigation captures the current state of EMR usage at a large multi-facility payer-provider healthcare organization. Prior research suggests low levels of EMR usage by radiologists due to incomplete information, misinformation, and technical difficulties accessing information.

Evaluation

This study is divided into two phases. Phase one involved contextual observation of 41 radiologists interpreting 344 clinical exams over a 3-month period. Results of these observations led to phase 2: the development of an application that captures radiologist usage of clinical content (Figure 1) across multiple EMRs, and relates usage statistics to key patient and exam identifiers. Phase one of the study is complete and phase two is in progress. Of the 344 case observations, 41 were ED exams, 66 were inpatient exams, and 269 were outpatient exams (Table 1). Radiologists relied solely on imaging for only 8% of the exams. In all other instances radiologists accessed a summarized view of EMR/RIS (40%), prior imaging reports (24%), and other clinical documentation (28%) within the EMR. Within the EMR, Office Notes (11%) and Exam Prescription (7%) were the predominate sources followed by Surgical Notes (2%), Labs (2%), ER notes (2%), Progress Notes (1%), History and Physical (1%), Pathology Notes (1%), Consult Notes (1%), Correspondence(<1%), and Non-Surgical Procedure Notes (<1%).

Discussion

The results of phase one suggest frequent EMR usage which appears to contradict prior research. Phase two data collection is in progress and will capture a broader set of usage metrics than in-person observation during clinical interpretation. This dataset will be used to inform the creation of a new radiologist centric information hierarchy based on relationships between procedure type, modality, and other patient/exam demographics.

Conclusion

Observational research shows that radiologists frequently use a variety of clincal data during image interpretation depending on exam type and the clinical context under which the exam was ordered. This work is providing extremely valuable data to help direct development of tools that can intelligently present EMR data to radiologists rather than requiring them to conduct manual searches.

SSJ13-03 Implementation of an Online Screening/Check-in Process Prior to MRI Studies: An Idea from the Airline Industry

Tuesday, Dec. 1 3:20PM - 3:30PM Location: S402AB

Awards
Trainee Research Prize - Resident

Participants
Ali Pirasteh, MD, Dallas, TX (*Presenter*) Nothing to Disclose
Maia VanDyke, Dallas, TX (*Abstract Co-Author*) Nothing to Disclose
Jamie Bolton-Ronacher, Dallas, TX (*Abstract Co-Author*) Nothing to Disclose
Yin Xi, Dallas, TX (*Abstract Co-Author*) Nothing to Disclose
Robin C. Eastland, RT, Dallas, TX (*Abstract Co-Author*) Nothing to Disclose
Denise Young, BS,RT, Dallas, TX (*Abstract Co-Author*) Nothing to Disclose
Jennifer C. Escobar, BS, Dallas, TX (*Abstract Co-Author*) Nothing to Disclose
Cecilia Hernandez, Dallas, TX (*Abstract Co-Author*) Nothing to Disclose
Seth Toomay, MD, Dallas, TX (*Abstract Co-Author*) Nothing to Disclose
Travis Browning, MD, Dallas, TX (*Abstract Co-Author*) Advisory Board, Hewlett-Packard Company; Advisor, McKesson Corporation
Ivan Pedrosa, MD, Dallas, TX (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate whether implementing a web-based screening and check-in process for MRI appointments will improve the workflow and patient turn-around time and reduce the operational cost in the Radiology Department.

METHOD AND MATERIALS

This IRB-approved, HIPAA-compliant study consisted of a prospective collection of the interview/screening duration prior to MRI for all outpatients over a six-week period after implementation of an online screening (OS) questionnaire. 773 patients were divided into OS (200 patients; 86 male; average age 54.4 years) and traditional screening (TS) (573 patients; 255 male, average age 54.3 years) groups. Differences in interview/screening duration were calculated with a generalized linear model with log link function with additional adjustments for differences in prevalence of possible causes of delay between both groups. Impact on operational cost was calculated by the amount of extended working hours of technologist per day and reported in cost-savings per year.

RESULTS

26% of patients utilized the OS. The average interview/screening duration for the OS group (12.0 minutes, standard deviation (SD) = 7.1) was significantly lower than that of the TS group (14.1 minutes, SD = 12.3, p = 0.004); 2 minutes shorter (p = 0.03) adjusting for differences in prevalence of potential causes of delay between the two groups. There was no difference in the median interview/screening duration for the OS (10 min) and TS groups (11 min)(p = 0.18). The cost reduction in technologist working hours was $21,000 per year, assuming a 100% utilization rate of the OS process.

CONCLUSION

Implementation of an online screening process prior to MRI results in faster patient screening, has the potential to result in cost savings, and provides a patient-centered, more efficient solution for screening prior to MRI examinations.

CLINICAL RELEVANCE/APPLICATION

An online MRI screening system can be implemented as an effective method in reducing delays and patient interview turn-around, has high potential for reduction in costs and possible increase in patient satisfaction.

SSJ13-04 Participants

Detailed Workflow Analysis of PACS Usage Patterns by Means of Process Mining

Tuesday, Dec. 1 3:30PM - 3:40PM Location: S402AB

Daniel Forsberg, PhD, Linkoping, Sweden (*Presenter*) Nothing to Disclose
Beverly Rosipko, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose
Jeffrey L. Sunshine, MD, PhD, Pepper Pike, OH (*Abstract Co-Author*) Research support, Siemens AG Travel support, Siemens AG Travel support, Koninklijke Philips NV Travel support, Sectra AB Travel support, Allscripts Healthcare Solutions, Inc

Background

Over the years, the radiological workflow has undergone large and much research has been devoted to how these changes affect the workflow and efficiencies. However, most of this research has focused on a very high level of the radiological workflow. In this work, we take on a much more detailed perspective as we analyze interaction patterns describing radiologists' usage of.

Evaluation

Event logs (containing information about commands used in the PACS) from one week of data, corresponding to 567 cases of single view chest radiographs read by 14 radiologists, were extracted for analysis. For each case, number of commands, number of command classes and time to complete a read were recorded. Statistical analysis was applied to compute the correlation and to determine which factors of radiologist, specialty and time of read that affect these variables. Further, techniques from process mining were applied to the interaction patterns to discover process models and to analyze the complexity of the derived process models.

Discussion

The statistical analysis showed that the number of commands and command classes per case only have a slightly positive correlation with the time to read a case. The factors time of day, radiologist and specialty were shown to affect the number of commands per case, and where radiologist also affects the number of command types. Applying process mining to the event logs of all users showed that a seemingly "simple" examination (single view chest radiographs) can be associated with a complex interaction process. However, repeating the process discovery on each individual radiologist revealed that the initially discovered complex interaction process consists of one group of radiologists with individually well-structured interaction processes and a second smaller group of users with increasingly complex usage patterns.

Conclusion

Detailed analysis of the workflow corresponding to the interaction patterns of radiologists reading examinations in a PACS presents a fresh opportunity for finding new areas of improvement of the radiological workflow.

SSJ13-05 No Patient Left Behind: Novel Application of Predictive Analytics to Improve Patient Access and Efficiency of Imaging Resources

Tuesday, Dec. 1 3:40PM - 3:50PM Location: S402AB

Participants
Alvin Y. Yu, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Omid Khalilzadeh, MD, MPH, Boston, MA (*Presenter*) Nothing to Disclose
Garry Choy, MD, MS, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Anand M. Prabhakar, MD, Somerville, MA (*Abstract Co-Author*) Nothing to Disclose
Synho Do, PhD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
James A. Brink, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Efren J. Flores, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

A missed care opportunity (MCO), defined as missing a health care appointment, impairs short and long term patient care. There are many factors that explain why MCOs occur. This study attempts to define a new paradigm for implementing value-based care in radiology: 'Patient connectivity' as a quantitative measure of patient access to healthcare resources. A real-world analogy is cell phone connectivity to a network - imagine the number of bars of reception. This study suggests a novel predictive model derived using machine learning techniques for quantification of "Patient Connectivity Index" (PCI) and prediction of MCOs in radiologic patient-care. This will allow us to better understand the patient population we serve and improve patient access by personalizing health care delivery.

METHOD AND MATERIALS

Data from 0.5 million outpatient radiologic exams performed at our institution in the calendar year 2014 was analyzed. Data was obtained and combined from Radiology Order Entry, Electronic Medical Record, City Data, and Google Maps. The dataset was divided into a learning (66%) and test set (33%). Multivariate multilevel regression analysis was used to define a "connectivity" measure based on these factors on the learning set, and the resulting predictive model was used to validate the accuracy of the model on the test set. Specifically, the following variables were implemented in this model: Age, Gender, Distance to hospital and transportation, Insurance, Primary Language, Ethnicity/Race, Time of year, ICD9 codes, and referral pattern.

RESULTS

Missing radiology appointments were significantly ($p<0.01$) associated with lower educational level, lower income, language barriers and certain ethnic backgrounds in our predictive model. The PCI (connectivity range 1-20%) could determine the predicted probability of MCOs with a good degree of accuracy.

CONCLUSION

Connectivity is a dynamic, multifactorial, co-dependent, and patient-specific measure of health care access. Many factors relate to another with linear and non-linear effects, resulting in MCOs. Moreover, external events and disease progression also affects PCI. This study suggests a predictive platform which will pinpoint bottlenecks to connectivity and facilitate specific interventions for increasing patient access and connectivity to the healthcare network.

CLINICAL RELEVANCE/APPLICATION

This work represents a tangible opportunity to deliver value-based imaging beyond the reading room.

SSJ13-06 Personalized Characterization of Nodule Cancer Risk Beyond Lung-Rads 1.0 with NLST Data

Tuesday, Dec. 1 3:50PM - 4:00PM Location: S402AB

Participants
Michael A. Morris, MD, MS, Baltimore, MD (*Presenter*) Nothing to Disclose
Jason M. Hostetter, MD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Babak Saboury, MD, MPH, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
James J. Morrison, MD, Novi, MI (*Abstract Co-Author*) Nothing to Disclose
Kenneth C. Wang, MD, PhD, Ellicott City, MD (*Abstract Co-Author*) Co-founder, DexNote, LLC;
Jean Jeudy JR, MD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Eliot L. Siegel, MD, Severna Park, MD (*Abstract Co-Author*) Research Grant, General Electric Company; Speakers Bureau, Siemens AG; Board of Directors, Carestream Health, Inc; Research Grant, XYBIX Systems, Inc; Research Grant, Steelcase, Inc; Research Grant, Anthro Corp; Research Grant, RedRick Technologies Inc; Research Grant, Evolved Technologies Corporation; Research Grant, Barco nv; Research Grant, Intel Corporation; Research Grant, Dell Inc; Research Grant, Herman Miller, Inc; Research Grant, Virtual Radiology; Research Grant, Anatomical Travelogue, Inc; Medical Advisory Board, Fovia, Inc; Medical Advisory Board, Toshiba Corporation; Medical Advisory Board, McKesson Corporation; Medical Advisory Board, Carestream Health, Inc; Medical Advisory Board, Bayer AG; Research, TeraRecon, Inc ; Medical Advisory Board, Bracco Group; Researcher, Bracco Group; Medical Advisory Board, Merge Healthcare Incorporated; Medical Advisory Board, Microsoft Corporation; Researcher, Microsoft Corporation

CONCLUSION

Lung cancer risk within Lung-RADS categories is modified by additional nodule characteristics and patient historical information. A convenient interface for clinicians to interact with large datasets may aid in evaluating additional characteristics affecting the risk of lung cancer compared to a matched cohort in real time.

Background

Lung-RADS 1.0 was developed as a criteria to modernize and standardize recommendations for lung nodule follow-up for patients eligible for lung cancer screening which builds on the Fleischner Society recommendations. A custom web interface previously showed additional patient characteristics from the NLST clinical dataset could provide a more personalized prediction of cancer risk. In this follow-up study, the authors use the same approach if additional characteristics could improve the Lung-RADS prediction from matched cohorts.

Evaluation

A custom web based interface to allow the user to interact with the NLST clinical dataset in real time was created. The largest nodule in each lobe for each patient was organized by slice number and location. These nodules were tracked until cancer was diagnosed or until the last screening study available. If cancer originated in the same lobe as a nodule, the nodule was considered malignant. Lung-RADS categories predict cancer risks that range from <1% for category 2 nodules to >15% for category 4B and 4X nodules. The occurrence of cancer diagnosis was compared to the Lung-RADS predicted rate across matched cohorts with similar personal histories and nodule characteristics. The web interface allows users to compute a personalized cancer risk based on these additional discriminators by querying the NLST dataset for matched cohorts in real time.

Discussion

Lung-RADS characterizes nodules with greater detail than the Fleischner Criteria, however features that increase suspicion for malignancy are not clearly defined and additional factors that may significantly modify cancer risk such as a patient's personal history are excluded. Harnessing large datasets such as the NLST could aid in comparing matched cohorts to identify additional important factors in further personalizing the prediction for a nodule's cancer risk.

RC453

Clinical Decision Support: Impact and Lessons from Large Scale Implementations

Tuesday, Dec. 1 4:30PM - 6:00PM Location: E353A

IN

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
Emanuele Neri, MD, Pisa, Italy (*Moderator*) Nothing to Disclose

Sub-Events

RC453A Results and Lesson from the Medicare Imaging Demonstration

Participants
Keith D. Hentel, MD, MS, New York, NY, (keh9003@med.cornell.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To understand the lessions learned in the Weill Cornell Implementation of CDS for the MID. 2) Apply lessons learned in the MID to guide future CDS implementations.

RC453B Mass General Hospital

Participants
Jeffrey B. Weilburg, MD, Boston, MA (*Presenter*) Nothing to Disclose

RC453C Virginia Mason

Participants
C. Craig Blackmore, MD,MPH, Seattle, WA, (craig.blackmore@vmmc.org) (*Presenter*) Royalties, Springer Science+Business Media Deutschland GmbH

LEARNING OBJECTIVES

1) To understand the implementation of clinical decision support at Virginia Mason. 2) To apply lessons learned from successful implementation of clinical decision support. 3) To analyze factors contributing to the success or failure of clinical decision support in decreasing inappropriate imaging.

ABSTRACT

At Virginia Mason, we published one of the earliest clinical decision support programs for advanced imaging. That program differed in many important ways from other programs, including the Medical Imaging Demonstration project, by deploying a targeted intervention directed at a limited number of high cost/high utilization studies. Our clinical decision support system achieved 25% decreases in imaging across the included studies through use of a "hard stop" barrier whereby inappropriate imaging was not permitted to proceed.

RC453D Brigham and Women's Hospital

Participants
Ramin Khorasani, MD, Roxbury Crossing, MA (*Presenter*) Consultant, Medicalis Corp

ABSTRACT

Clinical Decision Support (CDS) has been recognized as an important tool in helping reduce inappropriate use of medical imaging to improve the quality of care and reduce waste by providing evidence-based recommendation to ordering providers at the time of order entry. Three federal regulations aimed to assess the impact of imaging CDS on use of high cost imaging, and promote and accelerate its use. 1. (Medicare Improvements for Patients and Providers Act or MIPPA) required CMS to perform a large scale demonstration project (Medicare Imaging Demonstration or MID; 2011-2014) to assess the impact of imaging CDS based on pre-determined professional society guidelines on utilization of ambulatory targeted high cost imaging procedures for medicare fee for service patients. 2. Stage two of Meaningful Use of health IT federal regulations provide modest financial incentives for adoption of CDS, including for imaging, and 3. Promoting Evidence-Based care section of the Protecting Access to Medicare Act (PAMA) of 2014 mandates use of imaging CDS for specified ambulatory high cost imaging services as a requirement for payment for such services beginning January 2017. Despite these ongoing federal initiatives, adoption of imaging CDS has been limited in part because of ongoing debate on best practices for implementation and use of imaging CDS.In this session, speakers with experience in use of imaging CDS, including large scale implementation, will share their experience on impact of CDS, and lessons learnt from implementation of imaging CDS to help inform best practices for imaging CDS.

RC454

A Practical Approach for Beginning Radio-genomic Research

Tuesday, Dec. 1 4:30PM - 6:00PM Location: S501ABC

BQ IN

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
Maryellen L. Giger, PhD, Chicago, IL (*Presenter*) Stockholder, Hologic, Inc; Shareholder, Quantitative Insights, Inc; Royalties, Hologic, Inc; Royalties, General Electric Company; Royalties, MEDIAN Technologies; Royalties, Riverain Technologies, LLC; Royalties, Mitsubishi Corporation; Royalties, Toshiba Corporation; Researcher, Koninklijke Philips NV; Researcher, U-Systems, Inc
Hui Li, MD, PhD, Chicago, IL (*Presenter*) Nothing to Disclose
Karen Drukker, PhD, Chicago, IL, (kdrukker@uchicago.edu) (*Presenter*) Nothing to Disclose
Elizabeth S. Burnside, MD, MPH, Madison, WI (*Presenter*) Stockholder, NeuWave Medical Inc
Yuan Ji, Chicago, IL (*Presenter*) Nothing to Disclose
Alexandra V. Edwards, Chicago, IL (*Presenter*) Nothing to Disclose
John Papaioannou, MSc, Chicago, IL (*Presenter*) Nothing to Disclose
Chun-Wai Chan, MS, Chicago, IL (*Presenter*) Nothing to Disclose
Yitan Zhu, PhD, Evanston, IL (*Presenter*) Nothing to Disclose
Robert Tomek, MSc, Darien, IL (*Presenter*) Employee, Quantitative Insights, Inc
Michael R. Chinander, Chicago, IL (*Presenter*) Researcher, Quantitative Insights, Inc

LEARNING OBJECTIVES

1) Understand what planning and online resources are needed to create a successful cross-disciplinary radio-genomic research team that can efficiently meet hypothesis-generated imaging/genomic science objectives. 2) Comprehend what skill set distinctions are needed for a hypothesis-resolving radio-genomic research team and how those essential components can be assembled to investigate and/or discover a given disease signature. 3) Learn how to grasp a radio-genomic conceptual research framework that may at first seem unfamiliar to imaging scientists.

ABSTRACT

RCA35

Creating, Storing, and Sharing Teaching Files Using RSNA's MIRC® (Hands-on)

Tuesday, Dec. 1 4:30PM - 6:00PM Location: S401AB

ED IN

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
Krishna Juluru, MD, New York, NY (*Moderator*) Nothing to Disclose
Omer A. Awan, MD, Baltimore, MD (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Learn how easy it is to install the new and improved RSNA teaching file software with the one-click installer. 2) Learn how to create, organize, and share teaching files, create conference documents and save interesting cases for yourself, your group or your department.

RCB35

Radio-Genomic Research: Accessing Clinical Imaging-Genomics-Pathology Data from Public Archives-The Cancer Imaging Archive (Hands-on)

Tuesday, Dec. 1 4:30PM - 6:00PM Location: S401CD

IN

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
C. Carl Jaffe, MD, Boston, MA, (carljaffe@gmail.com) (*Presenter*) Nothing to Disclose
John B. Freymann, BS, Rockville, MD (*Presenter*) Nothing to Disclose
Justin Kirby, Bethesda, MD (*Presenter*) Stockholder, Myriad Genetics, Inc
Fred W. Prior, PhD, Little Rock, AR (*Presenter*) Stockholder, Siemens AG
Lawrence R. Tarbox, PhD, Saint Louis, MO (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Learn how to propose new data sets for hosting in The Cancer Imaging Archive (TCIA). 2) Identify and download existing TCIA data sets which match your research interests. 3) Collaborate with other researchers using Shared Lists and Digital Object Identifiers. 4) Identify support resources including the TCIA helpdesk, FAQs, and system documentation.

ABSTRACT

Access to large-scale genomic-clinical-pathology databases are essential for researchers to understand disease and devise precision medicine pathways, especially in cancer. But HIPAA compliant collections of network downloadable diagnostic clinical images, publically accessible that link to comprehensive molecular physiologic and clinical data has been limited till now. This hands-on session will teach the basic skills needed to navigate the "Big Data" Cancer Imaging Archive open-access database of diagnostic radiology and pathology images that are cross-linked to clinical disease cases analyzed and archived in the NIH Cancer Genome Atlas. With this knowledge radiologists and imaging scientists can undertake cutting-edge research capable of linking clinical imaging to discover new genomic-based disease signatures.

URL

RCC35

Standardized Terminology in Radiology: Applications and New Developments using RadLex and Playbook

Tuesday, Dec. 1 4:30PM - 6:00PM Location: S102D

IN

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
Kenneth C. Wang, MD, PhD, Ellicott City, MD, (kcwang@gmail.com) (*Moderator*) Co-founder, DexNote, LLC;

LEARNING OBJECTIVES

1) To recognize the need for standardized terminology for radiology imaging examinations. 2) To describe the RadLex Playbook, which provides standard names and codes for radiology orderables. 3) To demonstrate the value of RadLex Playbook for improving radiology practice.

Sub-Events

RCC35A Terminology Standardization in CT: Progress and Challenges

Participants
Laurel Burk, Springfield, VA, (laurel.burk@fda.hhs.gov) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Identify challenges associated with non-standard CT terminologies. 2) Compare currently available standard CT lexicons. 3) Explain the role of consensus standards in FDA's regulation of radiological devices.

ABSTRACT

The inconsistency in names used for CT acquisition and reconstruction parameters across different scanner models can be confusing to operators, possibly leading to unnecessary radiation exposure or poor image quality. The AAPM Working Group on Standardization of CT Nomenclature and Protocols (WGCTNP) is working toward a set of consensus recommended CT parameter terms and definitions. Ongoing work includes: identifying relevant terms from existing standard lexicons; mapping generic terms to vendor-specific terminology (lexicon published on the AAPM 'CT Scan Protocols' website); and identifying preferred names based on use in the literature and clinical practice.

RCC35B RadLex® Playbook: Standardized Terminology for Naming and Coding Imaging Procedures

Participants
Kenneth C. Wang, MD, PhD, Ellicott City, MD, (kcwang@gmail.com) (*Presenter*) Co-founder, DexNote, LLC;

LEARNING OBJECTIVES

1) To illustrate the motivations for RadLex Playbook. 2) To describe the Playbook semantic model. 3) To review Playbook implementation strategies. 4) To introduce the Playbook / LOINC harmonization project.

ABSTRACT

The historical lack of a standard naming scheme for imaging studies has limited exam interoperability. The RadLex Playbook provides a system for creating standard radiology procedure names and codes, enabling a variety of applications in dose tracking and optimization, enterprise integration, and quality improvement. This presentation will illustrate the motivations for Playbook adoption, and describe the semantic model used to create Playbook codes. We will also review strategies and technical considerations in Playbook implementation. Finally, we will describe work to harmonize Playbook with the LOINC system of codes.

RCC35C Standard Terminology for Radiology Reporting

Participants
Charles E. Kahn JR, MD, MS, Philadelphia, PA, (charles.kahn@uphs.upenn.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Define the roles of standardized vocabularies in radiology reporting. 2) Describe how terms from standardized vocabularies are being incorporated to RSNA's radiology reporting templates. 3) Understand how standardized vocabularies allow reporting templates and radiology reports to be interoperable across a variety of languages, information systems, and applications.

ABSTRACT

Standardized terminologies can help radiologists communicate the results of imaging procedures more effectively. A well-defined terminology can eliminate ambiguity, and can guide radiologists to use appropriate descriptive terms. Standardized vocabularies can overcome language barriers and the limitations of proprietary systems. This presentation will explore the roles of standardized terminologies in the reporting templates being developed by the RSNA Reporting Initiative. Structured reporting gives radiologists the opportunity to incorporate controlled vocabularies, such as RadLex®, into their reports to enhance the reports' clinical usefulness, facilitate data extraction, and improve quality.

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality

educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Charles E. Kahn JR, MD, MS - 2012 Honored Educator

RC523

Digital Information Security and Medical Imaging Equipment: Threats, Vulnerabilities and Best Practices

Wednesday, Dec. 2 8:30AM - 10:00AM Location: S403B

IN PH SQ

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants

Sub-Events

RC523A Medical Device Security in a Connected World

Participants
Kevin McDonald, Rochester, MN, (mcdonald.kevin@mayo.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand the changing environment of network and internet connected devices and software. 2) Be aware of the motivations and tatics of current threat actors. 3) Understand common security issues found in medical devices. 4) Know simple actions that can decrease risk.

ABSTRACT

Medical devices are increasingly becoming dependent on technology and network connectivity, at a time that the electronic environment is becoming more dangerous. Because of this medical devices and systems can become easy targets for attackers attempting to access PHI, disrupt patient care or even harm a patient. When tested, these devices have been shown to have multiple vulnerabilities. These vulnerabilities range from hardcoded passwords, publically available service passwords and no encryption of patient data. Because of this institutions using these devices need to work with their vendors to improve the security of medical devices and take actions themselves to help protect their environment and patients.

RC523B Knowing if Your Imaging Systems are Secure and Keeping Them That Way

Participants
J. Anthony Seibert, PhD, Sacramento, CA, (jaseibert@ucdavis.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand the vulnerabilities of imaging system modalities to security and privacy breeches. 2) Determine ways to protect and secure imaging systems from internal and external threats. 3) Describe institutional best-practices to maintain protection yet provide necessary accessibility for imaging modalities.

RC523C The US Government and Medical Device Security

Participants
Kevin Hemsley, Idaho Falls, ID (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) What are industrial control systems (ICS) and how do they play in the field. 2) What is the role and capabilities of ICS-CERT (Industrial Control Systems Cyber Emergency Response Team). 3) What is some steps that can be taken to protect ICSs.

RC553

Next Generation IT to Improve Quality and Safety

Wednesday, Dec. 2 8:30AM - 10:00AM Location: S405AB

IN PR SQ

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: .50

Participants
Ramin Khorasani, MD, Roxbury Crossing, MA (*Moderator*) Consultant, Medicalis Corp

ABSTRACT

Improving healthcare system performance is a major national focus. An important element of performance improvement in healthcare is national adoption and meaningful use of interoperable health information technology tools, supported by federal regulations as part of Health Information technology and Economic Health Act (HITECH). Radiology has been a leader in adoption of health IT tools and solutions. In this session, we will review some key, next generation health IT requirements to improve quality of care and patient safety while reducing waste.The speakers will use case example to demonstrate how health IT tools can be used to improve access to imaging, improve appropriateness of imaging ordering, improving radiology report value, enhance communication of critical test results, and enable appropriate follow up imaging and care coordination for patients.

Sub-Events

RC553A Improving Access and Appropriateness

Participants
Keith D. Hentel, MD, MS, New York, NY, (keh9003@med.cornell.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand avialable technologies available for improving access to imaging practices. 2) Understand available technologies for improving appropraiteness of imaging performed.

RC553B Improving Value of Radiology Reports

Participants
Ross W. Filice, MD, Washington, DC, (ross.w.filice@gunet.georgetown.edu) (*Presenter*) Nothing to Disclose

RC553C Improving Communication of Critical Results and Follow-up Recommendations

Participants
Ramin Khorasani, MD, Roxbury Crossing, MA (*Presenter*) Consultant, Medicalis Corp

RC554

Mobile Computing Devices

Wednesday, Dec. 2 8:30AM - 10:00AM Location: S404CD

IN SQ

AMA PRA Category 1 Credits ™: 3.25
ARRT Category A+ Credits: 3.50

Participants
David S. Hirschorn, MD, Staten Island, NY, (hirschorn.david@mgh.harvard.edu) (*Moderator*) Nothing to Disclose
Asim F. Choudhri, MD, Memphis, TN (*Moderator*) Nothing to Disclose
George L. Shih, MD, MS, New York, NY (*Moderator*) Consultant, Image Safely, Inc; Stockholder, Image Safely, Inc; Consultant, Angular Health, Inc; Stockholder, Angular Health, Inc;

Sub-Events

RC554A Introduction

Participants
David S. Hirschorn, MD, Staten Island, NY (*Presenter*) Nothing to Disclose

RC554B Platforms and Security

Participants
George L. Shih, MD, MS, New York, NY (*Presenter*) Consultant, Image Safely, Inc; Stockholder, Image Safely, Inc; Consultant, Angular Health, Inc; Stockholder, Angular Health, Inc;

LEARNING OBJECTIVES

1) Mobile Health: Discuss mobile healthcare trends and evolution involving Apple iOS and Google Android, with specific focus on mobile health apps and platforms, including Apple HealthKit and Apple ResearchKit. 2) Mobile Security: Provide basic understanding of different security concerns in mobile health and discuss options in the healthcare setting.

ABSTRACT

Mobile healthcare devices of all shapes and sizes are now ubiquitous in clinical setting. Radiologists and other providers are leveraging mobile solutions in their clinical workflow. The major mobile platforms provide distinct advantages for both app developers and end users (ie, clinicians and patients) in the healthcare setting. Both iOS and Android platforms have development toolkits that allow for health-related apps. Apple has released HealthKit and ResearchKit, which are more medically focused, and several apps are already available which leverage these new capabilities. A major EHR vendor, EPIC, now has the ability to directly communicate and with a patient's iPhone with bi-directional data-sharing. Wearable devices, such as the Apple iWatch, and other third party mobile health devices are also discussed. The wearable and portable devices will continue to accelerate the shift to mobile healthcare.Mobile devices will need to have the same or enhanced security compared with traditional computers because of increased portability and the Bring Your Own Device (BYOD) phenomenon where clinicians are increasingly using their personal devices for work. Managing enterprise mobile security on a wide range of work and personal mobile devices will remain challenging although can be alleviated by using Mobile Device Manager software which can deploy updates and enforce security policies. Shared mobile devices for patients in the clinical setting may also present similar challenges.

ABSTRACT

Mobile healthcare devices of all shapes and sizes are now ubiquitous in clinical setting. Radiologists and other providers are leveraging mobile solutions in their clinical workflow. The major mobile platforms provide distinct advantages for both app developers and end users (ie, clinicians and patients) in the healthcare setting. The two main platforms for tablet mobile devices are Apple iOS and the Google Android. Mobile devices will need to have the same or enhanced security compared with traditional computers because of increased portability and the Bring Your Own Device (BYOD) phenomenon where clinicians are increasingly using their personal devices for work. Managing enterprise mobile security on a wide range of work and personal mobile devices will remain challenging although can be alleviated by using Mobile Device Manager software which can deploy updates and enforce security policies. Shared mobile devices for patients in the clinical setting may also present similar challenges.

RC554C Apps, Bandwidth, and Integration

Participants
Asim F. Choudhri, MD, Memphis, TN (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To have an understanding of available applications available for mobile medical imaging, including native clients, web clients, and virtual desktop/terminal server approaches. 2) To have an understanding of bandwidth concerns in mobile medical imaging, including device data handling, network speeds, and possible bandwidth cost issues. 3) To have an understanding of possible clinical implementations of mobile medical imaging within radiology departments and in health care networks overall.

ABSTRACT

Applications: There are several vastly different approaches to mobile viewing of medical images. Native clients are programs written using a software development kit for a given platform. These clients can retrieve data from remote servers and view locally stored image data. Web clients are web-based programs which are often (but not always) platform independent. They will typically access remotely stored data which may be stored in a local cache but is usually not permanently stored on the mobile device. Virtual desktop/terminal server software allows a mobile device to access a remote computer or server. The remote server handles all

higher level processing and data storage, minimizing the processing requirements of the mobile device but possibly straining bandwidth limitations. Examples of several applications using each of these approaches will be presented, with a discussion of pros and cons for each method as it pertains to an individual user and as it pertains to widespread implementation within a healthcare network. Bandwidth: Viewing medical images may require transfer of datasets that are tens or hundreds of megabytes in size. This provides a special challenge for mobile devices which typically receive data via wireless communication. If using a cellular network, network bandwidth can be a limiting factor (as can data transfer costs). File compression can reduce the size of files, however requires data processing power and may involve compromises in image quality. Once data is on a device, image processing may overwhelm its processing capabilities compared with dedicated PACS workstations. We will discuss both network and device bandwidth concerns as it relates to mobile medical imaging, and possible solutions for overcoming obstacles. Integration into a healthcare system: Mobile review of medical imaging is a tool which has potential to significantly change health care delivery, but the specifics for implementation are unclear. After a device platform has been selected, security protocols established, and bandwidth concerns solved, each institution will need to determine what role this technology will play. Possibilities include radiology residents (or even faculty) consulting with subspecialty faculty, surgeons and interventionalists triaging patients for procedures and for procedure planning, however these approaches are simply extensions of existing practices. New frontiers in consultation will be discussed, including an example involving mobile imaging review in a multidisciplinary stroke team. Guidance will also be provided regarding training and establishing institutional "standard operating procedures" documents. The current state of medical-legal concerns and risk management strategies will also be discussed.

RC554D Displays and Quality Assurance

Participants
David S. Hirschorn, MD, Staten Island, NY (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Discuss ranges of spatial and contrast resolution for medical imaging. 2) Explore options for calibration and quality assurance. 3) Understand the impact of ambient light and viewing distance and angle on medical image display.

ABSTRACT

Mobile devices have significantly smaller displays than desktop or even laptop computers to make them lighter and more easily transported. They are also designed for shorter viewing distances which require smaller pixels. The smaller total display size tends to reduce the number of pixels, while the smaller pixel size tends to increase the number of pixels. On balance, these displays typically have considerably fewer pixels than their stationary counterparts. Nonetheless, even desktop displays typically have less resolution than the original image size of a radiograph which is typically about 5 megapixel (MP) for a chest radiograph. And both types of displays have more resolution than a single CT image, which is 0.25 MP. Since these devices do allow zooming and panning, they may be suitable for image interpretation under controlled circumstances. The main purpose of the DICOM Part 14 Grayscale Display Function is to ensure that contrast is preserved across the range of shades of gray from black to white, particularly at the edges where uncalibrated displays tend to fall off. With desktop displays this can be measured with a photometer, either external or built-in, and graphics adapter adjustments can be made to make the display conformant. Mobile devices typically do not offer this degree of adjustability. This requires a different approach to DICOM curve conformance, and a reasonable alternative is to present the user with a visual challenge to identify low contrast targets placed randomly on the display. If the user can find them and tap on them, then the display may be considered compliant, and if not, then the display should not be relied upon.

RCA41

Mobile Computing for Decision Support and Learning While You Work (Hands-on)

Wednesday, Dec. 2 8:30AM - 10:00AM Location: S401AB

IN

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
Michael P. D'Alessandro, MD, Iowa City, IA, (michael-dalessandro@uiowa.edu) (*Presenter*) Nothing to Disclose
Jeffrey R. Galvin, MD, Baltimore, MD (*Presenter*) Nothing to Disclose
James J. Choi, MD, West Des Moines, IA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Learn to perform decision support on a mobile device at the point-of-care to answer questions that arise during clinical work and thus tie learning to practice and receive point-of care CME for it. 2) Learn to read Ebooks and educational apps on a mobile device.3) Learn to stay up-to-date with radiology journals and society news on a mobile device.4) Learn to manage a library of journal articles on a mobile device.5) Learn to view podcasts and vodcasts on a mobile device. 6) Learn to maintain a learning portfolio and learning network on a mobile device.

ABSTRACT

Acquiring and maintaining competency in the practice of radiology requires a program of continuous learning. This continuous learning would be most effectively performed during clinical work, when it has the greatest potential for modifying physicians' knowledge, attitudes, and behaviors as well as positively affecting patients' care, outcomes, and lives. The advent of mobile computing, and the rich assortment of authoritative radiology resources it allows easy access to, now allows this dream to become reality. This course will be a hands-on, state-of-the-art review that will teach the radiologist how to use mobile computing to perform continuous learning while you work. The Apple iOS, Google Android and Microsoft Windows Phone platforms will be covered. Participants will be encouraged to bring their own mobile phone or tablet to the course and will be asked before the course to download into their mobile device several free apps that will be demonstrated, so they can follow along during the session. These free apps are listed on the course handout at http://www.radiologyebooks.com/rsna.html

URL

http://www.radiologyebooks.com/rsna.html

Active Handout:Michael Patrick D'Alessandro

http://abstract.rsna.org/uploads/2015/13013317/RCA41.pdf

RCB41

Hands-on Introduction to Social Media (Hands-on)

Wednesday, Dec. 2 8:30AM - 10:00AM Location: S401CD

IN

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 0

Participants

C. Matthew Hawkins, MD, Decatur, GA, (matt.hawkins@emory.edu) (*Presenter*) Nothing to Disclose
Safwan Halabi, MD, Stanford, CA (*Presenter*) Nothing to Disclose
Neil U Lall, MD, Cincinnati, OH (*Presenter*) Nothing to Disclose
Tirath Y. Patel, MD, Toledo, OH (*Presenter*) Nothing to Disclose
Amy L. Kotsenas, MD, Rochester, MN (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Appreciate the professional relevance of social media for radiologists. 2) Understand the differences between Facebook pages and personal accounts. 3) Better grasp how hospitals and groups can use Facebook to connect with patients. 4) Setup and use a Twitter account. 5) Understand the purpose of hashtags, lists, and DMs. 6) Get acquainted with other radiologists and radiology organizations on Twitter. 7) Evaluate enterprise solutions for managing multiple social media accounts for larger groups and organizations. 8) Understand how to safely /securely communicate via social media while maintaining HIPAA requirements.

URL

http://bit.ly/RSNASocialMediaIntro

Active Handout:Safwan Halabi

http://abstract.rsna.org/uploads/2015/11035017/RCB41.pdf

RCC41

Using IHE Profiles to Plan for Medical Imaging

Wednesday, Dec. 2 8:30AM - 10:00AM Location: S501ABC

IN

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
David S. Mendelson, MD, Larchmont, NY (*Moderator*) Spouse, Employee, Novartis AG; Advisory Board, Nuance Communications, Inc; Advisory Board, General Electric Company; Advisory Board, Toshiba Corporation
Kinson Ho, Waterloo, ON, (kinson.ho@agfa.com) (*Presenter*) Employee, Agfa-Gevaert Group
David A. Clunie, MBBS, Bangor, PA (*Presenter*) Owner, PixelMed Publishing LLC
Christopher Lindop, Waukesha, WI (*Presenter*) Employee, General Electric Company
Donald Dennison, Waterloo, ON, (don@dondennison.com) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Value of IHE with content and vendor neutral integration. 2) How content neutral clinical information is managed with a Vendor Neutral Archive (VNA). 3) Planning for a Vendor Neutral Archive (VNA) or expand upon an existing VNA system to support both imaging and non-imaging content and systems. 4) The benefit of using IHE Imaging profiles for cross-enterprise and cross-community image sharing".

ABSTRACT

Integrating the Healthcare Enterprise (IHE) is a joint initiative of healthcare professionals and industry vendors to improve the way clinical systems in healthcare share information. IHE promotes the coordinated use of established standards such as webservices, DICOM and HL7 to address specific clinical need in support of optimal patient care. Established in 1997, the IHE Radiology Committee, a development domain of IHE, has profiled the clinical use cases to develop a framework of interoperability, known as the IHE Integration Profiles. Integration Profiles are developed specifically to be 'Vendor Neutral'. The first Integration Profile developed by IHE is known as Scheduled Workflow. It specifies how imaging departmental workflow can operate seamlessly between vendors. The Integration Profiles are maintained and published by IHE in the IHE Technical Framework. With the introduction of Cross-Enterprise Document Sharing (XDS) in 2005, IHE has extended the definition of 'Neutral' to include non-imaging content storage in healthcare. This course will specifically deliver and review the IHE Integration Profiles developed by IHE Radiology and the other IHE domain committees profile which can be used by healthcare professionals and the industry for the interoperability specification, procurement and installation of a 'Content' Vendor Neutral Archive (VNA).

RCA42

Creating, Storing, and Sharing Teaching Files Using RSNA's MIRC® (Hands-on)

Wednesday, Dec. 2 10:30AM - 12:00PM Location: S401AB

ED IN

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
Krishna Juluru, MD, New York, NY (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Learn how to install the RSNA MIRC teaching file. 2) Demonstrate the ability to add new studies and create teaching files. 3) Share teaching file cases with other MIRC servers and other users.

ABSTRACT

RCB42

The Electronic Physician Annotation Device (ePAD): An Introduction and Tutorial (Hands-on)

Wednesday, Dec. 2 10:30AM - 12:00PM Location: S401CD

IN

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 0

Participants
Daniel L. Rubin, MD, MS, Palo Alto, CA (*Presenter*) Nothing to Disclose
Debra Willrett, Stanford, CA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Evaluate current approaches to collecting image data results (semantic and quantitative image features), and identify gaps in current tools and methods. 2) Identify specific ways the ePAD tool meets current gaps in approaches to collecting semantic and quantitative image features. 3) Describe concrete use cases for ePAD and how its use will improve care thorugh capturing semantic and quantitative image features. 4) Reduce the barrier to adoption and encourage research synergies by demonstrating the use of ePAD in actual patient data and use cases.

ABSTRACT

As biomedical informatics efforts are undertaken to build the learning health system, there is a need to include the information provided by medical imaging in these efforts, since imaging provides detailed information about the disease phenotype for diagnosis and its response to treatment. However, at present, radiology images are not leveraged in many healthcare applications (other than viewing the raw images) because the disease phenotype information they contain is unstructured and not directly machine-accessible. We developed the electronic Physician Annotation Device (ePAD), a freely-available Web-based platform for capturing and storing the phenotypic information contained in radiological images (quantitative and semantic image features) in an explicit, standardized, and machine-accessible format that is interoperable with medical standards such as DICOM and HL7. The ePAD platform is extensible, permitting the community to extend its capabilities with respect to extracting and computing image features, as well as enabling developers to build applications that leverage the information in images in combination with other clinical data. ePAD is being used to at several institutions internationally as well as in national resources such as The Cancer Genome Atlas (TCGA) project of the NIH to enable a coordinated national collection of minable radiological image data. We anticipate the radiology community will find ePAD useful not only in research use cases, but in future clincial applications that optimally leverage the wealth of semantic and quantiative data in images.URL: http://epad.stanford.edu/

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Daniel L. Rubin, MD, MS - 2012 Honored Educator
Daniel L. Rubin, MD, MS - 2013 Honored Educator

RCC42

Ergonomics

Wednesday, Dec. 2 10:30AM - 12:00PM Location: S501ABC

IN

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants

LEARNING OBJECTIVES

1) The attendee will learn how the radiology reading room environment can physically affect the radiologist. 2) Learn about repetitive stress injuries and how they may affect radiologists and technologists. 3) Learn about how PACS workstations (including mice, keyboards, screens, etc.); room lighting, sounds and temperature; and room furniture may be optimized to help prevent repetitive stress injuries. 4) Learn how radiologic technologists can also be affected by repetitive stress injuries.

ABSTRACT

This presentation will review the features of a reading a study at a PACS, and the interactions of the radiologist with the various devices. This includes desktops/tables height, chairs, keyboard location, monitor position, mouse position (and cleanliness), microphone positioning, room temperature, sound volume, ambient light, and body positioning. Each of these components will be discussed, showing how to prevent future problems with repetitive stress disorders. The goal is to raise awareness of ergonomics for the radiologist.

Sub-Events

RCC42A Introduction to Ergonomics

Participants
William J. Weadock, MD, Ann Arbor, MI (*Presenter*) Owner, Weadock Software, LLC

LEARNING OBJECTIVES

View learning objectives under main course title.

RCC42B Lessons Learned from Our Reading Room of the Future Lab

Participants
Eliot L. Siegel, MD, Severna Park, MD (*Presenter*) Research Grant, General Electric Company; Speakers Bureau, Siemens AG; Board of Directors, Carestream Health, Inc; Research Grant, XYBIX Systems, Inc; Research Grant, Steelcase, Inc; Research Grant, Anthro Corp; Research Grant, RedRick Technologies Inc; Research Grant, Evolved Technologies Corporation; Research Grant, Barco nv; Research Grant, Intel Corporation; Research Grant, Dell Inc; Research Grant, Herman Miller, Inc; Research Grant, Virtual Radiology; Research Grant, Anatomical Travelogue, Inc; Medical Advisory Board, Fovia, Inc; Medical Advisory Board, Toshiba Corporation; Medical Advisory Board, McKesson Corporation; Medical Advisory Board, Carestream Health, Inc; Medical Advisory Board, Bayer AG; Research, TeraRecon, Inc ; Medical Advisory Board, Bracco Group; Researcher, Bracco Group; Medical Advisory Board, Merge Healthcare Incorporated; Medical Advisory Board, Microsoft Corporation; Researcher, Microsoft Corporation

LEARNING OBJECTIVES

View learning objectives under main course title.

RCC42C No Strain, No Pain: A Guide to Reducing Musculoskeletal Strain and Eye Fatigue Among Radiologists

Participants
Rebecca L. Seidel, MD, Atlanta, GA, (rseidel@emory.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

ABSTRACT

INS-WEA

Informatics Wednesday Poster Discussions

Wednesday, Dec. 2 12:15PM - 12:45PM Location: IN Community, Learning Center

IN

AMA PRA Category 1 Credit ™: .50

Participants
Satre Stuelke, MD, Danville, PA (*Moderator*) Nothing to Disclose

Sub-Events

IN239-SD-WEA1 Automated Detection of Carotid Artery Calcifications on Dental Panoramic Radiographs: Patient-specific Localization of Regions of Interest

Station #1

Participants
Chisako Muramatsu, PhD, Gifu, Japan (*Abstract Co-Author*) Nothing to Disclose
Akitoshi Katsumata, DDS, PhD, Mizuho, Japan (*Abstract Co-Author*) Nothing to Disclose
Tatsuro Hayashi, PhD, Tokyo, Japan (*Abstract Co-Author*) Nothing to Disclose
Takeshi Hara, PhD, Gifu, Japan (*Abstract Co-Author*) Nothing to Disclose
Hiroshi Fujita, PhD, Gifu City, Japan (*Presenter*) Nothing to Disclose

PURPOSE

Carotid artery calcifications (CACs) are one of the indices useful in predicting the risk of arteriosclerosis. It has been suggested that CACs may be detectable on dental panoramic radiographs (DPR) obtained for dental examination. However, with the general window level for dental examination, these calcifications can be easily missed on DPRs when their purpose does not lie on arteries. An automated detection of CACs can be useful for assisting dentists in recognizing them and suggesting patients for further examination. The drawback of our previous detection scheme was a large number of false positives (FPs). In this study, we investigated the effect of patient-specific localization of regions of interest (ROIs) based on patient positioning and vertebra for reduction of FPs.

METHOD AND MATERIALS

The cases used in this study consisted of 100 DPRs including 31 cases with a total of 100 CACs. Our automated detection scheme included the automated segmentation of mandibular contour, determination of ROIs using the segmented contour, initial detection of CAC candidates using the top-hat filter, determination of image features for each candidate, and reduction of FPs by the rule-based method and support vector machine. In this study, the gold standard patient-specific ROIs were determined manually based on the location and inclination of vertebra, if they appear in the image, and the patient positioning predicted by the shape of mandibular contour. Using the manual ROIs, probabilistic atlases of carotid artery ROIs were generated, which were used for the automatic localization of ROIs.

RESULTS

Using the manual ROIs, the number of FPs per image was reduced by 80%. The use of probabilistic atlases resulted in the reduction of FPs by 30%. The results indicate the effectiveness of patient-specific localization of ROIs, which could be accomplished by the prediction of patient positioning using the segmented mandibular contour and the accurate detection of vertebra.

CONCLUSION

Determination of patient-specific ROIs can be effective for reduction of FPs in the automatic detection of CACs, which could be useful for screening arteriosclerosis patients.

CLINICAL RELEVANCE/APPLICATION

Automated detection of carotid artery calcifications on dental panoramic radiographs can be useful for early detection of arteriosclerosis through dental examination with no extra cost.

IN240-SD-WEA2 Web-Based Interactive Generation of Structured Reports for Breast MRI Improves Conformity with the BI-RADS Atlas 5th Edition

Station #2

Participants
Patrick H. Do, MD, San Jose, CA (*Presenter*) Nothing to Disclose
Jennifer T. Leung, MD, Mountain View, CA (*Abstract Co-Author*) Nothing to Disclose
Mahesh R. Patel, MD, San Jose, CA (*Abstract Co-Author*) Nothing to Disclose

CONCLUSION

A web-based application improves conformity in reporting, radiologist efficiency, and resident knowledge of the BI-RADS lexicon. There was widespread acceptance of this application by surveyed radiologists.

Background

The consistency of breast MRI interpretation and reporting has improved with the BI-RADS lexicon. New revisions to the lexicon provide further clarification in image interpretation. To educate residents on the new BI-RADS lexicon and improve consistency and accuracy with breast lesions descriptors, we developed and evaluated a customized, web-based application for automated generation of reports using the new lexicon.

Evaluation

An interactive, web-based structured report generator tailored to breast MRI without requiring input of protected health information was created with the use of HTML, CSS, JavaScript, jQuery, and additional open source web development tools. The web application has an intuitive graphical interface and provides images illustrating the key findings described in the BI-RADS lexicon. After selection of morphology and kinetics terms for each breast lesion, an appropriate structured report is generated and can be easily pasted into the electronic reporting system.A retrospective review was conducted to compare 50 reports generated with and without use of the application (100 total reports). Conformity to the BI-RADS lexicon, report generation efficiency, and satisfaction with the program was evaluated with a survey.

Discussion

Conformity with the new BI-RADS lexicon was found in 70% of reports without implementation and 96% with implementation. Twelve residents and three attendings were surveyed. Thirteen out of 15 (87%) users indicated the application increased efficiency and decreased ambiguity of reports compared to the previously utilized macro-based scheme. Two out of 14 (13%) had no preference between the two schemes. Ten out of 12 surveyed residents reported improved knowledge of breast lesion morphology and enhancement terminology following program implementation.

IN241-SD-WEA3 Customizable Triple-Modality Compatible Solid Organ Phantoms Utilizing 3D Printing

Station #3

Participants
Ramin Javan, MD, Washington, DC (*Presenter*) Nothing to Disclose
Ardalan Tangestanipoor, MD, Washington, DC (*Abstract Co-Author*) Nothing to Disclose

CONCLUSION

A 3D printed model of the thyroid gland was designed and built to serve as a prototype for triple-modality compatible solid organ diagnostic and interventional phantoms.

Background

Diagnostic phantoms play a major role in radiologic research as well as calibration and quality control of imaging devices. Furthermore, interventional phantoms have the potential for becoming important teaching tools. Recent advances in 3D printing technologies will allow radiologists and physicists to develop customizable and highly detailed multi-purpose imaging phantoms.

Evaluation

As a sample prototype, a custom mold of the thyroid gland was graphically designed using Autodesk 3D Studio Max 9.0 and subsequently 3D printed via a commercially available service with polyamide material. The mold contains a coronal cut with the anterior half fitting onto the posterior half with struts, creating a tight seal. The anterior half contains a hole, which allows for the pouring of desired liquid material into the cavity of the mold. The interior aspect of the posterior half contains small rods of various heights with sharp tips, which allow for placement and insertion of masses and cysts. Small masses of high or low echogenicity were created by injecting dissolved sodium alginate with or without hydrogel particles into calcium chloride solution. The parenchyma can be made with gelatin or using polyvinyl alcohol cryogel, mixed with variable amounts of calcium chloride for hyperdensity on CT, psyllium for echotexture on ultrasound and nickel or copper for T1 and T2 characteristics on MRI.

Discussion

The thyroid gland was chosen due to its small and relatively simple structural anatomy. The concept may be applied to more complicated solid organs such as the liver, kidneys and prostate. Inside structures such as vasculature, biliary tract, or urinary collecting system can be incorporated into these phantoms, either by graphic design or by reconstruction of these phantoms from actual patients' cross-sectional imaging data. Pathologic conditions, such as tumors or even physiologic phenomena, such as fluid dynamics can be incorporated into the design of these phantoms.

IN243-SD-WEA4 In-depth Multicenter Workflow Analysis of Liver Tumor Ablations for the Development of a Novel Computer-aided Software Tool

Station #4

Participants
Jan Egger, Graz, Austria (*Presenter*) Nothing to Disclose
Philip Voglreiter, Graz, Austria (*Abstract Co-Author*) Nothing to Disclose
Mark Dokter, Graz, Austria (*Abstract Co-Author*) Nothing to Disclose
Michael Hofmann, Graz, Austria (*Abstract Co-Author*) Nothing to Disclose
Harald F. Busse, PhD, Leipzig, Germany (*Abstract Co-Author*) Nothing to Disclose
Daniel Seider, Leipzig, Germany (*Abstract Co-Author*) Nothing to Disclose
Philipp Brandmaier, MD, Leipzig, Germany (*Abstract Co-Author*) Nothing to Disclose
Riitta H. Rautio, MD, Turku, Finland (*Abstract Co-Author*) Nothing to Disclose
Gabriele Zettel, Graz, Austria (*Abstract Co-Author*) Nothing to Disclose
Bianca Schmerbock, Graz, Austria (*Abstract Co-Author*) Nothing to Disclose
Martinus J. van Amerongen, Nijmegen, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Sjoerd Jenniskens, MD, Nijmegen, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Marina Kolesnik, Sankt Augustin, Germany (*Abstract Co-Author*) Nothing to Disclose
Bernhard Kainz, MSc,BSC, Graz, Austria (*Abstract Co-Author*) Nothing to Disclose
Roberto Blanco Sequeiros, MD, Oulu, Finland (*Abstract Co-Author*) Nothing to Disclose
Horst R. Portugaller, MD, Graz, Austria (*Abstract Co-Author*) Nothing to Disclose
Philipp Stiegler, Graz, Austria (*Abstract Co-Author*) Nothing to Disclose
Jurgen J. Futterer, MD, PhD, Nijmegen, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Dieter Schmalstieg, Graz, Austria (*Abstract Co-Author*) Nothing to Disclose
Michael Moche, MD, Leipzig, Germany (*Abstract Co-Author*) Nothing to Disclose

CONCLUSION

Reliable computer-aided support of the complex procedure of liver RFAs by study multicenter workflows to lay the foundation for a

Reliable computer-aided support of the complex procedure of liver RFAs by study multicenter workflows to lay the foundation for a novel software tool.

Background

Radiofrequency ablation (RFA) is a percutaneous procedure for cancer treatment, which belongs to the minimally invasive and image-guided techniques. Cancer cells are heated up and destroyed by focusing energy in the RF spectrum through a needle. Thus, needle placement and the right amount of energy play the crucial roles for a therapeutic success. However, there is no standardized practice for needle guidance, which can depend on the equipment, or personal preferences (like 2D/3D Ultrasound (US) or CT-guidance). The aim was to assess the clinical feasibility of a common multicenter workflow of thermally induced liver lesions for the development of a novel computer-aided RFA software tool.

Evaluation

RFAs of primary liver tumors where observed at four different clinical centers around Europe and discussed between medical and technical partners. As primary imaging modalities, CT scanners from the major manufactures (GE, Philips, Siemens and Toshiba) have been used. For needle placement, several navigation techniques were applied: CT-guidance, 2D US guidance, CT-US fusion; although the final needle position was always confirmed by a CT scan. Thus, a heat simulation can be used to prepare patient-specific ablation protocols, especially for cases where other organs like the diaphragm are close by. In addition, a study among 269 patients showed that the safety margin around the ablated tumor is the only independent factor that influenced tumor recurrence. Thus, we developed a bivariate visualization and a levels-of-detail-based distance algorithm supporting radiologists in both: RFA planning and monitoring. The algorithm has been evaluated by 13 interventional radiologists within multiple tasks of an official approved Visual Saliency study, showing a significant improvement of 42% (3.8±0.8 vs 5.4±0.4).

Discussion

Needle placement and RF simulation are crucial factors for a complete and successful ablation of liver tumors, which can be assisted by a software tool that results from studying the interventions of several experts.

IN008-EC-WEA5 **Acetabular Fractures: 3D Printing as an Educational Tool**

Custom Application Computer Demonstration

Awards
Identified for RadioGraphics

Participants
Matthew Manganaro, BS, MD, Ann Arbor, MI (*Presenter*) Nothing to Disclose
Yoav Morag, MD, Ann Arbor, MI (*Abstract Co-Author*) Nothing to Disclose
William J. Weadock, MD, Ann Arbor, MI (*Abstract Co-Author*) Owner, Weadock Software, LLC
Corrie M. Yablon, MD, Ann Arbor, MI (*Abstract Co-Author*) Nothing to Disclose
Erica B. Stein, MD, Ann Arbor, MI (*Abstract Co-Author*) Nothing to Disclose
Kara D. Gaetke-Udager, MD, Ann Arbor, MI (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

1. Present the 2 column theory; the anterior and posterior columns serve as struts to transfer forces from the lower extremities through the hip and SI joints into the axial skeleton.2. Discuss Letournel and Judet's classification system for aetabular fractures; consisting of ten injury patterns of which five patterns represent the majority of fractures types.3. Discuss the different surgical approach to the different fracture patterns.4. Discuss the difficulty in identifying the fracture patterns as the classification system is not based on axial sections.5. Demonstrate various acetabular fracture types using 3D printed models as an educational tool to better understand the spatial configuration of common pelvic acetabular fractures, their relation to anatomic landmarks, and the biomechanics of the different injury patterns.

TABLE OF CONTENTS/OUTLINE

1. Two Column Theory-Anterior--External rotation injuries-Posterior--Internal rotation injuries2. Letournel and Judet's Classification System-10 types (90% are 5 common types)--Isolated posterior wall--Both column --Transverse--Transverse-posterior wall--T-type fractures3. 3D Models-Common acetabular fracture types with demarcation of the columns

IN124-ED-WEA6 **A New Methodology for Structuring Radiological Reports Using a Dedicated Software**

Station #6

Participants
Flavio Barbosa, PhD, Ribeirao Preto, Brazil (*Abstract Co-Author*) Nothing to Disclose
Agma Traina, PhD, Sao Carlos, Brazil (*Abstract Co-Author*) Nothing to Disclose
Valdair F. Muglia, MD, PhD, Ribeirao Preto, Brazil (*Presenter*) Nothing to Disclose

CONCLUSION

The proposed methodology allowed information to be structured. It was possible to extract lexicon units, followed by normalization and ontological conceptualization, resulting in 3 superstructures, while maintaining references to their respective categories and free text radiology reports.

FIGURE (OPTIONAL)

http://abstract.rsna.org/uploads/2015/15007342/15007342_q5nr.jpg

Background

The structured report for imaging exams provides precision in information retrieval and communication between physicians; however may limit specialist's descriptions of important findings not covered by pre-defined structures. A computational ontological structure derived from free texts designed by specialists may be a solution. Therefore, the goal of our study was to develop a methodology for structuring information in radiology reports covering specifications required our native language, including the terminology to be used.

Evaluation

We gathered 1701 radiological reports of MRI of the lumbosacral spine from three different institutions, 1 academic and 2 private. Techniques of text mining and ontological conceptualization of lexical units extracted were used to structure information. Ten radiologists, specialists in MRI of lumbosacral exams evaluated the textual superstructure and terminology extracted, using an electronic questionnaire.

Discussion

The established methodology consists of six steps: 1) collection of radiology reports of a specific MRI examination; 2) textual decomposition; 3) normalization of lexical units; 4) identification of textual superstructures; 5) conceptualization of candidate-terms; 6) evaluation of superstructures and extracted terminology by experts using an electronic questionnaire. Three different textual superstructures were identified, with terminological variation in the name of their textual categories. The amount of candidate-terms conceptualized was 4183, yielding 727 concepts in our native language. 13963 relations between candidate-terms and concepts and 789 relationships among concepts. When evaluating adequacy the terms, 40 % of the evaluators fully agree they were adequate and 60% partially agree. Regarding the amount of terms used by the evaluators in their respective institutions, 70% used 24-30 terms and 30% 16-23 terms.

IN009-EC-WEA7 Natural Language Understanding of Radiology Reports: Myth or Reality

custom application computer demonstration

Participants
Rick K. Taira, PhD, Los Angeles, CA (*Presenter*) Nothing to Disclose
Frank Meng, PhD, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose
Denise R. Aberle, MD, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose

CONCLUSION

We present a system that factors the NLP problem according to semantic constituents including surface words, word-level semantics, ontologic concepts, ontologic propositions, ontologic frames and discourse events. This semantic orientated framework which utilized a high degree of target concept knowledge can potentially realize a system that truly understands a radiologist's description of findings for a given patient procedure.

FIGURE (OPTIONAL)

Background

Natural language processing (NLP) systems applied to radiology reports can potentially be used to curate phenotype descriptions of targeted pathologies. When applied to a large corpus of documents, interesting statistical patterns related to a variety of imaging appearance features can be explored and correlated to patient outcomes. The challenges of creating a system that truly understands and models the information according to real-world expectations however, are formidable. Traditional approaches to text processing emphasize word forms, word sequences, and grammatical structure. We present a NLP framework based on a semantic hierarchical network that is inspired by insight from neuro-cognitive processing models.

Evaluation

The processing architecture was evaluated on understanding text mentions of tumoral masses. One-hundred thousand sentences extracted from a radiology research database containing references to a mass were retrieved to serve as a sampling pool for training and evaluation. The output representation for understanding was a semantic frame definition that modeled a mass with over 200 slot properties. An overall recall and precision of the task of filling in slot values for a given sentence was over 80% for both scores. Test sentences were sampled uniformly across sentences of varying character length.

Discussion

The framework opens up new hybrid top-down and bottom-up strategies for better resolving traditionally difficult NLP problems. The top semantic layers insure that the resulting NLP interpretations are ontologically sanctioned according to real world models. Furthermore, we hypothesize the framework provides improved abstraction of NLP sub-problems such that software organization and hence development coordination are facilitated.

IN010-EC-WEA8 QIBA DRO Evaluation Tool for Assesing Analysis Software Quantification and Identifying Error Source for the General Kinetic Model

custom application computer demonstration

Participants
Tianbao Zhang, Bremen, Germany (*Abstract Co-Author*) Nothing to Disclose
Longquan Chen, MSc, Bremen, Germany (*Abstract Co-Author*) Nothing to Disclose
Daniel P. Barboriak, MD, Durham, NC (*Abstract Co-Author*) Advisory Board, General Electric Company
Hendrik O. Laue, PhD, Bremen, Germany (*Presenter*) Nothing to Disclose

CONCLUSION

Our evaluation tool is able to compare DROs for GKM with the results from DCE-MRI analysis packages using graphical and statistical tools, thus appraise the quality and quantity of the introduced errors and identify the source of the errors.[1]
http://qibawiki.rsna.org/index.php?title=Synthetic_DCE-MRI_Data

FIGURE (OPTIONAL)

http://abstract.rsna.org/uploads/2015/15008305/15008305_i56w.jpg

Background

The general kinetic model (GKM) is frequently used to obtain quantitative measures from DCE-MRI. The implementation of algorithms can vary or contain errors. A way to validate the consistency is using digital reference objects (DROs) [1]. We developed the QIBA DRO evaluation tool (QDET) to assess analysis software quantification using graphical and statistical tools. Our own implementation

of the GKM was used to deliberately add errors and create deviating parameter maps. QDET reads in calculated parameter maps (Ktrans and Ve), and statistically and visually compares the results with the ground truth.

Evaluation

The errors added and their effects were: Blood and tissue T1: The error was positively correlated with blood T1 variation; while it was negative correlated with tissue T1 variation. Flip angle (FA): Fewer pixels were calculated with smaller FAs, while Ktrans was overestimated/Ve was underestimated for large FAs. Repetition time (TR): high TR results in fewer calculated pixels, underestimated Ktrans and overestimated Ve, while low TR results in overestimated Ktrans and underestimated Ve. Hematocrit (HCT): high HCT results in underestimated Ktrans and Ve, while both were overestimated with low HCT. Time unit (min vs. s): calculated Ktrans has constant ratio of 60 to the reference data.

Discussion

QDET allowed to identify linear dependency between calculated and reference data and therefore could provide correction factors. The modified model results allowed some conclusions, e.g. if Ktrans and Ve were both underestimated or overestimated, then the error might result from a too high or low hematocrit, respectively. Fewer pixels were calculated for small Ve and large Ktrans and showed larger errors. Small changes in the implementation can have big effects on the final result, most prominent are T1 variation, TR and time unit.

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Daniel P. Barboriak, MD - 2013 Honored Educator

RCA43

Correlating Imaging with Human Genomics (Hands-on)

Wednesday, Dec. 2 12:30PM - 2:00PM Location: S401AB

IN

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
Daniel L. Rubin, MD, MS, Palo Alto, CA (*Presenter*) Nothing to Disclose
Sandy Napel, PhD, Stanford, CA (*Presenter*) Medical Advisory Board, Fovia, Inc; Consultant, Carestream Health, Inc; Scientific Advisor, EchoPixel, Inc
Olivier Gevaert, PhD, Stanford, CA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand the methods for and the potential value of correlating radiological images with genomic data for research and clinical care. 2) Learn how to access genomic and imaging data from The Cancer Genome Atlas (TCGA) and The Cancer Imaging Archive (TCIA) databases, respectively. 3) Learn about methods and tools for annotating regions within images with semantic and computational features. 4) Learn about methods and tools for analyzing molecular data, generating molecular features and associating them with imaging features.

ABSTRACT

Radiogenomics is an emerging field that integrates medical images and genomic data for the purposes of improved clinical decision making and advancing discovery of critical disease processes. In cancer, both imaging and genomic data are becoming publicly available through The Cancer Imaging Archive (TCIA) and The Cancer Genome Atlas (TCGA) databases, respectively. The TCIA/TCGA provide examples of matched molecular and image data for five cancer types, namely breast, lung, brain, prostate and kidney. The data in TCGA includes various omics data such as gene expression, microRNA expression, DNA methylation and mutation data. The community is beginning to extract image features from the MRI, CT and/or PET images in TCIA, including tumor volume, shape, margin sharpness, voxel-value histogram statistics, image textures, and specialized features developed for particular acquisition modes. They are also annotating the images with semantic descriptors using controlled terminologies to record the visual characteristics of the diseases. The availability of these linked imaging-genomic data provides exciting new opportunities to recognize imaging phenotypes that emerge from molecular characteristics of disease and that can potentially serve as biomarkers of disease and its response to treatment. They also provide an opportunity to discover key molecular processes associated with distinct image features, within one cancer type and across different cancer types. This workshop will describe datasets and tools that enable research at the intersection of imaging and genomics, and that point to opportunities to develop future applications that leverage this knowledge for diagnostic decision support and treatment planning.

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Daniel L. Rubin, MD, MS - 2012 Honored Educator
Daniel L. Rubin, MD, MS - 2013 Honored Educator

RCB43

Creating Radiology eBooks for the iPad (Hands-on)

Wednesday, Dec. 2 12:30PM - 2:00PM Location: S401CD

ED IN

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
Henry J. Baskin JR, MD, Salt Lake Cty, UT (*Presenter*) Nothing to Disclose
Justin Cramer, MD, Salt Lake City, UT (*Presenter*) Nothing to Disclose
Justin La Plante, MD, Sayre, PA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Become familiar with Apple's free ebook authoring tool, iBooks Author. 2) Create a sample radiology ebook during the course. 3) Learn how to freely share your ebook with others.

RCC43

Clinical Applications of 3D Printing (Part II)

Wednesday, Dec. 2 12:30PM - 2:00PM Location: S501ABC

IN

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

FDA Discussions may include off-label uses.

Participants
Jane S. Matsumoto, MD, Rochester, MN (*Moderator*) Nothing to Disclose
Glenn E. Green, MD, Ann Arbor, MI (*Moderator*) Nothing to Disclose

Sub-Events

RCC43A 3D Printed Models for Interventional Cardiovascular Planning

Participants
Zhen Qian, PhD, Atlanta, GA (*Presenter*) Research Grant, TeraRecon, Inc

LEARNING OBJECTIVES

1) Learn the potential role of 3D printed models in the planning of transcatheter valve replacement. a. Will demonstrate how to produce patient-specific 3D printed models that are anatomically accurate and biomechanically comparable to human valves. b. Will give examples of in-vitro simulation using 3D printed models integrated with sensors and imaging techniques for the planning of transcatheter valve replacement.

RCC43B 3D Printing in Otolaryngology

Participants
Glenn E. Green, MD, Ann Arbor, MI (*Presenter*) Nothing to Disclose
Maryam Ghadimi Mahani, MD, Ann Arbor, MI (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Become familiar with role of imaging in 3D print in otolaryngology. 2) Become familiar with novel treatment of tracheobronchomalacia in children using 3D print technology.

ABSTRACT

RCC43C 3D Printing in Interventional Radiology and Vascular Surgery

Participants
Matthew D. Tam, FRCR, Westcliff on Sea, United Kingdom, (matthewtam2005@gmail.com) (*Presenter*) Nothing to Disclose

ABSTRACT

3D printing in medicine and radiology is an exciting and growing field. Vascular surgery and interventional radiology procedures can benefit from 3D printing. It can be incorporated into daily practice through procedure planning and procedure execution. It can potentially advance the field through aiding implant design and development.Learning objectives:1) Understand the potential roles of 3D printing in vascular surgery and interventional radiology2) Gain an overview of the production of solid and hollow luminal models3) See examples of use of 3D models in real cases in a vascular interventional service

RCC43D 3D Printing in Forensic Medicine

Participants
Jonathan M. Morris, MD, Rochester, MN (*Presenter*) Nothing to Disclose

RCC43E 3D Models in Orthopedic Reconstructive Surgery

Participants
Michael Yaszemski, MD, PhD, Rochester, MN, (yaszemski.michael@mayo.edu) (*Presenter*) Nothing to Disclose

RCC43F 3D Printing as an Educational Tool

Participants
Jane S. Matsumoto, MD, Rochester, MN (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Will demonstrate use of color coded segmentation tools for teacing important anatomic relationships for a range of medical learners. 2) Will provide examples of role of 3D anatomic models of complex disease in enhanicng comprehension of complex anatomy and aid in surgical education. 3) Will highight the value of 3D models in patient education and informed consent.

INS-WEB

Informatics Wednesday Poster Discussions

Wednesday, Dec. 2 12:45PM - 1:15PM Location: IN Community, Learning Center

IN

AMA PRA Category 1 Credit ™: .50

Participants
Satre Stuelke, MD, Danville, PA (*Moderator*) Nothing to Disclose

Sub-Events

IN244-SD-WEB2 Quantitative CT Imaging Analysis of Objective Tumor Response in Patients with Multiple Pulmonary Metastases: Beyond the RECIST

Station #2

Participants
Jeongin Yoo, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Semin Chong, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Yang Soo Kim, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose

CONCLUSION

Each metastatic lung nodule has a different growth pattern in the same patient. In the evaluation of multiple but countable metastatic pulmonary nodules, the 3D volume is helpful in objective therapeutic response than maximum 3D diameter, long axis diameter, short axis diameter or maximum area.

Background

The RECIST criteria is commonly used in evaluating the treatment response. In the RECIST criteria, only the sum of maximum diameter of at last five target lesions represents the entire tumor burden and smaller lesions do not affect the result. However, in cases of most metastatic pulmonary nodules, which are be too many to be counted and measured, the natural history of each nodule has not been known yet. We evaluated the 3D CT characteristics of multiple but countable metastatic pulmonary nodules using semi-automated 3D volumetry software and assess the differences in the natural history of each nodule.

Evaluation

We analyzed the 3D CT characteristics of lung nodules on two serial chest CT in 10 patients with 156 metastatic pulmonary nodules (range, 5 to 52 nodules), which had been reported to show no interval change. All CT data were evaluated by semi-automated volumetry software. Each of nodules was measured in maximum 3D diameter (cm), long axis diameter (cm), short axis diameter (cm), maximum area (cm2) and volume (cm3), and compared the difference of these measures between the two examinations (Δ). Δ maximum 3D diameter, Δ long axis diameter, Δ short axis diameter and Δ maximum area showed predominant progression patterns (53.8%, 60.3%, 54.5%, 62.2% and 43.6%, respectively) whereas Δ volume showed a predominant no change pattern (41.7%). Correlation coefficients (r) of the number of metastatic nodules and the differences between the two times were as follows: Δ maximum 3D diameter, 0.793; Δ long axis diameter, 0.781; Δ short axis diameter, 0.823; Δ maximum area, 0.909; Δ volume, 0.26.

Discussion

This study showed that the 'no interval change' in a randomly selection may not imply the true 'no change', especially in multiple pulmonary metastases because each nodule has a different growth pattern. We think that the 3D CT parameters of each nodule may play a role in the evaluation of objective therapeutic response.

IN245-SD-WEB3 Machine Learning of Multi-material Electronic Cleansing for Dual-energy CT Colonography

Station #3

Participants
Rie Tachibana, Boston, MA (*Presenter*) Nothing to Disclose
Janne J. Nappi, PhD, Boston, MA (*Abstract Co-Author*) Royalties, Hologic, Inc; Royalties, MEDIAN Technologies;
Nadja Kohlhase, Niederaula, Germany (*Abstract Co-Author*) Nothing to Disclose
Junko Ota, Suita, Japan (*Abstract Co-Author*) Nothing to Disclose
Se Hyung Kim, Seoul, Korea, Republic Of (*Abstract Co-Author*) Research Grant, Mallinckrodt plc; Research Grant, Samsung Electronics Co Ltd
Hiroyuki Yoshida, PhD, Boston, MA (*Abstract Co-Author*) Patent holder, Hologic, Inc; Patent holder, MEDIAN Technologies;
Toru Hironaka, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To develop and evaluate the accuracy of a novel machine-learning electronic cleansing (ML-EC) scheme for dual-energy CT colonography (DE-CTC).

METHOD AND MATERIALS

Thirty patients were prepared for a CTC examination with reduced bowel cleansing by 18 g of magnesium citrate and fecal tagging by 50 ml of orally ingested iodine. The DE-CT (SOMATOM Definition) scans were performed at 140 kVp and 80 kVp energies. Our novel ML-EC scheme performs a water-iodine material decomposition and reconstructs virtual monochromatic images at multiple energies, after which a machine learning method [random forest (RF) or k-nearest neighbors (k-NN)] analyzes image features to label five material types (lumen air, soft tissue, fecal tagging, and their two partial-volume boundaries) on the CTC images and performs EC by removing materials other than soft tissues from the original CTC image. For pilot evaluation, we compared the performance of the RF-based ML-EC scheme, a k-NN-based ML-EC scheme, and a single-energy EC (SE-EC) scheme based on 720 volumes of interest (VOIs) that represent the three types of EC artifacts (Type I: air-tagging boundary; Type II: three-material

layer; Type III: three-material mixture) in current EC schemes. The EC accuracy was evaluated by measuring the mean overlap ratio (OR) between the material labels generated by the above EC schemes and those of the reference standard using a leave-one-patient-out resampling.

RESULTS

In RF-based ML-EC, the mean±std of ORs for Type I, II, and III artifacts were 0.968±0.045, 0.948±0.052, and 0.964±0.028, respectively, which were higher than those of kNN-based ML-EC (0.956±0.048, [p<.01], 0.924±0.049 [p<.01]; and 0.946±0.029 [p<.01], respectively) and SE-EC (0.956±0.050 [p<.01], 0.917±0.053 [p<.01], and 0.949±0.030 [p<.01], respectively). Visual assessment confirmed that the RF-based ML-EC generated less EC artifacts than did kNN-based ML-EC and SE-EC.

CONCLUSION

Our RF-based ML-EC scheme significantly outperformed a kNN-based ML-EC scheme and a conventional SE-EC scheme in identifying and minimizing EC artifacts on DE-CTC images.

CLINICAL RELEVANCE/APPLICATION

RF-based ML-EC yields substantial reduction of EC artifacts, thus can be effectively used to visualize the entire colonic surface and colonic lesions submerged in fecal materials on CTC examinations.

IN222-SD-WEB4 Reconstruction of a Trauma-induced Defect in the Calvarium using 3D Printing: A Novel Multidisciplinary Approach

Station #4

Participants
Pardeep Athwal, MD, Farmington, CT (*Presenter*) Nothing to Disclose
Andrew J. Pakchoian, DDS, West Hartford, CT (*Abstract Co-Author*) Nothing to Disclose
Aditya Tadinada, BDS, Farmington, CT (*Abstract Co-Author*) Nothing to Disclose

CONCLUSION

In areas where the quality of the tissue is not a concern, a lower radiation dose 3D modality like CBCT would be adequate to reconstruct a 3D print model to fill the traumatic defect.

Background

Additive manufacturing (i.e., 3D printing) has a wide array of applications in the field of engineering and medicine. This technology has come a long way since its initial introduction and many novel applications are being explored in the field of healthcare, particularly with the cloning of organs and prosthetics.A dilemma that healthcare providers in the armed forces face is reconstructing post-traumatic injuries on personnel returning from the battlefield. One possible solution is to have pre-deployment tomographic scans, which would aid in the pre-surgical planning and replacement of missing structures. The objective of this study is to evaluate the quality of 3D printed models acquired from 2 different 3D imaging modalities to reconstruct a simulated trauma induced defect in the parietal bone.

Evaluation

Three-dimensional renderings of a human skull with an induced 'star' shaped defect in the parietal bone were acquired using a 64-slice MDCT and CBCT. The star shaped cutout was imaged on both CT modalities and the acquired data was exported in dicom-3 format. An image processing software for 3D design and modeling, was used to create the mesh and extrapolate the star-shaped portion. The file was then converted and imported in the MakerWare slicer software. A fused deposition modelling 3D printer was used to recreate a solid model of the two induced star shaped defects. Both models were measured using digital calipers and the quality of each was visually inspected. Additionally, by inserting both models back into the induced defect in the parietal bone, the quality of fit was evaluated.

Discussion

From our preliminary experiments, 3D prints from both the imaging modalities yielded similar quality 3D prints with the acquisition from the Cone Beam CT yielding a slightly higher quality print. However, by actually imaging the cut out defect itself the fit of the FDM 3D printed model was found to be looser which can be explained by subtracting the thickness of the tool used to induce the defect.

IN247-SD-WEB5 Agreement between PACS Workstation and Ipad in the Interpretation of Cranial CT and CTA in Stroke. Intra and Inter Observer Reliability

Station #5

Participants
Daniel Lourido Garcia, Madrid, Spain (*Abstract Co-Author*) Nothing to Disclose
Agustina Vicente Bartulos, MD, Madrid, Spain (*Abstract Co-Author*) Nothing to Disclose
Santiago Resano Pardo SR, Madrid, Spain (*Abstract Co-Author*) Nothing to Disclose
Inmaculada Mota Goitia, Madrid, Spain (*Abstract Co-Author*) Nothing to Disclose
Alfonso Muriel Garcia, Madrid, Spain (*Abstract Co-Author*) Nothing to Disclose
Isabel Bermudez-Coronel, MD, Madrid, Spain (*Presenter*) Nothing to Disclose

CONCLUSION

Tablets are valid stroke diagnosis tools, valuable in the detection of early signs of stroke using the ASPECTS scale as well as for the classification of patients amendable for in thrombolysis. Our results are irrespective of the radiologist's expertise.

Background

Tablets allow physicians to view radiology images with basic post-processing tools. In acute stroke, its particularly important to obtain an accurate, effective and efficient radiology diagnosis in the least possible time, as time modifies the criteria for action. Our aim is to assess the intra- and inter-observer agreement over the diagnosis of acute stroke by means of a cranial CT and CT

angiography, using two different devices, PACS workstations and a tablet device.

Evaluation

A prospective observational study in which 252 consecutive emergency patients were analyzed, with suspected acute stroke during the period between February 2013 and March 2014. All of them underwent cranial CT; 111 also cranial CTA. The studies were interpreted by a senior emergency radiologist, a junior radiologist and a senior neuroradiologistwho did two readings, one at a PACS workstation and another on a tablet. Each radiologist performed two blind and independent readings of each case, one using PACS and another on a tablet with an interval of time of at least one month between both readings. The ASPECTS (Alberta Stroke Program Early CT) scale was used for the radiology diagnosis.

Discussion

Correlation between tablet and PACS for the basal CTs and early ischemic sings ranged from 0.74 and 0.83, with substantial-nearly perfect agreement. This improved with the analysis of the CTA source images (0.75-0.90). Correlation in the assesment of candidates for iv fibrinolysis ranged from 0.78 to 0.85 for the cranial CTs and between 0.71 and 0.88 for the CTAs, substantial-nearly perfect agreement. In the analysis of the cerebral areas affected, the kappa index was also substantial-nearly perfect. We found differences (<1 min) in the reading timesfor the interpretation of the basilar CTs and the CTA images, irrelevant from a clinical perspective.Our series is the highest published to date.

RCA44

National Library of Medicine: PubMed Tools: Save Searches and Create Personalized Search Options (Hands-on)

Wednesday, Dec. 2 2:30PM - 4:00PM Location: S401AB

IN

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
Tina Griffin, Chicago, IL (*Presenter*) Nothing to Disclose
Holly Ann Burt, MLIS, Chicago, IL (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Personalize PubMed by saving search strategies and creating email alerts. 2) Use My NCBI filters to link to library full-text articles and to focus PubMed searches. 3) Save collections of citations including a personal bibliography.

ABSTRACT

In this hands-on workshop session, explore the free My NCBI tool in PubMed. Discover how to develop and save search strategies, create email alerts on your research topics, and build permanent online bibliographies. With your My NCBI account, add permanent library filters and evidence-based filters to PubMed, use My Bibliography to create an online list of personal publications, limit searches to high impact journals, and utilize the link between the NIH Manuscript Submission System and PubMed. The National Library of Medicine (NLM) provides free web access to nearly 25 million citations for biomedical and clinical medical articles through PubMed.gov; MEDLINE is a subset of PubMed.

Handout:Holly Ann Burt

http://abstract.rsna.org/uploads/2015/15004107/2015myncbiRSNA.pdf

RCC44

Monitoring Radiation Exposure: Standards, Tools and IHE REM

Wednesday, Dec. 2 2:30PM - 4:00PM Location: S501ABC

IN SQ

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
Kevin O'Donnell, Vernon Hills, IL (*Moderator*) Employee, Toshiba Corporation;
Kevin O'Donnell, Vernon Hills, IL (*Presenter*) Employee, Toshiba Corporation;
Michael F. McNitt-Gray, PhD, Los Angeles, CA (*Presenter*) Institutional research agreement, Siemens AG; Research support, Siemens AG; ; ; ; ;
William W. Boonn, MD, Penn Valley, PA, (wboonn@gmail.com) (*Presenter*) Founder, Montage Healthcare Solutions, Inc; President, Montage Healthcare Solutions, Inc; Shareholder, Montage Healthcare Solutions, Inc; Shareholder, Nuance Communications, Inc; Shareholder, Merge Healthcare Incorporated

LEARNING OBJECTIVES

1) Learn about key radiation exposure metrics, such as CTDI, and how to interpret them. 2) Learn about radiation exposure monitoring methods and tools including 2a) Capturing dose information with the DICOM Radiation Dose SR (RDSR) standard. 2b) Managing RDSR objects with the IHE Radiation Exposure Monitoring (REM) Profile. 2c) Integrating 'CT dose screens' from legacy systems into RDSR. 2d) Pre-scan dose pop-ups on the CT console defined by the MITA Dose Check standard and AAPM guidance on their use. 3) Learn how to specify the above features when purchasing and integrating Radiology Systems. 9) Learn about components of a dose management program such as protocol optimization. 4) Participation in the ACR Dose Registry, and reporting requirements such as California SB-1237.

Active Handout:Michael F. McNitt-Gray

http://abstract.rsna.org/uploads/2015/11034700/RCC44 RSNA2015_RCC44_Monitoring_Radiation_Dose_mmg_handout.pdf

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

William W. Boonn, MD - 2012 Honored Educator

SSM13

Informatics (Clinical Workflow, Displays and Mobile Devices)

Wednesday, Dec. 2 3:00PM - 4:00PM Location: S403A

IN

AMA PRA Category 1 Credit ™: 1.00
ARRT Category A+ Credit: 1.00

Participants
Vamsi R. Narra, MD, FRCR, Saint Louis, MO (*Moderator*) Consultant, Biomedical Systems;
Rasu B. Shrestha, MD, MBA, Pittsburgh, PA (*Moderator*) Advisory Board, General Electric Company; Medical Advisory Board, Nuance Communications, Inc; Editorial Advisory Board, Anderson Publishing, Ltd; Advisory Board, KLAS Enterprises LLC; Advisory Board, Peer60; Board, Omnyx, LLC; Board, Health Fidelity, Inc

Sub-Events

SSM13-01 Novel Use of Redmine Issue Tracking Software as a Radiology Workflow Management Tool

Wednesday, Dec. 2 3:00PM - 3:10PM Location: S403A

Participants
Nathaniel Swinburne, MD, New York, NY (*Presenter*) Nothing to Disclose
Bradley N. Delman, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Luke C. Gerke, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose

Background

While the most basic radiology workflow entails a single viewing of a study by a radiologist and the rendering of a report, often a more complex process is required. A finding may need to be followed up or reviewed with a colleague; an improperly acquired study may necessitate a conversation with the technologist and patient recall for further imaging; a radiology resident may need to be alerted about a missed finding. We noted that these workflows are similar to those encountered in other industries and that a number of generic software packages exist to facilitate such tasks. We hypothesized that Redmine (http://redmine.org), a widely used free, open-source issue tracking application primarily used for software development, could be successfully adapted to handle these workflows within a large academic radiology department.

Evaluation

In 2014, we installed Redmine on a server running behind the department's firewall, ensuring data security and HIPAA compliance. Small modifications to the Redmine source code and PACS configuration files enable bidirectional communication between PACS and Redmine. The radiologist runs the browser-based client alongside PACS and creates an 'issue' in Redmine for a given study. With the installation of one of many existing Redmine plugins, key images may be attached from PACS. A user may be assigned to the issue, indicating responsibility for seeing it to completion. Multiple users may be added as 'watchers', receiving auto-generated emails when the record is updated (e.g., with pathology results or surgical findings). Existing records are viewed in a searchable database, allowing users to manage due dates and priorities and mark issues as resolved.

Discussion

Since launching, over 800 studies have been followed within our department using Redmine, enabling a broad range of issues to be tracked to completion. The application functions as an efficient, crowd-sourced teaching file and quality assurance system.

Conclusion

Workflows encountered in radiology are similar to those found in other industries. Our adaptation of Redmine demonstrates that tools designed for these other industries may be easily adapted for a clinical radiology practice.

SSM13-02 Hooking based Gesture-controlled Interface for Operating Rooms and Reading Rooms without Modification of Source Codes

Wednesday, Dec. 2 3:10PM - 3:20PM Location: S403A

Participants
Ben J. Park, BS, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Taekjin Jang, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Namkug Kim, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Stockholder, Coreline Soft, Inc
Sang Min Lee, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Sang Young Oh, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Jong-Woo Choi, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

Background

Recent technological advances in gesture based user interface have brought in numerous innovative ideas in viewing medical images. However, despite new attempts constantly being made to replace keyboards and mice, it is hard to find applications used in clinical practice. Physicians required interfaces that maintain aseptic conditions and seamlessly control medical images. Therefore, we developed and applied a message hooking program that maps a gesture to specific functions without any modification of the source codes of frequently used programs.

Evaluation

The program was set up in two different settings with a Leap Motion™ device for gesture detection. First, we installed this hooking program in the operating room. The aim was to accurately and safely browse images of a rhinoplasty and genioplasty patient from three different programs: CT images from a PACS viewer, volume rendered images from a 3D PACS viewer and patient photos from a basic image viewer. All three programs were seamlessly controlled by gestures and motions solely by the physician.Second, the

program was set up in the reading room to measure the performance compared to traditional input devices. Since contactless interfaces were not required in reading rooms, our goal was to use this program as a secondary device that provide several dominant features. We scanned through 96 images of a dynamic biliary CT study by gestures and compared the results with those of a mouse. Gesture based inputs significantly shortened time required to scan through images, 13.99±1.06 to 8.57±0.65sec($p<0.001$).

Discussion

The most important feature of the program was providing a contactless interface to control medical images from multiple programs without modification of source codes The program can be used solely with the sensor device or together with other input devices. Either way the program provided unparalleled user experience and increased performance in clinical setting.

Conclusion

We developed a message hooking program that detect gestures to control programs and applied it to operating and reading rooms. This program provided surgeons a new way to safely browse images during surgery and increased reading performances for radiologists.

SSM13-03 Does Color Visualization Affect Medical Image Interpretation? Sizing a Clinical Study Using Laboratory Pilot Reader Data

Wednesday, Dec. 2 3:20PM - 3:30PM Location: S403A

Participants
Silvina Zabala Travers, MD, Silver Spring, MD (*Presenter*) Researcher, Barco nv
Brandon D. Gallas, PhD, Rockville, MD (*Abstract Co-Author*) Nothing to Disclose
Wei-Chung Chen, PHD, Silver Spring, MD (*Abstract Co-Author*) Nothing to Disclose
Tom Kimpe, Kortrijk, Belgium (*Abstract Co-Author*) Employee, Barco nv
Aldo Badano, PhD, Silver Spring, MD (*Abstract Co-Author*) Research Grant, Barco nv

PURPOSE

The gap between laboratory and clinical studies is a known issue in imaging research. We describe a laboratory study aimed at determining if the choice of color scale and display device hardware affects the visual assessment of functional medical images. In addition, we present methodology for sizing a follow-up clinical study to confirm laboratory findings.

METHOD AND MATERIALS

The experiments used perfusion magnetic resonance imaging (MRI) as the basis for designing and performing the study. Synthetic images resembling dynamic, contrast-enhanced MRI of the brain were used to assess the performance of a rainbow (jet), a heated black-body (hot), and a gray (gray) scale with various display devices on the detection of small changes in intensity. We used a two-alternative, forced-choice design with 17 readers and 600 image pairs on four display devices: a medical-grade three-million-pixel display, a consumer-grade monitor, a tablet device and a phone. We used a custom-made software package (iMRMC) to calculate the percent of correct answers and uncertainties accounting for reader and case variability. We used the software to estimate the number of readers and cases necessary for achieving acceptable levels of statistical power in a follow-up clinical study.

RESULTS

The estimates of percent correct show that jet outperformed hot and gray in the high and low range of the color scales for all devices with a maximum difference in performance of 18% (CI: 6%, 30%). Performance with hot was differently for high and low intensity, comparable with respect to jet for the high range, and worse than gray for lower intensity values. Similar performance was seen between devices using jet and hot while gray performance was better for handheld devices. Time of performance was shorter with jet. The iMRMC sizing estimates indicate that a smaller set of images with fewer readers could provide similar statistical power.

CONCLUSION

Our findings demonstrate that the choice of color scale and display hardware affects the visual comparative analysis of color images.

CLINICAL RELEVANCE/APPLICATION

Color visualization is gaining popularity among imaging techniques. However, little evidence has surfaced on the effect of color on the interpretation of images. Our study suggests that color visualization might affect clinical interpretation and proposes a method to bridge the gap between laboratory and clinical studies to corroborate findings.

SSM13-04 The First High-resolution Mobile Virtual-reality Devices Are Here, Could They Become the Next Step in Mobile Diagnostic Imaging and Enable a New Dimension in Radiology?

Wednesday, Dec. 2 3:30PM - 3:40PM Location: S403A

Participants
Vasileios Moustakas, MD, Athens, Greece (*Presenter*) Nothing to Disclose
Demosthenes D. Cokkinos, MD, Athens, Greece (*Abstract Co-Author*) Nothing to Disclose
Sofia Tsolaki, Athens, Greece (*Abstract Co-Author*) Nothing to Disclose
Theodoros Kolios, MD, Athens, Greece (*Abstract Co-Author*) Nothing to Disclose
Maria G. Skilakaki, MD, Athens, Greece (*Abstract Co-Author*) Nothing to Disclose
Ploutarhos A Piperopoulos, MD, PhD, Athens, Greece (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The primary purpose of our research was to obtain one of the first high-resolution mobile virtual-reality (VR) prototypes and see if we could enable VR visualization of dicom images, without compromising stability or image quality, so that this mobile system could then be used for diagnostic imaging. Our secondary purpose was to verify that remote diagnosis of complete CT examinations performed elsewhere, using our mobile VR system, was feasible.

METHOD AND MATERIALS

The mobile VR system weighs only 0.3 kg, it is powered by a high-tech smartphone, with an ultra-high density 550ppi display. Using the system is like being in front of a 175 inch mega screen, while enabling visualization at 360 degrees.Once the dicom images are downloaded to the system via 4G/LTE, the user wears the device and can scroll through the images, viewing up to 56 at any time, while being on the move.Even if our VR system can visualize any dicom image, we chose to test the device using CT images, because it's a modality vastly used by emergency departments and requires the visualization of multiple images, taking advantage of the virtual 175 inch display.Once the VR system was ready, 271 exams were reviewed by a Consultant Radiologist in the hospital. The CT exams were reviewed remotely using VR by another Consultant Radiologist in another area, with no contact to the first examining doctor. The two doctors' independent double blinded reports were compared using standardized reporting systems to assess imaging quality of the VR system in comparison to the hospital's workstation.

RESULTS

In 1318/1355 (97.27%) results complete interobserver agreement was observed. The few 37/1355 (2.73%) contradicting results were limited to evaluations which also often present discrepancies between different examiners on the same monitor.

CONCLUSION

In most of the evaluated parameters, good interobserver agreement showed that the use of our VR system did not affect image quality and therefore did not alter the diagnosis. This technique can be used for remote diagnosis, avoiding the limitations of the relatively small displays of normal mobile devices. Therefore, remote diagnosis of complete CT examinations performed elsewhere using a mobile VR setting is feasible and useful.

CLINICAL RELEVANCE/APPLICATION

Remote diagnosis of CT examinations from a mobile VR device, that provides the equivalent of standing in front of a 175 inch display with a 360 degree view.

SSM13-06 Image Sharing Using Ubiquitous Patient Storage Services as an Alternative to Image Enabled PHR's

Wednesday, Dec. 2 3:50PM - 4:00PM Location: S403A

Participants
Eliot L. Siegel, MD, Severna Park, MD (*Abstract Co-Author*) Research Grant, General Electric Company; Speakers Bureau, Siemens AG; Board of Directors, Carestream Health, Inc; Research Grant, XYBIX Systems, Inc; Research Grant, Steelcase, Inc; Research Grant, Anthro Corp; Research Grant, RedRick Technologies Inc; Research Grant, Evolved Technologies Corporation; Research Grant, Barco nv; Research Grant, Intel Corporation; Research Grant, Dell Inc; Research Grant, Herman Miller, Inc; Research Grant, Virtual Radiology; Research Grant, Anatomical Travelogue, Inc; Medical Advisory Board, Fovia, Inc; Medical Advisory Board, Toshiba Corporation; Medical Advisory Board, McKesson Corporation; Medical Advisory Board, Carestream Health, Inc; Medical Advisory Board, Bayer AG; Research, TeraRecon, Inc ; Medical Advisory Board, Bracco Group; Researcher, Bracco Group; Medical Advisory Board, Merge Healthcare Incorporated; Medical Advisory Board, Microsoft Corporation; Researcher, Microsoft Corporation
Mohamed Shoura, PhD, Newton, MA (*Abstract Co-Author*) Employee, Paxeramed Corp
Mohammed I. Quraishi, MD, Louisville, KY (*Presenter*) Nothing to Disclose

Background

Our initial experience with the RSNA's Image Sharing initiative has been positive with patients reporting a high level of satisfaction with ready access to their own images and reports in the cloud after selecting a commercial image enabled personal health record. However this has required a workflow in which patients who almost never already have an image enabled PHR are required to sign up for one of these PHR providers, create a password, and learn how to interact with the specific PHR system portal. Patients are or will eventually be required to sign up for a paid service for storage and access to these sites. The purpose of our pilot study is to investigate an alternative approach in which a patient's existing cloud storage service can be utilized to store patient images.

Evaluation

A pilot study was performed utilizing a commercial PACS with interfaces to ubiquitously utilized storage available from providers such as Google Drive®, One drive®, DropBox® and others that offer both free and paid storage options to users. Alternatively, users are given the option not to utilize the cloud but to have images "pushed" to the local storage in their smart phones. Images from these various patient directed storage options can be viewed on a single viewer which has interfaces to the commercial email and storage providers. Survey data will be collected to determine the relative efficacy of this alternative standards based approach with regard to patient satisfaction. Relative patient preference for local (smartphone) or cloud storage will also be assessed.

Discussion

Initial experience with the pilot study has been that the approach has the advantages of the current RSNA image sharing approach including elimination of CD's, ready access of images and reports to patients and clinicians without the relative challenges and costs associated with an image enabled PHR provider.

Conclusion

Initial experience with a system that empowers patients to utilize their own existing storage providers for archival and review of images including opting out of cloud storage to store images on their smart phones has been encouraging. Survey results from patients and providers are expected to provide additional insights.

RCC45

Practical Informatics for the Practicing Radiologist: Part One (In conjunction with the Society for Imaging Informatics in Medicine)

Wednesday, Dec. 2 4:30PM - 6:00PM Location: S501ABC

IN

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants

LEARNING OBJECTIVES

1) Define and describe the fundamental components of imaging informatics in a very practical and easy-to-understand way. 2) Understand methods to minimize distraction and reporting time when using speech recognition and structured reporting. 3) Understand the history and basic principles of business analytics.

Sub-Events

RCC45A A Patient's Journey through Imaging Informatics

Participants
Marc D. Kohli, MD, San Francisco, CA (*Presenter*) Research Grant, Siemens AG

LEARNING OBJECTIVES

1) Describe the three major systems used in radiology departments and their function. 2) Provide details regarding the HL7 and DICOM standards including how they are important in radiology workflow. 3) Describe the function of an interface engine in a modern healthcare system.

ABSTRACT

Understanding how the basic systems in a radiology department interact to provide complete workflow is and important building-block for radiologists interested in informatics. This presentation will outline the RIS, PACS, and Voice recognition systems and illustrate how they interact as we follow a patient through the radiology department.

RCC45B Challenges in Enterprise Imaging

Participants
Alex Towbin, MD, Cincinnati, OH, (alexander.towbin@cchmc.org) (*Presenter*) Author, Reed Elsevier; Consultant, Reed Elsevier; Shareholder, Merge Healthcare Incorporated; Consultant, Guerbet SA; Grant, Guerbet SA

LEARNING OBJECTIVES

1) Describe the concept of an enterprise imaging archive. 2) Describe the differences between DICOM-based imaging and non-DICOM-based imaging. 3) Identify the unique challenges associated with incorporating non-DICOM images into an enterprise imaging archive.

ABSTRACT

Over the past 20 years, the field of radiology has built an impressive digital infrastructure, automating many portions of the imaging process from the time of order entry through image distribution. With the advent of small, low-cost, high quality digital cameras, other medical specialties have turned to imaging to visualize and document disorders yet, they have not implemented the same type of digital infrastructure as radiology. Today, thousands of medical images are obtained in hospitals each day. With the increasing reliance on imaging, there is a greater need to build systems and processes to obtain, store, and distribute these images across the enterprise so that health care providers can better care for their patients. Even though many of these problems have been solved in radiology, the solutions are not easily transferred to other specialties due to the differences in imaging hardware and the image acquisition workflow. The purpose of this talk is to describe the problems facing hospitals as they begin to build enterprise imaging archives and to discuss potential solutions to these problems.

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Alex Towbin, MD - 2014 Honored Educator

RCC45C Breaching the Moat: Current Concepts in IT Security

Participants
James Whitfill, MD, Scottsdale, AZ (*Presenter*) President, Lumetis, LLC; Co-author, Hitachi, Ltd

LEARNING OBJECTIVES

1) Understand how the changing nature of security threats requires a new approach to security within the healthcare enterprise. 2) Understand how changes from HIPAA and HITECH affect managing breaches and leaks of PHI.

ABSTRACT

The role of security continues to be elevated as more organizations find themselves victims of hacking and breaches. Banks, retail organizations, insurers and even Children's Hospitals have all been victims of security breeches. While efficient workflow for healthcare providers remains a key focus of imaging informatics, the growing threats from international hacking require greater and greater focus by IT and Healthcare organizations. In response to these developments, an increasing regulatory burden exists to report and mitigate against such breeches. Managing both of these challenges will take increasing amounts of resources in the near future.

RC653

Managing Radiology IT in the EHR World

Thursday, Dec. 3 8:30AM - 10:00AM Location: S502AB

IN LM

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
J. R. Geis, MD, Fort Collins, CO (*Moderator*) Advisor, Nuance Communications, Inc; Investor, Montage Healthcare Solutions; Vice Chair, ACR IT Informatics Commission

LEARNING OBJECTIVES

1) Identify EHR components relevant to radiology. 2) Understand how to assess and use those components to your advantage. 3) Discover potential and pitfalls of EHRs.

ABSTRACT

Sub-Events

RC653A EHR/RIS Optimization of Imaging Workflow for the Enterprise

Participants
Peter B. Sachs, MD, Aurora, CO (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Review the typical radiology department work flow in an EMR environment. 2) Identify the key work flow items that may require optimization. 3) Identify the key components necessary to carry out optimization. 4) Review examples of optimaztions carried out at the author's institution. 5) Discuss the impact these optimizations have had on radiology workflow/efficiency and patient care.

ABSTRACT

The development and deployment of electronic medical records has resulted in a significant impact on radiology work flow both postive and negaitve. Moving from paper driven to an electronic processes requires a highly functional, multi-disciplinary team to address break-fixes as well as optimizations. This presentation will review the optimal structure of the team and then discuss the requisite skill sets of the team members to insure gettting the most out of the EHR to drive high quality, efficient, patient-centered work flow in the radiology departmen.

RC653B RIS-EMR Driven Workflow for Diagnostic Radiologists - You Might Actually Want This

Participants
Cree M. Gaskin, MD, Keswick, VA (*Presenter*) Author with royalties, Oxford University Press; Author with royalties, Thieme Medical Publishers, Inc; ;

LEARNING OBJECTIVES

1) Present EHR driven workflow for the diagnostic radiologist at the speaker's institution. 2) Discuss radiologist engagement in EHR implementation for radiology-centric optimization. 3) Discuss impacts of EHR driven workflow on diagnostic radiologists' efficiency and quality of care delivery as well as user satisfaction.

ABSTRACT

Electronic Health Records (EHRs) are touted to improve the quality and efficiency of clinical care. As a result, EHR-meaningful use legislation has been passed in the U.S. to financially incentivize adoption of this technology. Still, some radiologists remain skeptical that the benefits of EHRs are applicable to their practice and some fear that the technology could even unnecessarily complicate their workflow.One newer model for integrating EHRs into radiologists' practice is to use an EHR to drive diagnostic radiologist workflow, rather than the more traditional or widespread models of PACS driven or third-party RIS driven workflow. This newer model provides opportunity to leverage EHR technology and data for the benefit of radiology-related care delivery. This presentation shares a radiologist-centric viewpoint from one institution which has successfully adopted EHR-driven workflow for diagnostic radiologists. Though the process of implementation is touched upon, the presentation focuses on the resultant clinical workflow and the impacts on quality, efficiency, and radiologist satisfaction.

RC653C PACS and Radiologist Workflow in a Multi-Enterprise Environment

Participants
Gary J. Wendt, MD, MBA, Middleton, WI (*Presenter*) Medical Advisory Board, McKesson Corporation; Medical Advisory Board, HealthMyne; Owner, WITS(MD), LLC; ;

LEARNING OBJECTIVES

1) Understand workflow challenges for a radiologist operating a multi-enterprise environment. 2) Understanding requirements for environments with a single versus multiple medical record numbers a. PACS b. Dictation systems c. EHR. 3) Using a master patient index to link patient's across sites.

ABSTRACT

As a radiology department expands across multiple organizations there are several challenges that are created. Among these is the capability of the PACS, dictation systems and electronic medical record to operate in a single versus a multiple medical record

number environment. These challenges are complicated further if there is no master patient index to link patient's across the multiple sites. All of these need to be taken into consideration prior to attempting to deploy a single workflow solution in multiple environments. Some possibilities that are discussed include using systems that function in a multiple medical record number environment, making changes to the demographic information in an interface engine or simply guaranteeing that each site uses unique identifiers. The benefits of having a single workflow solution across multiple environments is significant and helps to justify the cost of implementing in maintaining this type of environment.

RC654

Decision Support for Radiologists at the Time of Reporting

Thursday, Dec. 3 8:30AM - 10:00AM Location: S103CD

IN SQ

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
Charles E. Kahn JR, MD, MS, Philadelphia, PA, (charles.kahn@uphs.upenn.edu) (*Moderator*) Nothing to Disclose

Sub-Events

RC654A Structured Reporting

Participants
Charles E. Kahn JR, MD, MS, Philadelphia, PA, (charles.kahn@uphs.upenn.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Describe the RSNA's initiative to create a repository of radiology report templates. 2) Explore new information standards for representing and exchanging report templates. 3) Discuss how report templates can increase compliance with practice guidelines. 4) Describe new opportunities to incorporate decision support into radiology reporting.

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Charles E. Kahn JR, MD, MS - 2012 Honored Educator

RC654B Improving the Quality of Follow-up Recommendations

Participants
Tarik K. Alkasab, MD, PhD, Boston, MA, (talkasab@mgh.harvard.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Describe how informatics tools such as computer-assisted reporting/decision support can lead to more consistent radiologist recommendations for follow-up. 2) Describe how informatics tools will permit creation of 'structured recommendations'. 3) Discuss how these 'structured recommendations' can be used by downstream informations systems.

RC654C Enabling Evidence-based Recommendations in Radiology Reports

Participants
V. Anik Sahni, MD, Boston, MA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Describe the importance of evidence-based recommendations in radiology reports. 2) Explore the IT solutions available to integrate evidence-based recommendations into radiology reports. 3) Discuss tools available to monitor consistency and compliance of recommendations.

RCA51

3D Printing (Hands-on)

Thursday, Dec. 3 8:30AM - 10:00AM Location: S401AB

IN

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants

Frank J. Rybicki III, MD, PhD, Ottawa, ON (*Moderator*) Research Grant, Toshiba Corporation;
Frank J. Rybicki III, MD, PhD, Ottawa, ON (*Presenter*) Research Grant, Toshiba Corporation;
Jane S. Matsumoto, MD, Rochester, MN (*Presenter*) Nothing to Disclose
Jonathan M. Morris, MD, Rochester, MN (*Presenter*) Nothing to Disclose
Dimitris Mitsouras, PhD, Boston, MA (*Presenter*) Research Grant, Toshiba Corporation; Speakers Bureau, Toshiba Corporation
Andreas Giannopoulos, MD, Boston, MA, (agiannopoulos1@partners.org) (*Presenter*) Nothing to Disclose
Nicole Wake, MS, New York, NY (*Presenter*) Nothing to Disclose
Peter C. Liacouras, PhD, Bethesda, MD (*Presenter*) Nothing to Disclose
Thomas A. Foley, MD, Rochester, MN (*Presenter*) Nothing to Disclose
Kiaran P. McGee, PhD, Rochester, MN (*Presenter*) Nothing to Disclose
Michael W. Itagaki, MD, MBA, Seattle, WA (*Presenter*) Owner, Embodi3D, LLC
Shannon N. Zingula, MD, Rochester, MN (*Presenter*) Nothing to Disclose
Leonid Chepelev, MD,PhD, Ottawa, ON (*Presenter*) Nothing to Disclose
Adnan M. Sheikh, MD, Ottawa, ON (*Presenter*) Nothing to Disclose
AiLi Wang, Ottawa, ON (*Presenter*) Nothing to Disclose
Wilfred Dang, BS, Ottawa, ON (*Presenter*) Nothing to Disclose
Ekin P. Akyuz, BSc, Ottawa, ON (*Presenter*) Nothing to Disclose
Taryn Hodgdon, MD, Ottawa, ON (*Presenter*) Nothing to Disclose
Carlos H. Torres, MD, Ottawa, ON (*Presenter*) Nothing to Disclose
Anji Tang, Boston, MA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Learn the Standard Tessellation Language (STL) file format that is used in 3D priting. 2) Be exposed to a software package to enable segmentation of DICOM images using semi-automated and manual segmentation algorithms, allowing the user to demarcate desired parts. The most commonly used tools are thresholding, region growing, and manual sculpting. 3) Learn refinement of an output STL output so that it can be optimized for accurate printing of the desired anatomy and pathology. This step uses Computer Aided Design (CAD) software is used to perform steps such as "wrapping" and "smoothing" to make the model more homogeneous.

ABSTRACT

"3D printing" refers to fabrication of a tangible object from a digital file by a 3D printer. Materials are deposited layer-by-layer and then fused to form the final object. There are several 3D printing technologies that share similarities but differ in speed, cost, and resolution of the product. Digital Imaging and Communications in Medicine (DICOM) image files cannot be used directly for 3D printing; further steps are necessary to make them readable by 3D printers. The purpose of this hands-on course is to convert a set of DICOM files into a 3D printed model through a series of simple steps. Some of the initial post-processing steps may be familiar to the radiologist, as they share common features with 3D visualization tools that are used for image post-processing tasks such as 3D volume rendering. However, some are relatively or completely new to radiologists, including the manipulation of files in Standard Tessellation Language (STL). It is the STL format that is read by the 3D printer and used to output the hand held part of the patient's anatomy. This 90 minute session will begin with a DICOM file and will proceed through the steps to create a printable STL file. An extensive training manual will be provided before the meeting. It is highly recommended that participants review the training manual to optimize the experience at the workstation.

URL

Active Handout:Frank John Rybicki

http://abstract.rsna.org/uploads/2015/14003458/Active RCA13.pdf

RCC51

Quantitative Imaging and Informatics (In Association with the Society for Imaging Informatics in Medicine)

Thursday, Dec. 3 8:30AM - 10:00AM Location: S501ABC

IN BQ

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
Adam E. Flanders, MD, Penn Valley, PA, (adam.flanders@jefferson.edu) (*Moderator*) Nothing to Disclose
Luciano M. Prevedello, MD,MPH, Columbus, OH (*Moderator*) Nothing to Disclose

LEARNING OBJECTIVES

1) Develop an understanding of what quantitative imaging is and how it may revolutionize the way we practice diagnostic radiology today. 2) Learn the research advances and the current clinical applications of this technology. 3) Appreciate the current challenges involved in using these tools clinically and understand the steps required for a successful clinical implementation.

ABSTRACT

Medicine has undergone a gradual evolution in which diagnostic imaging has become the centerpiece in establishing a clinical diagnosis and in assessing disease response. In recent years, the focus has changed such that for some disease categories (e.g. oncology) we now perceive medical imaging as a phenotypic expression of the genetic makeup of that disease. To that end, imaging now serves as a biomarker of genetic disease subtypes with features that may offer clues to understanding the natural behavior of the disease and specific changes that may occur as part of a therapeutic response. It is now well recognized that there is a substantial amount of objective information contained within diagnostic imaging studies that can be exploited beyond the level of simple measurements. The extraction of quantitative and semi-quantitative information from imaging studies that is both useful and reproducible is the challenge and opportunity for clinical trials research and radiologic reporting today and in the future. This session will explore the revolution and evolution of quantitative imaging; providing attendees with research advances, clinical applications, and the challenges of clinical implementation.

Sub-Events

RCC51A What is Quantitative Imaging?

Participants
Katherine P. Andriole, PhD, Dedham, MA (*Presenter*) Advisory Board, McKinsey & Company, Inc;

LEARNING OBJECTIVES

1) Be able to describe what is meant by quantitative imaging. 2) Understand existing issues in implementing quantitative imaging techniques in the clinical arena as well as in the research realm, and see how informatics tools may help. 3) Be aware of on-going international efforts to address current challenges and to move quantitative imaging forward.

ABSTRACT

Quantitative imaging has rapidly evolved in recent years from a promising research activity to an essential clinical tool. Physicians consider the objective metrics obtained from imaging studies, in making critical patient management decisions. What is meant by quantitative imaging will be described using illustrative real-world use cases. Existing issues including technical as well as workflow challenges will be discussed. An introduction to imaging informatics tools and techniques such as standards, integration, data mining, cloud computing, ontologies, data visualization and navigation tools, and business analytics applications that may assist in filling current gaps in the clinical implementation of quantitative imaging will be given. An overview of activities of the RSNA's Quantitative Imaging Biomarkers Alliance (QIBA), an international initiative whose goal is to optimize the potential of quantitative imaging, including a description of the data warehouse project will be provided.

RCC51B Informatics Approaches to Enable Quantitative Imaging in Real World Radiology Practice

Participants
Daniel L. Rubin, MD, MS, Palo Alto, CA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To highlight limitations in current radiological quantitative imaging practice and identify opportunities for improvement through informatics. 2) To introduce Annotation and Image Markup (AIM) as a new standard for capturing and sharing quantitative imaging metadata. 3) To demonstrate new AIM-enhanced tools that can streamline and improve quantitative imaging assessment and workflow for the radiologist.

ABSTRACT

Radiology practice is increasingly a quantitative endeavor. Radiologists frequently need to measure the length of lesions to track treatment response or measure the size of structures to for diagnostic assessment. Current practices of quantitation are cumbersome; measurements are recorded as screen captures that cannot be processed by machine, and the numbers must be transcribed into a radiology report. It is currently exceedingly difficult to create structured databases of quantitative image information for discovery about how, say, change in tumor size over time relates to drug treatment. Quantitative imaging is currently at best a labor-intensive process and at worst error-prone. We have been developing informatics methods to streamline the electronic capture of quantitative imaging results as "image metadata" in structured format that can be easily processed by computers. Tools that we are producing will allow the radiologist to perform quantitative imaging assessment in their current routine workflow-measuring lesions on the PACS, while simultaneously their measurements will be captured and transmitted in standardized formats to applications that can automate accurate reporting, analysis, and decision support. In the future such tools will even help researchers to discover new ways that quantitative signals in images can improve assessment of treatment and prediction of

disease course.

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Daniel L. Rubin, MD, MS - 2012 Honored Educator
Daniel L. Rubin, MD, MS - 2013 Honored Educator

RCC51C QI Clinical Use Cases Outside of Oncology

Participants
Eliot L. Siegel, MD, Severna Park, MD (*Presenter*) Research Grant, General Electric Company; Speakers Bureau, Siemens AG; Board of Directors, Carestream Health, Inc; Research Grant, XYBIX Systems, Inc; Research Grant, Steelcase, Inc; Research Grant, Anthro Corp; Research Grant, RedRick Technologies Inc; Research Grant, Evolved Technologies Corporation; Research Grant, Barco nv; Research Grant, Intel Corporation; Research Grant, Dell Inc; Research Grant, Herman Miller, Inc; Research Grant, Virtual Radiology; Research Grant, Anatomical Travelogue, Inc; Medical Advisory Board, Fovia, Inc; Medical Advisory Board, Toshiba Corporation; Medical Advisory Board, McKesson Corporation; Medical Advisory Board, Carestream Health, Inc; Medical Advisory Board, Bayer AG; Research, TeraRecon, Inc ; Medical Advisory Board, Bracco Group; Researcher, Bracco Group; Medical Advisory Board, Merge Healthcare Incorporated; Medical Advisory Board, Microsoft Corporation; Researcher, Microsoft Corporation

LEARNING OBJECTIVES

1) List the current greatest challenges to quantitative imaging from an informatics perspective. 2) Describe how data from clinical trials and the electronic medical record can provide decision support tools associated with the application of quantitative imaging. 3) Be able to articulate the requirements for 'next generation' quantitative imaging and opportunities for improvement of the current generation of CAD software.

ABSTRACT

In the current and future era of Big Data and advanced algorithms to model and diagnose complex disease, structured reporting, natural language processing and quantitative imaging have become essential elements for diagnostic imaging. Additionally it is absolutely essential that our imaging reports including scanning parameters, diagnosis, findings, recommendations, etc. as well as quantitative measurements and impressions from the pixel data be made available for the next generation of diagnostic, staging, and treatment algorithms. Currently there are several major challenges to making these imaging data accessible in a machine recognizable manner and these will be listed, including the application of a method to 'tag' medical images and a means of structuring and classifying findings made by radiologists and other human interpreters as well as computer algorithms that make quantitative measurements and computer aided detection and diagnosis. Once these data are available they can be utilized for decision support in radiology such as determination of which patients should be screened, estimation of the likelihood of malignancy when a nodule is detected, and refinement of CAD algorithms based on a priori estimates of likelihood of disease.

MSRT53

ASRT@RSNA 2015: 3D Post Processing - Not Just a Pretty Picture

Thursday, Dec. 3 10:30AM - 11:30AM Location: N230

IN

AMA PRA Category 1 Credit ™: 1.00
ARRT Category A+ Credit: 1.00

Participants
Adrienne Coya, MS, RRA, New York, NY, (abc2011@med.cornell.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Define key 3D post processing terminology and techniques. 2) Identify where 3D post processing can improve diagnostic accuracy on CT and MRI exams. 3) Examine the role of 3D post processing in surgical and treatment course planning.

RCA52

National Library of Medicine: Online Images and Datasets: Options for Research and Presentations (Hands-on)

Thursday, Dec. 3 10:30AM - 12:00PM Location: S401AB

IN

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
Holly Ann Burt, MLIS, Chicago, IL (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Identify freely available online image databases and data archives including those with online case studies. 2) Use basic searching skills across a variety of databases. 3) Locate copyright options for literature images and radiology datasets.

ABSTRACT

In this hands-on workshop, explore radiographic images and data available online. The National Library of Medicine (NLM) is only one of many agencies which support freely available online image databases and data archives. Topics include searching for journal images, identifying copyright options, and finding case studies or images specifically for patients and families. Use search engines and portals offering a radiology option; discover public data archives and how to search and access datasets; and identify available imaging tools. Learn which databases may be the best starting point for your research.

Handout:Holly Ann Burt

http://abstract.rsna.org/uploads/2015/15004109/2015onlinedatabasesRSNA.pdf

RCB52

Using Keynote: An Alternative to Power Point (Hands-on)

Thursday, Dec. 3 10:30AM - 12:00PM Location: S401CD

ED IN

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
Shawn D. Teague, MD, Indianapolis, IN (*Presenter*) Stockholder, Apple Inc

LEARNING OBJECTIVES

1. Modify the master slides used in a template. 2. Change the aspect ratio for a presentation from 4:3 to 16:9. 3. Utilize movies in a presentation. 4. Utilize the remote control feature in Keynote with a mobile device.

RCC52

Practical Informatics for the Practicing Radiologist: Part Two (In conjunction with the Society for Imaging Informatics in Medicine)

Thursday, Dec. 3 10:30AM - 12:00PM Location: S501ABC

IN

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants

Sub-Events

RCC52A Saving Your Body (and Your Mind): Redesigning the Radiology Reading Environment

Participants
Eliot L. Siegel, MD, Severna Park, MD (*Presenter*) Research Grant, General Electric Company; Speakers Bureau, Siemens AG; Board of Directors, Carestream Health, Inc; Research Grant, XYBIX Systems, Inc; Research Grant, Steelcase, Inc; Research Grant, Anthro Corp; Research Grant, RedRick Technologies Inc; Research Grant, Evolved Technologies Corporation; Research Grant, Barco nv; Research Grant, Intel Corporation; Research Grant, Dell Inc; Research Grant, Herman Miller, Inc; Research Grant, Virtual Radiology; Research Grant, Anatomical Travelogue, Inc; Medical Advisory Board, Fovia, Inc; Medical Advisory Board, Toshiba Corporation; Medical Advisory Board, McKesson Corporation; Medical Advisory Board, Carestream Health, Inc; Medical Advisory Board, Bayer AG; Research, TeraRecon, Inc ; Medical Advisory Board, Bracco Group; Researcher, Bracco Group; Medical Advisory Board, Merge Healthcare Incorporated; Medical Advisory Board, Microsoft Corporation; Researcher, Microsoft Corporation

LEARNING OBJECTIVES

1) Describe three issues with human factors related to the modern reading room. 2) Indicate potential solutions for lighting, ambient noise, and ergonomic challenges.

RCC52B Changing Information Systems: A Survival Guide

Participants
Steven C. Horii, MD, Philadelphia, PA (*Presenter*) Spouse, Employee, Cerner Corporation; ;

LEARNING OBJECTIVES

1) Describe common issues facing departments changing vendors. 2) Explain the techniques that can be used at time of contracting to ensure future access to data. 3) List techniques used for image migration.

RCC52C So Many Images, So Little Time: Advanced Imaging Techniques

Participants
Adam E. Flanders, MD, Penn Valley, PA, (adam.flanders@jefferson.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To appreciate the diversity of advanced visualization techniques.2) To understand how advanced visualization extends the value of medical imaging.3) To learn how advanced visualization has changed traditional workflow strategies.4) To appreciate some of the pitfalls of automation and the need for expert supervised assessment of advanced visualization output.

ABSTRACT

SSQ11

ISP: Informatics (Quality and Safety)

Thursday, Dec. 3 10:30AM - 12:00PM Location: S403A

CT MR IN SQ

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

FDA Discussions may include off-label uses.

Participants
Woojin Kim, MD, Philadelphia, PA (*Moderator*) Co-founder, Montage Healthcare Solutions, Inc; Shareholder, Montage Healthcare Solutions, Inc; Board of Directors, Montage Healthcare Solutions, Inc; Advisory Board, Zebra Medical Vision Ltd
Kevin W. McEnery, MD, Houston, TX (*Moderator*) Advisor, Koninklijke Philips NV
Kevin L. Junck, PhD, Birmingham, AL (*Moderator*) Nothing to Disclose

Sub-Events

SSQ11-01 Informatics Keynote Speaker: Role of Informatics in Quality

Thursday, Dec. 3 10:30AM - 10:40AM Location: S403A

Participants
Woojin Kim, MD, Philadelphia, PA (*Presenter*) Co-founder, Montage Healthcare Solutions, Inc; Shareholder, Montage Healthcare Solutions, Inc; Board of Directors, Montage Healthcare Solutions, Inc; Advisory Board, Zebra Medical Vision Ltd

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Woojin Kim, MD - 2012 Honored Educator

SSQ11-02 How I Missed Your Cancer? An Eye-Tracking Study of Radiological Error in the Detection of Lung Nodules

Thursday, Dec. 3 10:40AM - 10:50AM Location: S403A

Participants
Gregory DiGirolamo, PhD, Worcester, MA (*Abstract Co-Author*) Nothing to Disclose
Zachary Zaniewski, Worcester, MA (*Presenter*) Nothing to Disclose
Max P. Rosen, MD, MPH, Worcester, MA (*Abstract Co-Author*) Stockholder, Everest Scientific Inc; Consultant, PAREXEL International Corporation; Stockholder, Cynvenio Biosystems, Inc; Medical Advisory Board, Cynvenio Biosystems, Inc

PURPOSE

Radiologists may miss findings on ~30% cases. These misdiagnoses can result from visual or cognitive/decision-making errors. Visual errors may include: Scanning errors-not visually fixating on the region that contains an abnormality. Cognitive/Decision errors include: Decision errors-visually fixating on an abnormality, but declaring it normal, and/or Recognition errors- visually fixating on the region of an abnormality, but not identifying it. We investigated conscious recognition errors and whether Radiologists might have unconscious detection of lung nodules despite no conscious recognition.

METHOD AND MATERIALS

6 experienced Radiologists interpreted 18 axial chest CT scans (9 normal and 9 abnormal), each consisting of 200-400 slices. There were 16 lung nodules in total across the 9 abnormal CT scans. The presence and location of lung nodules were identified by a mouse click. Using an Eye-Link 1000, we tracked the location and duration of eye fixations using an invisible (to the observer) grid on each image. Error rates were calculated as our main index of accuracy, and duration of eye movements in each grid region were used to determine if there was unconscious detection of a lung nodule.

RESULTS

On average, 8/16 (50%, +/- 9%) lung nodules were consciously identified, and registered by a mouse click. However, even when no conscious detection of the lung nodule was registered, Radiologists made significantly longer fixations to the grid regions where the lung nodules were located, ($p < .007$). Radiologists fixated longer in the grid region where a nodule was located when compared to any other region in that same image ($p < .02$), even when the nodule was not consciously detected. Radiologists also fixated longer in the grid region where a lung nodule was present (even when not consciously detected) than any grid region in a normal image, $p < .03$.

CONCLUSION

Our data suggest that even when not consciously recognized, experienced radiologists unconsciously detect the location of lung nodules.

CLINICAL RELEVANCE/APPLICATION

Many findings missed in clinical practice, may actually be detected unconsciously. The use of eye-tracking, or other technologies may improve Radiologists' performance.

SSQ11-03 Scanning Clinical Security Worldwide: Maps and Country Ratings

Thursday, Dec. 3 10:50AM - 11:00AM Location: S403A

Participants
Oleg S. Pianykh, Newton Highlands, MA (*Presenter*) Nothing to Disclose

Background

The fundamental standards of digital medical data exchange, such as DICOM and HL7, date back to the late 1980s. And although these standards went through countless enhancements, one particular aspect - security -remained virtually untouched. The main purpose of our work was to perform the first comprehensive study of clinical security worldwide.

Evaluation

We used DICOM and HL7 association establishment protocols to develop a fast, parallel-processing security-probing application. Testing each IP address for its openness to transmit medical data (with no actual data transferred), the application scanned the entire worldwide space of IP addresses in 3 weeks. Geolocation services were used to map each unsecure IP we identified. As a result, we compiled a comprehensive map of open clinical servers worldwide, with different levels of security threats.

Discussion

Our scan discovered 2774 DICOM servers worldwide, out of which 719 were open for medical data communications. HL7 results were similar. Each protocol was used to categorize our findings by different levels of security threats, and geolocation data - by countries and regions. As a result, we compiled clinical security ratings per country, per capita, and per IT infrastructure. We also built the first map of DICOM/HL7 adoption worldwide

Conclusion

Medical data archives, left wide-open to security threats, is by far the most common security problem, which needs to be addressed with a robust, standardized, and fully implemented solution. Our results demonstrate the full scope of this problem, and the areas where it needs to be solved first.

SSQ11-04 Institution Certification System for Low-Dose Lung Cancer CT Screening in Japan: Development of a New Web-based Image Evaluation Function

Thursday, Dec. 3 11:00AM - 11:10AM Location: S403A

Participants
Rikuta Ishigaki, PhD, Kyoto, Japan (*Abstract Co-Author*) Nothing to Disclose
Yoshihisa Muramatsu, PhD, Kashiwa, Japan (*Presenter*) Nothing to Disclose
Yuichiro Maruyama, MD,PhD, Komoro, Japan (*Abstract Co-Author*) Nothing to Disclose
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Michael F. McNitt-Gray, PhD, Los Angeles, CA (*Abstract Co-Author*) Institutional research agreement, Siemens AG; Research support, Siemens AG; ; ; ; ;
Yoshito Tabata, Kyoto, Japan (*Abstract Co-Author*) Nothing to Disclose
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Kouzou Hanai, PhD,RT, Tokyo, Japan (*Abstract Co-Author*) Nothing to Disclose

Background

In Japan, an institution certification system is being established by the Accreditation Council for Lung Cancer CT Screening. Given progress in database systems with a dose index registry (DIR) function known as the combined application dose index (CADI), the CADI system will be used to evaluate both dose and image quality. A special image evaluation function has been developed for this new use.

Evaluation

The CADI system consists of a CADI server and clients. Image data and dose information are compiled in DICOM and IHE-REM databases. Web-based access to the CADI server is possible from approved CADI clients, permitting image evaluation for lung cancer CT screening. This system was certified as meeting the IHE REM Profile at the NA Connectathon 2013, and the web-based access is WADO compliant.A demonstration study was conducted between January 5 and March 31, 2015. A chest phantom containing simulated lesions (LSCT-001, Kyoto Kagaku) was scanned using the CT screening protocols at each institution (16 institutions, 22 CT systems). CT images (as a 5 mm-slice and a 1 mm interval) and dose reports were sent to CADI clients and transferred to the CADI server, and dose information and image interpretation by certified radiologists were analyzed. The calculated CTDIvol values were 1.9±0.8 mGy (mean ± SD). The calculated DLP values were 65.1±26.7 mGy (mean ± SD).The submitted phantom images are reviewed for image quality and the detectability of the simulated lesions is assessed. The average detected diameter (mean ± SD) was 8.9±0.8 mm for the right lung (Design contrast = 100 HU) and 5.7±0.4 mm for the left lung (Design contrast = 270 HU).

Discussion

It is essential to ensure the appropriate image quality at reduced dose for CT screening in healthy people. Dose and image quality evaluations were performed from the CADI client on Web, and statistical analyses were performed. This allows standardization of CT screening across Japan; Institutions certified by the Accreditation Council will be able to provide reliable CT screening services.

Conclusion

We have developed a new web-based image evaluation function for the CADI system to establish an institution certification system for lung cancer CT screening.

SSQ11-05 Conventional X-ray Dose Analysis in Pediatrics Patients in Different Hospitals Using a Centralized Electronic Platform

Thursday, Dec. 3 11:10AM - 11:20AM Location: S403A

Participants
Eduardo Fraile Moreno, MD, PhD, San Sebastian de Los Reyes, Spain (*Presenter*) Nothing to Disclose
Carlos Benito, Madrid, Spain (*Abstract Co-Author*) Nothing to Disclose
Jose Carmelo Albillos, Alcorcon, Spain (*Abstract Co-Author*) Nothing to Disclose
Patricia Fraga Rivas, MD, Coslada, Spain (*Abstract Co-Author*) Nothing to Disclose
Esther Dominguez-Franjo, MD, PhD, Madrid, Spain (*Abstract Co-Author*) Nothing to Disclose
Josefa Galobardes Monge, MD, Parla, Spain (*Abstract Co-Author*) Nothing to Disclose
Trinidad Villarejo, Parla, Spain (*Abstract Co-Author*) Nothing to Disclose

Background

Imaging diagnostics studies using Xray modalities are increasing the impact on cumulative doseof irradiation delivered to patients. At the same time, a new legislation (2013/59/Euratom) will be put in place to register dose patient history on his Electronic Health Record. Dose is a concern for everybody in healthcare environment and especially sensitive when we speak about dose deliveredto kids.Our objective is to analyze variability on the dose in non-focused pediatric departments and determinate root causes to fix them.

Evaluation

The analysis for pediatric segment has been done in 6 hospitals connected in the same network The studies have been performed in Emergency departments with the same manufacturer and model of digital Xray equipments and same configuration.Data are storage on real time from modalities to a central server used to analyze them. Data from patient studies were collected over a period of one month. They were classified according to patient age (0-1 year; 1-5years; 5-10 years and 10-15 years) and gender. For each category of patient, the most used protocols were evaluated and their associated dose levels were collected. For each protocol, an alert threshold was calculatedbased on the usual clinical practice (2 times the percentile median).The root causes were classified (bad patient positioning, bad collimation on patient, pediatrics study protocol not selected, bad protocol selected depending on morphology) and measured.

Discussion

This analysis demonstrates that 15.28% of the extra dose applied to pediatric population is caused directly by misunderstanding or lack of knowledge of how to handle this type of patients. Most of these mistakes can be fixed by dose education through Change Acceleration Process (CAP) to take in account seriously the pediatric segment in radiology studies and specific trainings to remind Xray technology basis. Consciousness will be done with explanations of dose effect on kids (stochastics and determinists effects)

Conclusion

Dose monitoring electronic solution allow us reeucing the variability on the dose in non-focused pediatric departments and determinate root causes to fix them

SSQ11-06 Biometric Patient Identity Verification during Magnetic Resonance Imaging of the Brain Using Multi-planar Reconstruction Scout Image

Thursday, Dec. 3 11:20AM - 11:30AM Location: S403A

Participants
Yasuyuki Ueda, Fukuoka, Japan (*Presenter*) Nothing to Disclose
Junji Morishita, PhD, Fukuoka, Japan (*Abstract Co-Author*) Nothing to Disclose
Shohei Kudomi, Ube, Japan (*Abstract Co-Author*) Nothing to Disclose
Katsuhiko Ueda, BS, Ube, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Patient misidentification error management is one of the important factors of patient safety. We studied the use of magnetic resonance (MR) images for the purpose of biometric patient identity verification, and show the accuracy of verification performance for clinical use.

METHOD AND MATERIALS

Anatomy-related multi-planar reconstruction (MPR) images, including posterior surface of brainstem and the internal auditory canal (IAC), generated from one three-dimensional fast scout scan of each MR examination were used as biological-fingerprint images in this study. We calculated a correlation value as a similarity score between current and prior biological-fingerprint images. This procedure consists of three major steps, i.e., biological feature extraction, normalization, and calculation of correlation value. In order to evaluate the verification performance, we calculated a false rejection rate (FRR), a false acceptance rate (FAR) and a half-total error rate (HTER) by the discriminant analysis utilizing the squared Mahalanobis distance to declare the patient as genuine or an impostor. Moreover, to evaluate overall performance deliverance from a receiver operating characteristic (ROC) curve, the area under the ROC curve (AUC), and the equal error rate (EER) were calculated.

RESULTS

The database of this study consisted of 730 temporal pairs of MR examination of the brain. Many patients of this study have the following disorders: brain tumor and cerebrovascular angiopathy, and 168 patients have undergone surgical operation of the brain before the current examination. Our results indicated a high performance in verifying patients. Our method gave an HTER of 1.59% with an FAR of 0.023% (62/266,085), and an FRR of 3.15% (23/730). The AUC and EER were achieved at 0.998 and 1.37%, respectively.

CONCLUSION

Our method makes it possible to verify the identity of the patient only using some existing medical images without the addition of incidental equipment. We expect our method to be a key solution to patient misidentification problems.

CLINICAL RELEVANCE/APPLICATION

Our method is useful when we have no other way of confirming whether the registered patient information is correct or not and will contribute to patient misidentification error management caused by human errors.

SSQ11-07 CT Dose Monitoring and Management System Based on Open-source Software Resources and In-House Development

Thursday, Dec. 3 11:30AM - 11:40AM Location: S403A

Participants
Da Zhang, PhD, Boston, MA (*Presenter*) Nothing to Disclose
Larry Barbaras, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Matthew R. Palmer, PhD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The monitoring and management of radiation dose have become crucial requirements of modern radiology departments. Powerful open-source DICOM utilities could facilitate the implementation of professional-grade systems for collecting CT radiation dose data. However, the heterogeneity of dose data and inconsistent implementations of the DICOM SR standard among different CT models and vendors require additional customization and programming. We present the development, unique features, and clinical applicability of a CT dose tracking system based on freely-available software resources.

METHOD AND MATERIALS

Radiation dose structured reports (RDSR) are auto-transmitted from the CT scanners to a Conquest DICOM server. The server spawns two external processes: 1) 'dcm2xml' (from DCMTK) translates RDSR into XML; 2) a PowerShell script mines the XML data and populates database tables.Dose dashboards on the server provide query and display functionality for individual CT exams, while a data dump service provides massive output of dose records for periodic dose analysis and protocol management. Also, a web service that receives real-time queries from the dictation system returns customized dose strings for automatic inclusion in the radiologic reports.For protocol review, dose entries in the dumped data are cleaned and validated. Heterogeneous protocol identifiers are normalized and re-mapped to core protocol names, using a regular expression based method. Similar protocol names are grouped together for per-scanner analysis and cross-scanner comparison. The core protocols that comprise the majority of exams were identified, and summary data were prepared for visual analysis.

RESULTS

Over 5000 CT dose records per month have been collected from ten CT scanners (of 7 models and 3 vendors) distributed in three practice sites. Non-trivial inconsistencies in the adoption of RDSR capabilities, especially in the handling of protocol names, were observed. Comparison of dose performance across scanners and against national data was used to trigger root-cause analysis and protocol review.

CONCLUSION

Using open-source software resources and in-house expertise, a highly functional and customizable dose monitoring and management system can be developed with limited expense and effort.

CLINICAL RELEVANCE/APPLICATION

The developed dose tracking and reporting system could greatly facilitate the tasks of CT dose monitoring and management.

SSQ11-08 Implementation of a Virtual 'Learning from Discrepancy' Meeting: A Method to Improve Radiologist Attendance and Facilitate Shared Learning from Radiological Error

Thursday, Dec. 3 11:40AM - 11:50AM Location: S403A

Participants
Anoma Lalani Carlton Jones, MBBS, FRCR, London, United Kingdom (*Presenter*) Nothing to Disclose
Mary E. Roddie, MD, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To assess the effect on radiologist participation in learning from discrepancy meetings (LDMs) in a large radiology department spread across three hospital sites by establishing virtual LDMs using OsiriX (Pixmeo).

METHOD AND MATERIALS

Submitted radiological discrepancy cases were added to an OsiriX database after anonymisation with clinical information available at the time and any relevant previous imaging. Prepared cases were loaded onto iMacs in the radiology reporting rooms on each site. For each virtual LDM radiologists were given a 3-week period to review cases either on their own or in groups and send their feedback to the LDM convenor. The learning points and consensus feedback were attached to each case before it was added to a permanent LDM library on the iMacs. Attendance was recorded and compared with that from the previous 4 years of conventional meetings. We obtained radiologist feedback comparing the two types of LDM using an anonymous online questionnaire sent out after the first year of virtual LDMs.

RESULTS

Numbers of radiologists attending increased significantly from a mean of 12.5 ± 3.1 for the conventional LDM to 27.3 ± 6.2 for the virtual LDM ($p < 0.0001$) and the percentage of radiologists achieving the UK standard of participation in at least 50% of LDMs per year (the UK standard) rose from an average of 18% to 68%. The number of cases submitted per meeting rose significantly from an average of 11.1 ± 2.9 for conventional LDMs to 15.2 ± 6.2 for virtual LDMs ($p < 0.02$). Analysis of 30 returned questionnaires showed that radiologists welcomed being able to review cases at a time and place of their choosing and at their own pace. They reported that were able to give more honest feedback in the absence of peer pressure. Many felt that the LDM library was a useful educational resource and had changed their clinical practice by highlighting frequently occurring errors.

CONCLUSION

Replacement of conventional LDMs rotating between hospital sites in a large radiology department by virtual LDMs improved radiologist participation in the process of group learning from radiological discrepancy and increased the number of submitted cases.

CLINICAL RELEVANCE/APPLICATION

Introduction of a virtual 'learning from discrepancy' meeting (LDM) and an LDM library can increase radiologist participation in the process of learning from discrepancy and increase the number of cases submitted.

SSQ11-09 Does Dose Awareness Increase after Implementation of a Dose Monitoring Software in Computed Tomography

Thursday, Dec. 3 11:50AM - 12:00PM Location: S403A

Participants
Christina Heilmaier, MD, Zurich, Switzerland (*Presenter*) Nothing to Disclose
Niklaus Zuber, Zurich, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Dominik Weishaupt, MD, Zurich, Switzerland (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Dose monitoring becomes more and more important and is an important part of quality control. We wanted to examine whether dose awareness of medical staff increased after a dose monitoring software was installed and implemented in clinical routine.

METHOD AND MATERIALS

Dose data of two computed tomography scanners was collected from April 2014 to February 2015. We used a dose management software to separately analyze data from April to June 2014 (period 1) and July 2014 to February 2015 (period 2). Starting July 2014 radiographers were instructed look for and answer alarms ('alerts') when dose exceeded predefined thresholds. Chi-square tests were applied to check for statistical significant changes in number and reasons for alerts between both periods. Thresholds were set as 75th-percentile of the distribution of dose length product (DLP, Gy*cm).

RESULTS

A total of 13,217 scans were conducted (period 1, n=4,943; period 2, n=8883) and dose data was successfully transferred to the software in all cases. A total of 609 alerts occurred (period 1, n=293; period 2, n=316), mean alert quota 5%. Comparison of both periods showed a significant decrease of mean alert quota in period 2 (4%; period 1, 6%; $p<0.001$). Decline was mainly caused by a reduced number of notifications due to patient off-centering (period 1, n=129; period 2, n=77; $p<0.001$), which means patient was not positioned properly in the isocenter of the scanner. Relative number of high body weight alerts (BMI≥25 kg/m2) grew in period 2 (51%, n=160; period 1, 36%. n=106), but difference was not statistical significant ($p=0.159$). All other alert causes were comparable in both periods ($p>0.05$): scan repetition due to severe motion artifacts (period 1, n=32, 11%; period 1, n=36, 11%), osteosynthesis material (OSM) in scanning area and leading to dose up-regulation (period 1, n=24, 8%; period 2, n=28, 9%) and others such as imaging on spine-board (period 1, n=3, 1%; period 2, n=15, 5%).

CONCLUSION

A dose monitoring software can be successfully implemented in clinical routine and increases dose awareness in medical staff, thereby leading to a reduction of the number of dose alerts due to human error.

CLINICAL RELEVANCE/APPLICATION

Implementation of a dose monitoring software in clinical routine can be successfully accomplished and is an important tool for increasing dose awareness in medical staff, thereby improving quality assurance and patient safety.

SSQ20

Physics (CAD)

Thursday, Dec. 3 10:30AM - 12:00PM Location: S404AB

IN PH

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
Heang-Ping Chan, PhD, Ann Arbor, MI (*Moderator*) Institutional research collaboration, General Electric Company
Hiroyuki Yoshida, PhD, Boston, MA (*Moderator*) Patent holder, Hologic, Inc; Patent holder, MEDIAN Technologies;

Sub-Events

SSQ20-01 Automatic Spatial Linking of Lesions in Breast MRI Follow-up Images

Thursday, Dec. 3 10:30AM - 10:40AM Location: S404AB

Participants
Lei Wang, Bremen, Germany (*Presenter*) Nothing to Disclose
Albert Gubern-Merida, PhD, Nijmegen, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Susanne D. Diekmann, MD, MSc, Bremen, Germany (*Abstract Co-Author*) Nothing to Disclose
Ritse M. Mann, MD, PhD, Nijmegen, Netherlands (*Abstract Co-Author*) Speakers Bureau, Bayer AG
Hendrik O. Laue, PhD, Bremen, Germany (*Abstract Co-Author*) Nothing to Disclose
Horst K. Hahn, PhD, Bremen, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Automatically linking the lesions detected in breast MRI follow-up examinations is required for the development of a computer-aided diagnosis (CAD) system to quantify characteristic changes of the lesions. In this work, we develop a registration-based method that enables automatic linking of lesions detected in breast MRI follow-up studies.

METHOD AND MATERIALS

From 51 subjects participating in a MRI screening program, we collected 102 dynamic contrast enhanced MRI (DCE-MRI) images, forming 51 pairs of follow-up studies. Current and prior examinations were acquired in different scanners with a time interval of one year, using transversal and coronal views, respectively. One experienced radiologist manually placed 71 pairs of markers, indicating the center locations of 71 pairs of lesions found in both current and prior studies. Automatic lesion linking is achieved by registering current and prior MRI examinations. First, a motion correction algorithm is performed on both current and prior DCE-MRI. Then, fully automatic breast segmentation is applied on the current and prior pre-contrast images to extract breast masks, which are used to obtain an initial affine transform. Then, a non-rigid registration algorithm using normalized gradient fields as similarity measure together with curvature regularization is exploited to register the current and prior pre-contrast images. Since the follow-up scans may have inconsistent field of views, the registration only focuses on the segmented breast regions to enforce the alignment accuracy in breast areas, such that non-breast regions will not attract and influence the registration process.

RESULTS

Based on the deformation fields obtained by registration, markers labeling the lesions in the current image were transformed to the prior image frame, where the distance between the transformed markers and the markers originally labeled in prior images was computed. The average distance error was 9.6 ± 9.3 mm.

CONCLUSION

The proposed system is potentially applicable to automatically link the lesions detected in a CAD system to investigate the characteristic changes.

CLINICAL RELEVANCE/APPLICATION

Visual assessment and comparison of characteristic change of the lesions in breast DCE-MRI follow-up exams is time consuming, and computer-aided lesion comparison may increase clinical effectiveness.

SSQ20-02 Information-preserving Pseudo-enhancement Correction for Computer-aided Detection (CADe) in Dual-energy CT Colonography (DE-CTC)

Thursday, Dec. 3 10:40AM - 10:50AM Location: S404AB

Participants
Janne J. Nappi, PhD, Boston, MA (*Presenter*) Royalties, Hologic, Inc; Royalties, MEDIAN Technologies;
Se Hyung Kim, Seoul, Korea, Republic Of (*Abstract Co-Author*) Research Grant, Mallinckrodt plc; Research Grant, Samsung Electronics Co Ltd
Hiroyuki Yoshida, PhD, Boston, MA (*Abstract Co-Author*) Patent holder, Hologic, Inc; Patent holder, MEDIAN Technologies;

PURPOSE

To evaluate the effect of information-preserving pseudo-enhancement correction on the accuracy of computer-aided detection (CADe) in dual-energy CT colonography (DE-CTC).

METHOD AND MATERIALS

Twenty patients were prepared for a DE-CTC examination by use of one-day bowel preparation with 18 g of magnesium citrate and 50 ml of non-ionic iodine. The DE-CTC image acquisitions (SOMATOM Definition, Siemens Healthcare) were performed at 140 kVp and 80 kVp energies in supine and prone positions with 1-mm slice thickness. No intravenous contrast was used. An experienced

board-certified radiologist correlated the CTC images with the findings of subsequent optical colonoscopy. The DE-CTC images were then subjected to a novel dual-energy pseudo-enhancement correction method that corrects for pseudo-enhancement distortions of soft tissue on DE-CTC images caused by adjacent orally administered high-density fecal tagging, without distorting the dual-energy information that is contained within the images. For evaluation, a dual-energy CADe (DE-CADe) scheme was used to detect challenging polyps 6 - 9 mm in size from the DE-CTC images without and with the application of the pseudo-enhancement correction. The detection performance of the DE-CADe scheme was assessed by use of leave-one-patient-out evaluation.

RESULTS

There were 15 colonoscopy-confirmed polyps measuring 6 - 9 mm in largest diameter. Without the pseudo-enhancement correction, the DE-CADe scheme detected 9 polyps (60%) at 4.3 false-positive (FP) detections per patient and 10 polyps (67%) at 53 FP detections per patient. With the application of the dual-energy pseudo-enhancement correction method, the DE-CADe scheme detected 12 polyps (80%) at 5.5 FP detections per patient. For larger polyps (n=14), the detection sensitivity was 93% without and 100% with the pseudo-enhancement correction.

CONCLUSION

The information-preserving dual-energy pseudo-enhancement correction method can improve the detection accuracy of CADe for challenging colorectal lesions in DE-CTC.

CLINICAL RELEVANCE/APPLICATION

The proposed method can improve the accuracy of CADe and quantitative imaging in DE-CTC by correcting for pseudo-enhancement distortions of images without changing their dual-energy information.

SSQ20-03 Evaluation of a Novel Method to Segment the Pectoral Muscle Surface in Automated Whole Breast Ultrasound

Thursday, Dec. 3 10:50AM - 11:00AM Location: S404AB

Participants
Albert Gubern-Merida, PhD, Nijmegen, Netherlands (*Presenter*) Nothing to Disclose
Tao Tan, Nijmegen, Netherlands (*Abstract Co-Author*) Research Grant, QView Medical, Inc
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Nico Karssemeijer, PhD, Nijmegen, Netherlands (*Abstract Co-Author*) Shareholder, Matakina Technology Limited; Consultant, QView Medical, Inc; Shareholder, QView Medical, Inc; Director, ScreenPoint Medical BV; Shareholder, ScreenPoint Medical BV;

PURPOSE

Segmentation of anatomical structures in automated 3D breast ultrasound (ABUS) is required for development of computer-aided detection (CAD) and other techniques to make clinical workflow more efficient, such as automatic linking of findings between different ABUS views and multimodal registration. We propose a novel method to segment the anterior pectoral surface in ABUS images.

METHOD AND MATERIALS

We randomly collected 74 ABUS (25 Anterior-Posterior, 15 MEDial, 31 LATeral and 3 SUPerior views) volumes obtained in routine clinical care at two medical centers using the S2000 automated 3D breast ultrasound system (Siemens, Erlangen, Germany). Manual pectoral muscle delineations of the anterior surface were provided by a trained researcher. We developed an algorithm to segment the pectoral muscle surface in ABUS volumes: First, the chest wall is segmented using a previously validated software that models the chest wall as a cylinder. Thereafter, the chest wall surface is used to perform a cylindrical transformation on the ABUS volume. By applying this transformation, the chest wall and the pectoral muscle are straightened and shape variability of the pectoral muscle across volumes can be encoded in a probabilistic atlas. In the last step, gradient and atlas information are used to guide the pectoral muscle surface segmentation in a dynamic programming approach. The algorithm was applied to the 74 ABUS volumes of the study dataset following a leave-one-out strategy. Distance (mean+-stdev) between manual and automated pectoral muscle surfaces was used as evaluation measure.

RESULTS

The presented approach achieved a mean surface distance error of 3.47+-3.03 mm, compared to the manual annotations. The surface distance error for AP, LAT, MED and SUP view volumes was 2.61+-4.15, 3.78+-4.15, 4.17+-2.37 and 3.78+-1.02 mm, respectively.

CONCLUSION

Automated pectoral muscle segmentation is challenging due to high variation in pectoral muscle anatomy. The proposed method shows promising results on segmenting the pectoral muscle surface.

CLINICAL RELEVANCE/APPLICATION

ABUS is a promising modality for screening but reading is time consuming for radiologists. Availability of supporting tools such as computer-aided detection may expedite introduction of ABUS in practice.

SSQ20-04 Automatic Coronary Calcium Scoring and Cardiovascular Risk Estimation in the Pan-Canadian Lung Cancer Screening Trial

Thursday, Dec. 3 11:00AM - 11:10AM Location: S404AB

Participants
Nikolas Lessmann, Utrecht, Netherlands (*Presenter*) Nothing to Disclose
Ivana Isgum, PhD, Utrecht, Netherlands (*Abstract Co-Author*) Research Grant, Pie Medical Imaging BV; Research Grant, 3mensio Medical Imaging BV;
Stephen Lam, MD, Vancouver, BC (*Abstract Co-Author*) Nothing to Disclose
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Max A. Viergever, Utrecht, Netherlands (*Abstract Co-Author*) Research Grant, Pie Medical Imaging BV;
Bram Van Ginneken, PhD, Nijmegen, Netherlands (*Abstract Co-Author*) Stockholder, Thirona BV Co-founder, Thirona BV Research Grant, MeVis Medical Solutions AG Research Grant, Canon Inc Research Grant, Toshiba Corporation Research Grant, Riverain Technologies, LLC

PURPOSE

Coronary artery calcium (CAC) scores determined in low-dose ungated chest CT, as acquired for lung cancer screening, strongly and independently predict cardiovascular events (CVE). Automatic CAC scoring can complement lung cancer screening by identifying subjects at risk of a CVE. We investigated agreement and reliability of an automatic CAC scoring method previously developed for CAC scoring in the Dutch-Belgian lung cancer screening trial (NELSON) in the Pan-Canadian Early Detection of Lung Cancer Study (PanCan).

CONCLUSION

Automatic coronary calcium scoring in lung cancer screening CT scans is feasible. To achieve good agreement with manual scores representative training data was not necessary.

CLINICAL RELEVANCE/APPLICATION

Automatic quantification of cardiovascular risk in lung cancer screening programs can identify subjects at high risk who might benefit from preventive treatment. This might improve the overall cost-effectiveness.

SSQ20-05 Leveraging Mid-Level Semantic Boundary Cues for Computer-Aided Lymphadenopathy Detection

Thursday, Dec. 3 11:10AM - 11:20AM Location: S404AB

Participants
Ari Seff, Bethesda, MD (*Abstract Co-Author*) Nothing to Disclose
Le Lu, PhD, Bethesda, MD (*Abstract Co-Author*) Nothing to Disclose
Ronald M. Summers, MD, PhD, Bethesda, MD (*Presenter*) Royalties, iCAD, Inc; Research funded, iCAD, Inc;

PURPOSE

To improve an automated system for detection of mediastinal and abdominal enlarged lymph nodes (LNs) (>10 mm in short axis diameter) on CT scans.

METHOD AND MATERIALS

Two lymph node CT datasets (90 patients with 388 mediastinal LNs and 86 patients with 595 abdominal LNs) were used. Images were acquired in the portal venous phase with a slice thickness of 1-1.25 mm. A radiologist examined each scan, manually segmenting all ground truth enlarged LNs. Accompanying each target region was a list of previously generated LN candidate centroids. For each candidate, nine 2D views of size 45×45 voxels were sampled one voxel apart, along each of the three orthogonal planes. Patches of size 15×15 voxels were extracted from the 2D views and labeled as positive if the center resided on a LN boundary. 150 representative LN contour classes (known as sketch tokens) were defined via k-means clustering. Patch-level gradient channels and self-similarity channels were used to train a random forest classifier for contour classification. The random forest model was then used to obtain 150 contour class probability scores per voxel for all 2D views. Taking the voxel-wise sums and maximums of the scores resulted in two new boundary cue maps. In addition to the raw CT intensity images, these two maps served as additional inputs for HOG computation. A linear SVM was trained using the three concatenated feature sets for classification of views as containing LN or not. The mean of the resulting view-level scores served as the candidate score.

RESULTS

Six-fold cross-validation demonstrated that the enhanced feature maps lead to 15%-23% greater recall than the baseline HOG (e.g., 78% versus 56% sensitivity at 3 FP/scan in the abdomen and 78% versus 63% at 3 FP/scan in the mediastinum). This performance improvement was found to be statistically significant via paired-sample t-tests ($p << .01$). Additionally, our system outperformed the state-of-the-art deep learning system in the mediastinal region (e.g. 78% vs. 70% sensitivity at 3 FP/scan).

CONCLUSION

We developed a novel method to learn enriched, semantic feature maps that facilitate significantly improved performance for automated lymph node detection.

CLINICAL RELEVANCE/APPLICATION

Detection of lymphadenopathy is critical for cancer staging and assessing treatment response. Automated detection may permit more accurate and time efficient assessment.

SSQ20-06 Feasibility of Fully Automatic Coronary Artery Calcium Scoring and Cardiovascular Risk Determination with Radiation Therapy Treatment Planning CT of Breast Cancer Patients

Thursday, Dec. 3 11:20AM - 11:30AM Location: S404AB

Participants
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Sofie Gernaat, Utrecht, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Richard A. Takx, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
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PURPOSE

Coronary artery calcifications (CAC) are strong and independent predictors of cardiovascular events and all-cause mortality. The

aim of this study was to investigate the agreement between automatic and manual CAC scoring and determination of cardiovascular risk in radiation therapy (RT) treatment planning CT acquired in breast cancer patients.

METHOD AND MATERIALS

This study included 461 female breast cancer patients undergoing RT planning CT (Philips, 16 x 0.75 mm collimation, 120 kVp, 3 mm section thickness, no-ECG synchronization, with or without breath-hold). Calcium was scored automatically using an algorithm developed for CAC scoring in low-dose chest CT that employs supervised pattern recognition to identify CAC by texture, size, and spatial features. To determine agreement of automatic cardiovascular disease (CVD) risk assignment, all scans with CAC score >0 and an equal number of randomly selected zero score images were chosen for manual expert CAC scoring. Only one scan per patient was analyzed. Scoring was performed with standard 130 HU threshold. Reference and automatic Agatston scores were computed. Each patient was assigned to a CVD risk category based on the Agatston score (0, 1-10, 10-100, 100-400, >400). Agreement was computed as proportion of agreement between automatic and manual risk category assignment. Proportion of agreement beyond chance was determined using linearly weighted kappa for risk category assignment between automatic and manually determined risk categories.

RESULTS

162 scans were analyzed. Reference CAC score in 80 images was zero. In the remaining scans, reference median Agatston score was 76.1 (range 1.2-1745.5). Automatic and manual expert scoring assigned 78% (126/162) of patients to the same CVD risk category. This was higher for patients scanned with breath-hold (86%, 48/56) than for those without (74%, 78/106). Linearly weighted kappa was 0.78 (95%, CI: 0.71-0.85). For patients scanned with and without breath-hold this was 0.83 (CI: 0.72-0.94) and 0.75 (CI: 0.66-0.84), respectively.

CONCLUSION

Automatic CVD risk determination in RT treatment planning CT for breast cancer patients results in good agreement with manual expert scoring. Agreement is higher when scanning is performed with breath-holding.

CLINICAL RELEVANCE/APPLICATION

Fully automatic CAC scoring and CVD risk determination in breast cancer patients undergoing RT treatment planning CT is feasible without additional costs.

SSQ20-07 Automatic Detection of Interval Changes between Low-Dose CT Images Using Subtraction Images

Thursday, Dec. 3 11:30AM - 11:40AM Location: S404AB

Participants
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PURPOSE

To develop an automatic system for detecting interval changes between low-dose CT images in a lung cancer screening setting using analysis of subtraction images.

METHOD AND MATERIALS

Given two CT scans, a prior and a current scan, lung segmentation and non-rigid registration is performed and a subtraction image is obtained by subtracting the deformed prior scan from the current scan. In the subtraction image, potential candidate regions with true change are determined using banded thresholding and morphological operations. For each candidate, a set of intensity, shape and context features is computed. A GentleBoost classifier using 250 regression stumps is used to differentiate real change from subtraction artifacts. We selected all subjects which had been referred to a pulmonologist from one site of the NELSON lung cancer screening trial. Per subject, we selected the scan on which the referral was based upon and the corresponding prior scan. This resulted in 124 scan pairs which were divided randomly into a training and test set. In addition, 50 random pairs of CT scans for which long-term follow-up had been scheduled were selected as additional normal cases for the test set. An experienced radiologist annotated all relevant changes (volume change of preexisting nodules, mucus in airways, or onset of new opacifications) by inspecting the subtraction images and the two original images side-by-side. In addition, the quality of the subtraction images, an indication of the performance of the registration algorithm, was scored on a 1-5 scale with 5 being the best. Performance was evaluated using free-response operating characteristic analysis.

RESULTS

In total, 92 relevant changes were annotated by the experienced radiologist in the test set. The quality of the subtraction images was rated high: only five subtraction images (4%) had a rating lower than 4. FROC analysis showed that the automatic system detected 71% of all relevant change at an average of 2.0 false positives per scan.

CONCLUSION

Automatic detection of interval changes between low-dose CT images is feasible and may be of additional value when reading follow-up scans in a lung cancer screening setting.

CLINICAL RELEVANCE/APPLICATION

Detection of interval changes between consecutive low-dose CT images is crucial in lung cancer screening. Visual comparison of CT

scans is tedious and prone to errors and may therefore benefit from automatic indications of interval changes.

SSQ20-08 Automated Detection of Mass-like, Non-mass-like and Focus Breast Cancer Lesions Visible in False-negative Screening DCE-MRI

Thursday, Dec. 3 11:40AM - 11:50AM Location: S404AB

Participants
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PURPOSE

Breast cancer lesions are regularly overlooked or misinterpreted in breast MRI screening due to lesion appearance suggesting benign disease, extensive background enhancement or fatigue and lack of experience analyzing 4D data. In this study, we evaluate the performance of an automated computer-aided detection (CAD) system to detect mass-like, non-mass-like and focus breast cancer lesions that were, in retrospect, visible on earlier screening MRIs but only detected in a subsequent scans.

METHOD AND MATERIALS

Between 2003 and 2013, we identified 24 prior-negative MRI scans (BI-RADS 1/2) with 24 breast cancers (10 mass-like, 8 non-mass-like and 6 foci) in a MRI screening program. Cancers were detected by radiologists at the following screening round. Additionally, 120 normal scans were collected from the same MRI screening program from different women without history of breast cancer or breast surgery. A previously validated fully automated CAD system was applied to this dataset to detect malignant lesions. The system corrects for motion artifacts and segments the breast. Subsequently, lesion candidates are detected using relative enhancement and texture features to characterize breast cancer lesions. The final classification is performed using region-based morphological and kinetics features computed on segmented lesion candidates.The detection performance was evaluated using free-response receiver operating characteristic analysis and bootstrapping. A CAD finding was considered a true positive when its center was inside a lesion annotation. The false positive rate (FP/case) was determined on the normal cases.

RESULTS

At 4 FP/case, the sensitivity for detecting mass-like and non-mass-like lesions in prior-negative scans was 0.50 (95% confidence interval 0.17-0.83) and 0.85 (0.50-1.00), respectively. At the same FP/case, the CAD system did not detect focus breast cancer lesions.

CONCLUSION

A CAD system was able to automatically detect 50% and 85% of mass-like and non-mass-like enhancement lesions that were missed in screening with MRI, respectively. Further improvement is required to detect focus lesions. The integration of such a system in clinical practice might aid radiologists to avoid screening errors.

CLINICAL RELEVANCE/APPLICATION

Automated lesion detection in breast MRI can facilitate breast cancer screening and reduce reading errors.

SSQ20-09 Optimisation of the Selection of Women with an Increased Risk of a Masked Tumour for Supplementary Screening

Thursday, Dec. 3 11:50AM - 12:00PM Location: S404AB

Participants
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PURPOSE

The sensitivity of mammograms is low for women with dense breasts, because cancers may be masked by dense tissue. In this study we investigate methods to identify women with density patterns associated with a high masking risk. Four methods based on quantitative volumetric breast density analysis are compared to an area based density measure.

METHOD AND MATERIALS

We used the last negative screening mammograms of 87 women who subsequently presented an interval cancer (IC), and 870 randomly selected normal screening exams from women without cancer as controls. Volumetric breast density maps (VBDMs) were computed using software provided by Matakina (Wellington, New Zealand). These maps provide the dense tissue thickness for each pixel location. We used the VBDMs to compute four masking measures: 1) Volume of glandular tissue (VGT), 2) Percent dense volume (PDV), 3) Percent area where dense tissue thickness exceeds 1cm (PA1), and 4) Possibility that there is a tumor, with diameter t, at a location with dense tissue thickness d, normalized to the breast area, taking into account the size distribution of screen detected cancers (PT). In addition we determined percentage dense area (PDA) after classifying pixels automatically in dense and non-dense classes using a random forest classifier. Methods were applied to MLO views and then averaged per exam. For each method, we selected cases with the highest masking measure by thresholding and computed the fraction of ICs as a function of the fraction of controls selected. Furthermore we computed the ratio between IC with supplemental screening offer and the supplemental screening rate.

RESULTS

The highest ratio between IC and supplemental screening rate has been observed for PA1 with a screening rate of 5% and a sensitivity of almost 20%. For screening rates above 20%, the highest response of IC can be observed when using PA1 and PT for stratification.

CONCLUSION

We showed that the different breast density measures are suited for stratification. A careful choice of the stratification criteria is necessary depending on the number of women that one is willing to offer supplemental screening.

CLINICAL RELEVANCE/APPLICATION

To make supplemental breast cancer screening feasible and cost efficient, it is necessary to have a high response in the target group while the selected women in the overall screening population remains low.

INS-THA

Informatics Thursday Poster Discussions

Thursday, Dec. 3 12:15PM - 12:45PM Location: IN Community, Learning Center

IN

AMA PRA Category 1 Credit ™: .50

Participants
Arnon Makori, MD, Chicago, IL (*Moderator*) Medical Advisory Board, Carestream Health, Inc

Sub-Events

IN248-SD-THA1 Clear Cell RCC: Discrimination from Other RCC Subtypes and Oncocytoma Using Multiphasic MDCT Texture and Surface Features

Station #1

Participants
Jonathan R. Young, MD, Los Angeles, CA (*Presenter*) Nothing to Disclose
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Heidi Coy, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose
Hyung J. Kim, PhD, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose
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Steven S. Raman, MD, Santa Monica, CA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To investigate whether multiphasic MDCT texture and surface features can discriminate clear cell renal cell carcinoma (ccRCC) from papillary RCC (pRCC), chromophobe RCC (chRCC), and oncocytoma. ccRCC is the most common and lethal subtype of RCC. pRCC and chRCC are RCC subtypes that have a more favorable prognosis than ccRCC. Oncocytoma are benign mimics of RCC.

METHOD AND MATERIALS

With IRB approval for this HIPAA-compliant retrospective study, we derived a cohort of 102 ccRCCs, 39 pRCCs, 16 chRCCs, and 29 oncocytomas with preoperative 4-phase MDCT (comprised of unenhanced, corticomedullary, nephrographic, and excretory phases). The cohort was divided into two equal parts for training and testing purposes. Each lesion was segmented in all phases using proprietary software. All contours were reviewed by a fellowship-trained GU radiologist. Histogram distribution and texture features of the surface and the whole lesion volume were calculated for each lesion. Sequential forward feature selection, followed by sequential backward feature selection, was used to select features to discriminate ccRCC from pRCC, chRCC, and oncocytoma using a logistic regression classifier, where weighted accuracy is maximized.

RESULTS

In the training set, accuracies ranging from 84-98% in discriminating ccRCC from pRCC, chRCC, and oncocytoma were achieved. In the testing set, the classifier discriminated ccRCC from pRCC with an accuracy up to 84%. The classifier discriminated ccRCC from chRCC and oncocytoma with accuracies only up to 64%.

CONCLUSION

Histogram distribution and texture features on multiphasic MDCT can help discriminate ccRCC from pRCC with a relatively high accuracy. Although discriminating ccRCC from chRCC and oncocytoma appeared promising in our training set, accuracies only up to 64% were obtained in the testing set. These low accuracies in the testing set may reflect variability within chRCCs and oncocytomas that is larger than what is captured in our training set, causing large discrepancies between the training and testing sets.

CLINICAL RELEVANCE/APPLICATION

Histogram distribution and texture features on multiphasic MDCT can help discriminate ccRCC from pRCC and thus provide a non-invasive means of guiding further management.

IN249-SD-THA2 The Evaluation of Glomerular Filtration Rate (GFR) based on Quantitative Iodine Density Images through Spectral CT Imaging

Station #2

Participants
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Long Cui, MD, PhD, Shenyang, China (*Presenter*) Nothing to Disclose

PURPOSE

To investigate the feasibility and accuracy of measuring GFR of contralateral renal in patients with renal cell carcinoma by using material decomposition algorithm in single-source dual-energy spectral CT images (sDECT).

METHOD AND MATERIALS

In this study, twenty patients with renal cell carcinoma were scanned in a single-source dual-energy spectral CT imaging

technique. And iodine-based material decomposition images were reconstructed. Glomerular filtration rate(GFR) of contralateral renal was calculated as relative GFR using simplified "two-point Patlak plot" with iodine concentration. Renal scintigraphy was used as the reference.

RESULTS

The measured GFR using iodine concentration showed strongly correlation with no significant difference from renal scintigraphy($p>0.05$,t test) and the Pearson correlation coefficient was 0.933($p<0.001$), split renal function(CT)=13.744+0.724×split renal function(renal scintigraphy).

CONCLUSION

The material decomposition analysis of the Spectral CT can measure iodine concentration more easily and consistently, and it provided an accurate semi-quantitative determination of GFR measurement.

CLINICAL RELEVANCE/APPLICATION

Glomerular Filtration Rate based on quantitative Iodine density images in spectral CT imaging can be a promising new way to evaluate kidney function.

IN250-SD-THA3 Machine Learning Software for Automated Image Segmentation and Quantitative Analysis of Glioblastomas - Generating Virtual Expert Consensus

Station #3

Participants
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PURPOSE

Create virtual expert consensus to perform automated image segmentation for analyzing MRI of glioblastomas (GBMs).

METHOD AND MATERIALS

MRI may potentially provide a means of predicting clinical and genomic features of GBMs. The Response Assessment in Neuro-Oncology (RANO) Working Group suggested volumetric tumor assessment may help overcome limitations of typical linear measurements, but did not recommend immediate adoption due to a lack of standardization and clinical availability.Machine learning enables multiple experts to train software for automated image analysis, thus creating virtual expert consensus. The method was implemented with Weka machine learning software and FIJI, a variant of NIH ImageJ. Fully automated segmentation was performed based on voxel intensities (T1w, T2w, FLAIR, and postcontrast T1w) and local spatial parameters (e.g. structure tensor). Voxel classifications include skull/extracranial tissues, brain, total tumor, and enhancing tumor. Hard and fuzzy segmentation can be performed.10 image sets were segmented individually by two radiologists, a board certified neuroradiologist and a senior PGY-5 radiology resident for training the software. Leave-one-out cross-validation testing was performed, i.e. each case was automatically segmented based on training with the 9 other cases. The segmentations of each operator were compared with one another and with the automated method using Jaccard similarity indices (JI).

RESULTS

Mean JI between the automated method and operators 1 and 2 was 0.95 and 0.94, respectively, for skull-stripping. Mean JI ranged from 0.72 to 0.74 for total tumor and for enhancing tumor segmentation. Although mean JI for tumor segmentation was lower, agreement between the operators was on the same order at 0.78 and 0.79 for total and enhancing tumor, demonstrating inter-observer variability. JI for single cases ranged from 0.5 to 0.9 with lower agreement occurring with ill-defined tumor. Fuzzy classification may be helpful in these cases.

CONCLUSION

Automated image segmentation based on machine learning provides virtual expert consensus for analyzing MRI of GBMs and may help ongoing efforts to apply quantitative image analysis on a larger scale by providing a standard.

CLINICAL RELEVANCE/APPLICATION

Generating virtual expert consensus by enabling multiple radiologists train machine learning algorithms may facilitate quantitative image analysis of brain tumors and other pathologies.

IN251-SD-THA4 Correlation and Consistency between Subjective Radiologist's Perception and Objective RECIST (Response Evaluation Criteria in Solid Tumors) Assessment of Oncological Lesion Change in Trial Patients

Station #4

Participants
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PURPOSE

RECIST defines objective measures for interval change of oncological disease in treatment trial patients. Disease progression is defined as increase of sum index lesion size by ≥20% from most recent prior exam communicated in the radiology report. Reports typically also contain a subjective, qualitative description of each index lesion's size change, which may or may not follow RECIST. The purpose of our study was to evaluate how percent change in index lesion size corresponds to the change perceptions described in the report and how this correlates with RECIST's ≥20% threshold for progression.

METHOD AND MATERIALS

90 RECIST worksheets were obtained of trial patients (IRB 13-0397). For each measurement on the worksheet, percent change was computed with respect to the most recent prior exam, the qualitative change description was manually extracted from the exam's radiology report and normalized onto a five-point scale (Decreased; Minimally Decreased; Stable; Minimally Increased; Increased). For each scale item, average growth was computed. Cohen's κ statistic is used to assess consistency of the normalized qualitative descriptions Increased with RECIST's ≥20% thresholds.

RESULTS

The worksheets contained 874 lesion measurements; 374 had a qualitative change description in the report (211 Stable; 22 Minimally Increased; 60 Increased). 31.7% (19/60) of Increased lesions had change <20%; 40.9% (9/22) of Minimally Increased lesions had change ≥20%.Average growth for Minimally Increased lesions was 18%±12% and 39%±34% for Increased lesions. Consistency between Increased lesion change described as Increased and RECIST's >20% threshold was κ = 0.62. Maximum κ = 0.65 was observed for threshold ≥12%. For tumors, maximum κ = 0.72 was observed at threshold ≥11%; for lymph nodes (LNs) in long axis, maximum κ = 0.74 at ≥28%; for LNs in short axis, maximum κ = 0.61 at ≥26-29%.

CONCLUSION

Radiologists' qualitative assessment of lesion size increase shows only fair to reasonable agreement with threshold values established by RECIST. With the exception of LN growth, radiologists use a smaller threshold value to differentiate stable from increased size compared to RECIST threshold values.

CLINICAL RELEVANCE/APPLICATION

Oncologic disease status plays a critical role in determining patient eligibility in clinical trails and optimizing treatment, which emphasizes the need for consistency between radiologists' assessment and RECIST criteria.

IN252-SD-THA5 From Paper to Voice: Voice-activating the Universal Protocol Time-Out Process in Interventional Radiology

Station #5

Participants
Colin J. McCarthy, MD, Boston, MA (*Presenter*) Nothing to Disclose
Alvin Y. Yu, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Garry Choy, MD, MS, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Raul N. Uppot, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

CONCLUSION

Application of a voice-guided electronic checklist on a mobile platform is time-efficient and brings relevant information to the clinical team at the point-of-care, increasing team-work, compliance, accountability, and patient safety.

Background

The Universal Protocol was developed to prevent wrong site, wrong procedure and wrong person surgery. All procedures, including in Interventional Radiology (IR), require a pre-procedure time-out. In situations where volume is high, there is possibility for error, omission, or non-compliance during the time out process.We developed a mobile platform that gives voice to the EHR - CADI (Clinical Assist Decision Interface) vocalizes information integrated from the EHR, decision support and ancillary clinical workflow systems to bring real-time information to the point-of-care for the time-out process.

Evaluation

We deployed CADI during the time-out process within IR. Before a procedure, CADI vocalizes patient identity, procedure type/side, pertinent lab values/meds, and allergies at the point-of-care. Subjectively, the CADI time-out process takes 60-90 seconds to complete.For the study, we manually validated CADI's time-out information on 19 patients over a 2 week period. A Clinical Fellow first conducted a traditional manual paper-based time-out with pre-collected patient information. CADI then vocalized the same information peri-procedurally and was graded by hand according to "correct," "incorrect," or "missing" responses (Figure 1). The overall precision was 99% and recall was 91%.

Discussion

We have deployed a voice-based electronic time-out system with high precision and recall (> 90%). The design favors precision over recall, as accuracy of information retrieved is valued over comprehensiveness. In summary, CADI is intended to be a natural participant in the time-out process for information reconciliation rather than a human substitute.There are many benefits to the system. Information is retrieved in real-time. The voice aspect encourages teamwork, prompting team members and even patients to actively participate. Events are recorded, allowing compliance tracking and documentation. The time-out sequence is customizable for different specialties and procedures.

IN011-EC-THA6 Automated Multi-Atlas Segmentation of Cartilage from Knee MR Images Using Locally-Weighted Voting and Graph Cuts

custom application computer demonstration

Participants
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CONCLUSION

Our method can be applied to the segmentation of tibial and patellar cartilages, and can be used in morphometric assessment for diagnosis, prognosis and treatment planning of OA.

FIGURE (OPTIONAL)

http://abstract.rsna.org/uploads/2015/15016975/15016975_z4f6.jpg

Background

Automated segmentation of cartilage from knee MR images is a prerequisite process for the morphometric assessment of cartilage structure. However, it has suffered from the challenges of cartilage due to the low contrast surroundings and large variations of appearance and shape. We propose an automatic segmentation method of cartilage in knee MRI using multi-atlas-based locally-weighted voting (LWV) and graph cuts.

Evaluation

Our method was tested on a dataset consisting of 14 volumetric 3T PD VISTA coronal knee joint MRI scans of osteoarthritis (OA) patients. All images were acquired using Achieva 3.0T Philips Medical systems with a pixel size of 0.31mm, a slice thickness of 0.5mm and 512 x 512 resolutions. For training atlases, all images were manually segmented by three experts and tested by leave-one-out validation method. In atlas selection, coronal slab-average projection images were generated in training and target image and 2D affine registration was performed to select similar training images to the target image. In bone segmentation, bone atlases were aligned to the target bone by volume- and object-based two-stage 3D affine registration. Bone was then segmented with these aligned bone atlases using LWV and graph cuts. In cartilage segmentation, cartilage atlases were aligned to the target cartilage by applying bone's 3D affine transformations. Then shape-constrained weighting of LWV and graph cuts were proposed to restrict the cartilage label near the bone surfaces. For evaluation, our segmentation results were visually assessed and Dice similarity coefficient was measured between automatically and manually segmented femur and femoral cartilages.

Discussion

Atlas selection enabled our method to be robust to the variation of the cartilage shape. Volume- and object-based two-stage alignment reduced the misalignment of target and training atlases without non-rigid registration. Our shape-constrained weighting of LWV and graph cuts enabled our method to avoid the leakage into low contrast surroundings.

IN012-EC-THA7 Computer Simulation of Contrast Enhancement in the Whole Body: A Highly Accurate Simulation of the Bolus Transmission of Contrast Material in Individual Organs

custom application computer demonstration

Participants
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Masao Kiguchi, RT, Hiroshima, Japan (*Abstract Co-Author*) Nothing to Disclose
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CONCLUSION

Accurate simulation of the CE in individual organs was achieved with our simulation model in which individual organs were divided into sub-compartments and the bolus transmission of CM in these organs was modeled.

FIGURE (OPTIONAL)

http://abstract.rsna.org/uploads/2015/15009650/15009650_yf4a.jpg

Background

An understanding of the hemodynamics of contrast material (CM) is indispensable for planning the optimal CM administration protocol at CT or MRI. A numerical simulation model for analyzing contrast enhancement (CE) in the whole body has been proposed [Bae et al., Radiology, 98]. While it is useful for predicting CE in organs, it does not consider the bolus transmission of CM in individual organs and the precision of calculations is not certain at faster CM injection speeds. We propose a highly accurate simulation method that considers the bolus transmission of CM in individual organs.

Evaluation

The conventional simulation model assumes that the CM is mixed immediately and completely in all organs. Our method subdivides individual organs into sub-compartments to simulate the transmission of CM within organs. Subdivided compartments are connected serially and the transmission effects are internally restricted to each sub-compartment. The proposed simulation method was implemented using the C# programming language. To convert accurately the CM concentration into the CT value we calculated the

conversion coefficient by measuring the actual CT values of the CM. Conversion coefficients were acquired from scans using iohexol (300 mgI/mL) and a 320-row detector scanner (Aquilion ONE, Toshiba Medical Systems). We validated the accuracy of our method by comparing the simulated- with the actual time density curves (TDC) acquired in individual patient organs.

Discussion

While a second extremum in the TDC of the aorta attributable to CM re-circulation did not appear in the conventional model, it did in ours (see attached figure). The time course and magnitude of the first and second extremum in the TDC of individual organs in our model was analogous to the TDC obtained in patients. Our simulation was more accurate than the conventional model with respect to both the shape and the extremum value of the TDC of all organs.

IN013-EC-THA8 Lesion Registration for Longitudinal Disease Tracking Using Thin-Plate Splines Deformation for Multiple Sclerosis eFolder

custom application computer demonstration

Participants
Kevin C. Ma, MS, Los Angeles, CA (*Presenter*) Nothing to Disclose
Xuejun Zhang, PhD, Nanning City, China (*Abstract Co-Author*) Nothing to Disclose
Lilyana Amezcua, MD, Los Angeles, CA (*Abstract Co-Author*) Consultant, Biogen Idec Inc Consultant, Bayer AG Consultant, Teva Pharmaceutical Industries Ltd Consultant, Merck KGaA Consultant, Pfizer Inc Advisory Board, Biogen Idec Inc Advisory Board, Bayer AG Advisory Board, Teva Pharmaceutical Industries Ltd Advisory Board, Pfizer Inc Advisory Board, Merck KGaA Speaker, Biogen Idec Inc Speaker, Bayer AG Speaker, Teva Pharmaceutical Industries Ltd Speaker, Merck KGaA Speaker, Pfizer Inc
Mark S. Shiroishi, MD, Los Angeles, CA (*Abstract Co-Author*) Consultant, Guerbet SA; Research Grant, Toshiba Corporation;
Alexander Lerner, MD, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose
Brent J. Liu, PhD, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose

CONCLUSION

A MS lesion registration process has been demonstrated for tracking longitudinal lesion changes for multiple sclerosis patients. The TPS-based algorithm is able to perform brain warping and normalization, and the results are integrated with MS eFolder data and displayed on the web-based user interface.

Background

Previously, we have demonstrated an imaging informatics system, MS eFolder, which integrates multiple sclerosis patients' clinical data with imaging and quantified white matter lesion data. The system is web-based with a DICOM-compliant system workflow, and performs complex data analysis and data mining for MS. This year, we aim to highlight disease progress monitoring by applying brain normalization and registration algorithms to register lesions in longitudinal studies. Patients' MRI brain studies are normalized to ICBM template, and lesions are identified and registered in subsequent longitudinal studies. The brain warping algorithm is based on thin-plate splines deformation (TPS) and provides a user interface to perform semi-automatic image warping. We aim to demonstrate the user interface, results of brain warping and lesion registration, and complete patient profiles and lesion tracking in longitudinal MS studies.

Evaluation

We have collected clinical and imaging data from 15 patients with 4 longitudinal studies each. Quantitative lesion analysis, including lesion volumes, number of lesions, lesion locations, and brain parenchyma ratio, are performed by the automatic CAD algorithm. A user interface for the TPS warping program guides the user to mark select points and perform image warping to the ICBM brain atlas. The resulting normalized brain provides standardized coordinate maps for identifying lesion location and registering lesions in longitudinal studies. A web-based user interface for MS eFolder is modified to display lesion changes and contours over native DICOM images.

Discussion

We have successfully applied TPS-based warping algorithm on the brain MRI images. The web-based user interface is able to display the results of MS lesion registration and tracking in longitudinal studies. Lesion size changes can be observed and related to patients' clinical and social history.

RCA53

National Library of Medicine: Find Articles You Need: Searching PubMed/MEDLINE Efficiently (Hands-on)

Thursday, Dec. 3 12:30PM - 2:00PM Location: S401AB

IN

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
Marilia Y. Antunez, MA, Fredonia, NY (*Presenter*) Nothing to Disclose
Holly Ann Burt, MLIS, Chicago, IL (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand how PubMed constructs a query and how to develop and refine effective search strategies in radiology. 2) Use PubMed tools including Clinical Queries, Related Articles, Single Citation Matcher and Loansome Doc. 3) Build focused searches using the Medical Subject Headings (MeSH) vocabulary for radiology and limit searches to radiology-oriented journals. 4) Understand how to save and download citations.

ABSTRACT

This hands-on workshop covers key searching techniques, changes to PubMed, and how to develop effective search strategies for PubMed and MEDLINE. Topics covered include: why keywords don't always give the results you expect, how to limit to specific journals, quick searches to find evidence-based citations, how to access full-text articles, and downloading citations to reference manger programs. The National Library of Medicine (NLM) provides free web access to nearly 24 million citations for biomedical and clinical medical articles through PubMed (available online at PubMed.gov). MEDLINE is a subset of PubMed which includes links to sites providing full text articles and to other related databases and resources.

URL

Handout:Holly Ann Burt

http://abstract.rsna.org/uploads/2015/14003436/2015pubmedRSNA.pdf

RCC53

Next Generation Infrastructure for Medical Imaging (In Association with the Society for Imaging Informatics in Medicine)

Thursday, Dec. 3 12:30PM - 2:00PM Location: S501ABC

IN

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
Paul J. Chang, MD, Chicago, IL, (pchang@radiology.bsd.uchicago.edu) (*Moderator*) Co-founder, Stentor/Koninklijke Philips NV; Researcher, Koninklijke Philips NV; Medical Advisory Board, lifeIMAGE Inc; Medical Advisory Board, Merge Healthcare Incorporated

LEARNING OBJECTIVES

1) The participant will be introduced to the importance of information system integration and interoperability to support modern imaging informatics workflow. 2) Examples of practical integration strategies that have been used successfully (e.g. web viewer EHR integration, single sign-on, RIS vs PACS driven workflow) will be discussed. 3) Advanced integration strategies, including using vendor APIs, state aggregation, SOA, and IHE, will be presented.

ABSTRACT

Modern imaging informatics workflow requires consumption, choreography, and orchestration of content from multiple disparate information systems that do not natively "talk to each other." Without optimal integration and interoperability amongst these systems, humans are required to serve as "integrating agents:" this frequently results in inefficiency and error. This session will provide an introduction to the importance of system integration and will provide a practical introduction to commonly used integration strategies. In addition, more advanced integration approaches, including leveraging vendor APIs (application programming interfaces), IHE, and SOA (service oriented architecture) will be discussed.

Sub-Events

RCC53A Interoperability and Integration-from HL7, DICOM, IHE, to SOA

Participants
Paul J. Chang, MD, Chicago, IL, (pchang@radiology.bsd.uchicago.edu) (*Presenter*) Co-founder, Stentor/Koninklijke Philips NV; Researcher, Koninklijke Philips NV; Medical Advisory Board, lifeIMAGE Inc; Medical Advisory Board, Merge Healthcare Incorporated

LEARNING OBJECTIVES

1) The participant will be introduced to the importance of information system integration and interoperability to support modern radiology workflow. 2) Examples of practical integration strategies that have been used successfully (e.g. web viewer EHR integration, single sign-on, RIS vs PACS driven workflow) will be discussed. 3) Advanced integration strategies, including using vendor APIs, state aggregation, SOA, and IHE, will be presented.

ABSTRACT

Modern radiology workflow requires consumption, choreography, and orchestration of content from multiple disparate information systems that do not natively "talk to each other." Without optimal integration and interoperability amongst these systems, humans are required to serve as "integrating agents:" this frequently results in inefficiency and error. This session will provide an introduction to the importance of system integration and will provide a practical introduction to commonly used integration strategies. In addition, more advanced integration approaches, including leveraging vendor APIs (application programming interfaces), IHE, and SOA (service oriented architecture) will be discussed.

RCC53B Image Sharing-A Fond Farewell to CDs

Participants
David S. Mendelson, MD, Larchmont, NY (*Presenter*) Spouse, Employee, Novartis AG; Advisory Board, Nuance Communications, Inc; Advisory Board, General Electric Company; Advisory Board, Toshiba Corporation

LEARNING OBJECTIVES

1) Understand the importance of Image Sharing / Exchange with regard to the quality of care a radiologist delivers as well as to efforts to control costs. 2) Understand the benefits and pitfalls of CDs and the transition to internet based sharing. 3) Understand the different internet (Cloud) based solutions that are available and what distinguishes them. 4) Learn that the cloud can be employed not only for archival but for a variety of radiology services. 5) Learn about the IHE XDS-I and related profiles and their role in internet based image exchange. 6) Understand what solutions a radiologist might implement at this time. 7) Understand how image exchange fits into the broader efforts directed at healthcare information exchange and interoperability through EHRs.

ABSTRACT

The safe and secure exchange of heatlhcare information is of paramount importance in delivering the highest quality of care to our patients. The realm of Health Information Exchange while nascent is undergoing explosive growth. The exchange of radiologic exams and reports must be tightly integrated into this process. Radiological images have historically presented some unique challenges. This session will focus on existing solutons for image exchange/interoperability and discuss how it is expected to evolve over the next few years through the use of internet based technologies.

RCC53C Vendor Neutral Archives vs Archive Neutral Vendors: Towards the Next Generation Archive

Participants

Richard L. Kennedy, MSc, Sacramento, CA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand the differences between vendor neutral archives, archive neutral vendors, and cloud archives. 2) Identify key strategic advantages and disadvantages of these three respective models of archival. 3) Observe some potential obstacles to implementation of these three respective models of archival.

INS-THB

Informatics Thursday Poster Discussions

Thursday, Dec. 3 12:45PM - 1:15PM Location: IN Community, Learning Center

IN

AMA PRA Category 1 Credit ™: .50

Participants
Arnon Makori, MD, Chicago, IL (*Moderator*) Medical Advisory Board, Carestream Health, Inc

Sub-Events

IN253-SD-THB1 Automated Radiomic Features Complement the Prognostic Value of VASARI in the TCGA-GBM Dataset

Station #1

Participants
Emmanuel Rios Velazquez, PhD, Boston, MA (*Presenter*) Nothing to Disclose
Vivek Narayan, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Patrick Grossmann, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
William D. Dunn JR, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose
David Gutman, MD, PhD, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose
Hugo Aerts, PhD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To compare the complementary prognostic value of automated Radiomic features to that of radiologist-annotated VASARI features in TCGA-GBM MRI dataset.

METHOD AND MATERIALS

For 96 GBM patients, pre-operative MRI images were obtained from The Cancer Imaging Archive. The abnormal tumor bulks were manually defined on post-contrast T1w images. The contrast-enhancing and necrotic regions were segmented using FAST. From these sub-volumes and the total abnormal tumor bulk, a set of Radiomic features quantifying phenotypic differences based on the tumor intensity, shape and texture, were extracted from the post-contrast T1w images. Minimum-redundancy-maximum-relevance was used to identify the most informative Radiomic, VASARI and combined Radiomic-VASARI features in 70% of the dataset (training-set). Multivariate Cox-proportional hazards models were evaluated in 30% of the dataset (validation-set) using the C-index for OS. A bootstrap procedure was used to assess significance while comparing the C-Indices of the different models.

RESULTS

Overall, the Radiomic features showed a moderate correlation with the radiologist-annotated VASARI features (r = -0.37 - 0.49); however that correlation was stronger for the Tumor Diameter and Proportion of Necrosis VASARI features (r = -0.71 - 0.69). After MRMR feature selection, the best-performing Radiomic, VASARI, and Radiomic-VASARI Cox-PH models showed a validation C-index of 0.56 (p = NS), 0.58 (p = NS) and 0.65 (p = 0.01), respectively. The combined Radiomic-VASARI model C-index was significantly higher than that obtained from either the Radiomic or VASARI model alone (p = <0.001).

CONCLUSION

Quantitative volumetric and textural Radiomic features complement the qualitative and semi-quantitative annotated VASARI feature set. The prognostic value of informative qualitative VASARI features is increased with the addition of quantitative features from the contrast-enhancing and necrotic tumor regions. These results should be further evaluated in larger validation cohorts.

CLINICAL RELEVANCE/APPLICATION

Radiomics is an emerging field with tremendous potential to revolutionize the way in which we monitor the response of cancers to therapy. The prognostic value of informative qualitative VASARI features is increased with the addition of quantitative features from the contrast-enhancing and necrotic tumor regions in GBM. The VASARI feature set could incorporate quantitative imaging tumor descriptors.

IN254-SD-THB2 Head Mounted Display with Multi Display Mirroring and 3D Navigator for Augmented Reality in Interventional and Surgical Procedures

Station #2

Participants
Marco Solbiati, Busto Arsizio, Italy (*Presenter*) Nothing to Disclose
Alessandro Rotilio, Milano, Italy (*Abstract Co-Author*) Shareholder, RAW Srl
Giovanni Mauri, MD, San Donato Milanese, Italy (*Abstract Co-Author*) Consultant, Esaote SpA
Tiziana Ierace, MD, Busto Arsizio, Italy (*Abstract Co-Author*) Nothing to Disclose
Luigi Solbiati, MD, Busto Arsizio, Italy (*Abstract Co-Author*) Nothing to Disclose

CONCLUSION

MDM and 3DN are new technologies in the field of augmented reality. Results of our experience were positive for each variable By offering real time visualization of preacquired images, and an elevated special accuracy, such technologies hold the potential of improving operator performances, reducing operating time with an enhanced comfort. HDM with MDM and 3DN may help sparing space in operatory theatre with a potential cost reduction.More investigations and comparisons of MDM and 3DN with standard techniques are needed to better assess all the potential applications and the results in clinical setting.

Background

Head Mounted Displays (HMD) are new devices that can display several information during interventional or surgical procedures

Head Mounted Displays (HMD) are new devices that can display several information during interventional or surgical procedures. Multi-Display Mirroring (MDM) and 3D Navigator (3DN) implements two main purviews: a) better ergonomy in looking at data and b) superimposition of information to real life environment. MDM is a new device able to transfer multiple data and preacquired images to the same HMD. 3DN is a software that produces a 3D reconstruction of the patient's images and can superimpose it on the patient's body.

Evaluation

Operator's comfort, continuity of data streams, and time saving for MDM and 3DN were estimated by operators on a 1-10 subjective scale. Accuracy of localization for 3DN was evaluated by measuring distance between real lesion seen on ultrasound and virtual lesion.Estimations were respectively for MDM and 3DN (mean ± standard deviation): 8±2 and 7±1 for operator's comfort, 9±1 and 8±1 for continuity of data streams, and 9±1 and 9±1 for time saving. Accuracy of localization was 2±0.5 mm.

Discussion

MDM and 3DN are devices able to help clinicians obtaining more information and better visualization. Operator's gave an elevated score of comfort, continuity of data streams, and time saving for both MDM and 3DN. Accuracy of localization of 2mm seems to be adequate for clinical application in vivo. As several different images from different sources can be visualized with HDM, this solution may also help sparing space in operatory theatre with a potential cost reduction.

IN255-SD-THB3 3D Visualization and Quantification of Carotid Intra-Plaque Hemorrhage, an Imaging Biomarker for Atherosclerotic Disease

Station #3

Participants
Mariam Afshin, PhD,MENG, Toronto, ON (*Presenter*) Nothing to Disclose
Navneet Singh, MD, Toronto, ON (*Abstract Co-Author*) Nothing to Disclose
Tishan Maraj, Toronto, ON (*Abstract Co-Author*) Nothing to Disclose
Tina Binesh Marvasti, Toronto, ON (*Abstract Co-Author*) Nothing to Disclose
Alan R. Moody, MD, Toronto, ON (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Carotid intra-plaque hemorrhage (IPH) is an imaging biomarker that can predict progression of atherosclerosis which is estimated to cause one quarter of all strokes. We propose a novel semi-automatic assessment technique based on a 3D segmentation algorithm to facilitate vessel wall characterization and quantify IPH volumes using 3D MRI sequence.

METHOD AND MATERIALS

Following IRB approval, a total of 20 patients were imaged using a 3T MRI scanner and a 16-channel neurovascular coil. 3D-MRIPH, a rapid T1-weighted fat suppressed gradient-echo, and 3D time-of-flight (TOF) sequences were used to acquire images in coronal and axial planes respectively. To make consistent measurements across subjects, a 4 cm segment of the vessel at the index-carotid bifurcation were considered. A trained user was asked to mark one distal and one proximal point on the maximum intensity projection of the 3D TOF sequence. Shape prior and signal intensity information were used to detect lumen boundary. The lumen boundary was then registered to the corresponding images in the MRIPH sequence. The same procedure was repeated to detect the outer wall. Sternocleidomastoid (SCM) muscle was segmented manually in a single slice of MRIPH in the transverse plane just distal to the bifurcation. The mean intensity of the region inside SCM contour was used to detect IPH volume automatically using an adaptive thresholding algorithm set at 1.5 times the signal intensity of SCM.

RESULTS

a) Presence of the IPH visually corresponds with thickening and high intensity profile in the vessel. The larger the IPH region, the thicker the vessel. VWT (Vessel Wall Thickness) and VWI (Vessel Wall Intensity) maps can provide complementary information to facilitate diagnosis of the atherosclerosis disease. b) Estimated IPH volumes correlate well with those estimated manually by an expert radiologist (R=0. 97).

CONCLUSION

We developed a semi-automatic vessel wall framework based on the intensity and thickness in MR images estimated from user-provided delineation of only two slices. The algorithm was evaluated on 40 carotids of 20 subjects and was demonstrated as an effective tool to diagnose atherosclerotic disease.

CLINICAL RELEVANCE/APPLICATION

3D visualization and quantification of vessel wall and IPH volumes semi-automatically provides a rapid means of presenting complex image data which represent imaging biomarkers of complex atherosclerotic disease.

IN256-SD-THB4 PRONTO: Open Source Webapp for Management of Imaging Protocols and Protocol Updates

Station #4

Participants
Joanna G. Escalon, MD, New York, NY (*Presenter*) Nothing to Disclose
Lilin Wang, MENG, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Gray R. Lyons, MD,PhD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Roger J. Bartolotta, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Apostolos J. Tsiouris, MD, New York, NY (*Abstract Co-Author*) Research Consultant, BioClinica, Inc
George L. Shih, MD, MS, New York, NY (*Abstract Co-Author*) Consultant, Image Safely, Inc; Stockholder, Image Safely, Inc; Consultant, Angular Health, Inc; Stockholder, Angular Health, Inc;

CONCLUSION

PRONTO provides a practical way to manage protocols and the process of updating protocols through email notifications, making a practice always ready for high quality imaging.

Background

Keeping CT and MR protocols up-to-date is of paramount importance for patient safety (e.g., minimizing radiation dose) and for sustaining a high quality imaging practice. Managing the process of protocol changes from committee decisions to implementing modality updates has been a cumbersome process, especially with many practices using Word or Excel files.

Evaluation

We developed a free open source web-based protocol management system (Demo: http://pronto.trove.nyc) using an open source LAMP software stack using the PHP CodeIgniter Framework (Source Code: http://src.pronto.trove.nyc) to manage the process of protocol updates. This software allows for easy distribution (web-based), updating (CSV upload), and notification (email notification for new and modified protocols). We created standard spreadsheets with defined columns for both CT and MR parameters. Protocol changes involve (1) editing the spreadsheet and (2) then uploading the CSV. The webapp will automatically detect any new protocols or changes to existing protocols, which will (3) trigger an email notification.We currently have uploaded our CT protocols (total of 162 protocols), and are working to upload our MR protocols.

Discussion

Protocol management and standardization has become an important part of most radiology practices. While some 3rd party vendor tools are available, many practices use standard documents or spreadsheets for management. Our solution provides a free convenient web-based way to distribute protocols to physicians and technologists, and also manage the process of protocol updates with email notifications to appropriate parties. Other features include a history log to keep track of protocol modification dates and who updated them. A search box allows protocols to be located by name and/or indication, which may be helpful for residents and technologists during the protocoling process. Each protocol also has a unique URL that can be easily shared. Protocols can be easily exported and backed up with a single click.

RCC54

The Use of Business Analytics for Improving Radiology Operations, Quality, and Clinical Performance (In Association with the Society for Imaging Informatics in Medicine)

Thursday, Dec. 3 2:30PM - 4:00PM Location: S501ABC

IN LM SQ

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
Katherine P. Andriole, PhD, Dedham, MA (*Moderator*) Advisory Board, McKinsey & Company, Inc;

LEARNING OBJECTIVES

1) Understand what is meant by business analytics in the context of a radiology practice. 2) Be able to describe the basic steps involved in implementing a business analytics tool. 3) Learn how business analytics tools can be used for quality assurance in radiology, for maintenance of certification (MOC), and for practice quality improvement. 4) Be introduced to the capabilities of current and potential future business analytics technologies.

ABSTRACT

This course will provide an overview of the use of business analytics (BA) in radiology. How a practice manages information is becoming a differentiator in the competitive radiology market. Leveraging informatics tools such as business analytics can help a practice transform its service delivery to improve performance, productivity and quality. An introduction to the basic steps involved in implementing business analytics will be given, followed by example uses of BA tools for quality assurance, maintenance of certification (MOC) and pracitce quality improvement . The power of current business analytics technologies will be described, along with a look at potential future capabilities of business analytics tools.

Sub-Events

RCC54A Introduction to Business Analytics Demonstrating Application to Radiology

Participants
Katherine P. Andriole, PhD, Dedham, MA (*Presenter*) Advisory Board, McKinsey & Company, Inc;

LEARNING OBJECTIVES

1) Gain an overview of business analytics tools and understand how they might be used in radiology. 2) Be able to describe the general steps involved in business analytics, including extract, transform, load (ETL) and key performance indicators (KPI). 3) See a demonstration implementation of an open-source business analytics tool using a radiology use case.

ABSTRACT

This session will provide a general overview of business analytics concepts and how they can be used in radiology. A walk through of the basic steps involved in implementation including identifying, collecting, transforming, and dynamically presenting key performance indicators (KPI) will be demonstrated. The extract, transform, load (ETL) steps will be shown using an example use case, and multiple database sources taken from a radiology practice.

RCC54B Operational and Predictive Analytics in Radiology

Participants
Paul G. Nagy, PhD, Baltimore, MD, (pnagy@jhu.edu) (*Presenter*) Institutional license agreement, Analytical Informatics, Inc

LEARNING OBJECTIVES

1) Explain the big data science and radiology. 2) Identify the role of informatics in capturing, extracting, analyzing, and communication quality projects. 3) Illustrate graphical dashboarding examples to support quality efforts.

ABSTRACT

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Paul G. Nagy, PhD - 2014 Honored Educator

RCC54C Capabilities of Current and Future Business Analytics Technologies

Participants
Mindy Licurse, MD, Philadelphia, PA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To gain familiarity with currently available business technologies and their relevance to radiology practice. 2) To consider how existing business technologies can support quality assurance in radiology. 3) To learn about business analytics features that may be available/desirable in the future to augment and support both the practice of radiology.

ABSTRACT

RC721

Medical Physics 2.0: Information Management and Display

Thursday, Dec. 3 4:30PM - 6:00PM Location: E353A

PH IN

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
Ehsan Samei, PhD, Durham, NC (*Director*) Nothing to Disclose
Douglas E. Pfeiffer, MS, Boulder, CO (*Director*) Nothing to Disclose

Sub-Events

RC721A Information Management and Display Perspective

Participants
Ehsan Samei, PhD, Durham, NC (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To gain an appreciation for interaction between medical physics and information technology in modern medicine 2) To understand how physics can add value to patient care in the area of information and image management and technology.

RC721B Information Management and Display 1.0

Participants
Donald Peck, PhD, Detroit, MI (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Review the different areas of imaging informatics. 2) Understand the methodology for developing informatics standards and their current status. 3) Understand the components of various informatics systems. a. Enhanced DICOM objects. b. Vender neutral archives for enterprise image storage. c. Web distribution protocols. d. Dose monitoring. e. Reporting systems. f. Structured reports.

ABSTRACT

Imaging informatics is part of every radiology practice today. Imaging informatics covers everything from the ordering of a study, through the data acquisition and processing, display and archiving, reporting of findings and the billing for the services performed. The standardization of the processes used to manage the information and methodologies to integrate these standards is being developed and advanced continuously. These developments are done in an open forum and imaging organizations and professionals all have a part in the process. In this presentation the flow of information and the integration of the standards used in the processes will be reviewed. The role of radiologists and physicists in the process will be discussed. Current methods for validation of informatics systems function will also be discussed.

RC721C Information Management and Display 2.0

Participants
Michael J. Flynn, PhD, Detroit, MI (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Review the display performance evaluation methods used for monitor QA. 2) Understand current guidelines for display systems that are used for medical imaging. 3) Learn about emerging requirements for handheld display, and color display.

RC753

Computer Aided Diagnosis (Development and Clinical Applications)

Thursday, Dec. 3 4:30PM - 6:00PM Location: E350

BR CT OI IN

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

FDA Discussions may include off-label uses.

Participants
Emanuele Neri, MD, Pisa, Italy (*Moderator*) Nothing to Disclose
Hiroyuki Yoshida, PhD, Boston, MA (*Moderator*) Patent holder, Hologic, Inc; Patent holder, MEDIAN Technologies;

LEARNING OBJECTIVES

1) Understand needs of CAD in radiologic image interpretation. 2) Understand basic concept of CAD in assisting radiologists' image reading. 3) Understand the usefulness of CAD in improving radiologists' performance. 4) Learn historical review of CAD developments. 5) Learn CAD for detection and differential diagnosis of common cancers. 6) Learn ROC analysis of radiologists' performance without and with CAD in observer studies.

ABSTRACT

Computer-aided diagnosis (CAD) has become one of the major topics in medical imaging and diagnostic radiology. In this refresher course, the principles of CAD will be presented, together with current developments as well as clinical applications of CAD.CAD aims at improving radiologists' diagnostic accuracy, and it can be used as primary, concurrent, or second reader. In principle, the CAD performs a morphological recognition of the pathology (nodule, focal lesion, polyp, etc.) combined with quantitative information (MR signal intensity, CT density, contrast enhancement, volume, etc.)Many different types of CAD schemes have been developed for detection and/or characterization of various lesions in different imaging modalities, including conventional projection radiography, CT, MRI, and ultrasound imaging. Organs that are subjected to research for CAD include the breast, lung, colon, brain, liver, kidney, and the vascular and skeletal systems.For detection of breast cancer on mammograms, more than 10,000 commercial CAD systems have been used clinically in assisting radiologists worldwide. For detection of lung cancer, CAD schemes have been developed for detection of pulmonary nodules on chest radiographs and CT images. In addition, CAD schemes have been developed for differential diagnosis of distinction between malignant and benign lesions. For colon cancer, CAD schemes have been developed for detection of polyps in CT colonography. Observer performance studies with use of ROC analysis indicated an improved performance in radiologists' task for detection and/or classification of these lesions.

URL

Sub-Events

RC753A Development of a CAD: From Benchtop to Clinic

Participants
Ronald M. Summers, MD, PhD, Bethesda, MD, (rms@nih.gov) (*Presenter*) Royalties, iCAD, Inc; Research funded, iCAD, Inc;

LEARNING OBJECTIVES

1) To understand what radiology problems are amenable to computer aided detection. 2) To understand the steps required to develop and validate a radiology computer-aided detection product. 3) To understand the current performance and future trends in computer-aided detection with respect to indications, algorithms, sensitivity, false positive rates and pitfalls.

ABSTRACT

RC753B CAD for CT Colonography: Where Do We Stand?

Participants
Daniele Regge, MD, Candiolo, Italy, (daniele.regge@ircc.it) (*Presenter*) Speakers Bureau, General Electric Company

LEARNING OBJECTIVES

1) Review interpretation pitfalls of CT colonography that could be overcome with CAD. 2) Present different reading paradigms of CAD for CT colonography and analyze their performances. 3) Summarize advantages and limitations of the use of CAD for CT colonography in different clinical settings.

RC753C CAD for Breast Cancer Detection: Where Do We Stand?

Participants
Ulrich Bick, MD, Berlin, Germany, (Ulrich.Bick@charite.de) (*Presenter*) Equipment support, Hologic, Inc; License agreement, Hologic, Inc; Royalties, Hologic, Inc; Equipment support, Toshiba Corporation; Institutional research collaboration, Siemens AG

LEARNING OBJECTIVES

1) To learn about different applications of computer-aided diagnosis (CAD) in breast imaging. 2) To understand the potential and risks of using CAD in mammography screening. 3) To realize the impact of CAD on soft-copy reading and work-flow

RC753D CAD for Lung Cancer Detection: Where Do We Stand?

Participants
Kunio Doi, PhD, Chicago, IL, (k-doi@uchicago.edu) (*Presenter*) Shareholder, Hologic, Inc; License agreement, Hologic, Inc; License agreement, Deus Technologies, LLC; License agreement, Riverain Technologies, LLC; License agreement, Mitsubishi Corporation; License agreement, MEDIAN Technologies; License agreement, General Electric Company; License agreement, Toshiba Corporation; Research support, Deus Technologies, LLC; Research support, E. I. du Pont de Nemours & Company; Research support, Elcint Medical Imaging Ltd; Research support, FUJIFILM Holdings Corporation; Research support, General Electric Company; Research support, Hitachi, Ltd; Research support, Eastman Kodak Company; Research support, Konica Minolta Group; Research support, Mitaya Manufacturing Co, Ltd; Research support, Mitsubishi Corporation; Research support, Koninklijke Philips NV; Research support, Hologic, Inc; Research support, Riverain Technologies, LLC; Research support, Seiko Corporation; Research support, Siemens AG; Research support, 3M Company; Research support, Toshiba Corporation

LEARNING OBJECTIVES

View learning objectives under main course title.

ABSTRACT

RC754

Preparing your Radiology Practice and IT Department for Big Data

Thursday, Dec. 3 4:30PM - 6:00PM Location: S105AB

IN

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
Paul J. Chang, MD, Chicago, IL, (pchang@radiology.bsd.uchicago.edu) (*Moderator*) Co-founder, Stentor/Koninklijke Philips NV; Researcher, Koninklijke Philips NV; Medical Advisory Board, lifeIMAGE Inc; Medical Advisory Board, Merge Healthcare Incorporated

LEARNING OBJECTIVES

1) The potential of applying "Big Data" approaches to radiology will be discussed. 2) The participant will be introduced to the importance of developing a comprehensive IT architecture and capability beyond the EMR in order to effectively use "Big Data" tools. 3) Strategies for preparing IT for "Big Data" will be discussed.

ABSTRACT

Current and near future requirements and constraints will require radiology practices to continuously improve and demonstrate the value they add to the enterprise. Merely 'managing the practice' will not be sufficient; groups will be required to compete in an environment where the goal will be measurable improvements in efficiency, productivity, quality, and safety. This will require optimally leveraging IT enabled business intelligence, analytics, and data driven workflow. In many ways, this challenge can be described as a "Big Data" problem, requiring the application of newer "Big Data" approaches and tools. Unfortunately, many have discovered that an "EMR centric" IT perspective may severely limit the ability for the enterprise to maximally leverage these newer tools to create differentiable value. This session will provide an introduction to the importance of developing a comprehensive architectural strategy to augment the existing EMR to more effectively consume "Big Data" tools.

Sub-Events

RC754A Getting Your IT Infrastructure Ready for Big Data

Participants
Paul J. Chang, MD, Chicago, IL, (pchang@radiology.bsd.uchicago.edu) (*Presenter*) Co-founder, Stentor/Koninklijke Philips NV; Researcher, Koninklijke Philips NV; Medical Advisory Board, lifeIMAGE Inc; Medical Advisory Board, Merge Healthcare Incorporated

RC754B NoSQL Approaches: Beyond the Traditional Relational Database

Participants
Paul J. Chang, MD, Chicago, IL, (pchang@radiology.bsd.uchicago.edu) (*Presenter*) Co-founder, Stentor/Koninklijke Philips NV; Researcher, Koninklijke Philips NV; Medical Advisory Board, lifeIMAGE Inc; Medical Advisory Board, Merge Healthcare Incorporated

LEARNING OBJECTIVES

1) The distinction between the traditional relational (SQL) database and "NoSQL" approaches will be discussed. 2) The attendees will be given a basic introduction to how "NoSQL" tools, such as Hadoop, MapReduce, MongoDB can be complementary to existing approaches. 3) NoSQL applications and their relevance to radiology will be discussed.

ABSTRACT

Current and near future requirements and constraints will require radiology practices to continuously improve and demonstrate the value they add to the enterprise. Merely 'managing the practice' will not be sufficient; groups will be required to compete in an environment where the goal will be measurable improvements in efficiency, productivity, quality, and safety. This will require optimally leveraging IT enabled business intelligence, analytics, and data driven workflow. These approaches will require the ability to consume and utilize all available enterprise data, including unstructured reports, multimedia objects, etc. Other industries have realized that traditional IT approaches, such as the relational (SQL) database, cannot optimally address these "difficult" data objects. Many outside of the medical domain have successfully augmented traditional approaches by newer "Big Data" and "NoSQL" methodologies, such as Hadoop, MapReduce, MongoDB, etc. In this session, an introduction to these newer tools will be presented.

RC754C Deep Learning: An Example of Big Data Applications

Participants
Jeremy Howard, San Francisco, CA (*Presenter*) CEO, Enlitic; Shareholder, Enlitic

LEARNING OBJECTIVES

1) A technical overview of machine learning and deep learning will be presented. 2) Applications of machine learning and deep learning in radiology will be illustrated. 3) Challenges in deploying machine learning and deep learning in radiologist workflow and productivity demands will be discussed.

ABSTRACT

Computers in radiology have often promised to deliver faster clinical decisions, more accurate diagnoses, and transformative visualizations. Computer aided diagnostics (CAD) has been deployed to guide radiologists in their detection of abnormalities and identification of disease. Historically, CAD has been based on domain-driven heuristics, and more recently used simple machine learning on structured data. Both of these require extensive manual engineering making them very slow to build, limited in their flexibility, and less accurate than we would like. Deep learning is a new paradigm that offers a transformative solution. Instead of demanding countless human hours of painstaking feature generation and selection, deep learning automatically discovers clinically-

relevant features by first architecting a hierarchy of patterns (loosely modelled on the brain's own neural neural networks) and then updating those patterns upon observing examples. As radiology requires complex associative pattern recognition, deep learning is the ideal companion tool. Enlitic is developing a deep neural network of the entire human body that will offer a new way forward in which the radiologist has immediate access to the most relevant clinical information. In this talk, we will present a technical overview of machine learning and deep learning, illustrate its applications in radiology, and detail some of the challenges improving radiological workflow using deep learning poses.

RCB55

Making the Most of Google Docs: Docs, Slides, Forms, and Sheets (Hands-on)

Thursday, Dec. 3 4:30PM - 6:00PM Location: S401CD

IN

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
Marc D. Kohli, MD, San Francisco, CA (*Moderator*) Research Grant, Siemens AG
Marc D. Kohli, MD, San Francisco, CA (*Presenter*) Research Grant, Siemens AG
Ross W. Filice, MD, Washington, DC, (ross.w.filice@gunet.georgetown.edu) (*Presenter*) Nothing to Disclose
Aaron P. Kamer, MD, Indianapolis, IN (*Presenter*) Nothing to Disclose
Andrew B. Lemmon, MD, Atlanta, GA (*Presenter*) Nothing to Disclose
Thomas W. Loehfelm, MD, PhD, Atlanta, GA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Describe the benefits and drawbacks of using Google tools for collaborative editing. 2) Explain issues related to storing protected health information in Google Drive. 3) Demonstrate the ability to use the Google productivity applications for collaboration on document, spreadsheet, online form and presentation creation.

ABSTRACT

Note: Attendees should have or create a Google account prior to coming to the session.In today's busy environment, we need tools to work smarter, not harder. Google's suite of productivity applications provides a platform for collaboration that can be used across and within institutions to produce documents and presentations and to obtain and work-up data with ease. However, with increased sharing, security concerns need to be addressed. At the end of the session, learners should be able to demonstrate creating, sharing, and editing a document as a group.

RCC55

RadLex®: Overview of a New Lexicon for Radiology

Thursday, Dec. 3 4:30PM - 6:00PM Location: S501ABC

IN SQ

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants

Sub-Events

RCC55A Overview of RadLex®

Participants
Kenneth C. Wang, MD, PhD, Ellicott City, MD, (kcwang@gmail.com) (*Presenter*) Co-founder, DexNote, LLC;

LEARNING OBJECTIVES

1) Review the rationale for developing a lexicon for medical imaging. 2) See how an imaging lexicon can be used for education, research, and clinical reporting. 3) Understand the key technical factors in creating a complete and organized vocabulary for medical imaging. 4) Learn about the formats in which RadLex is distributed and the tools that are available for maintaining and using terminology systems. 5) Discover how you can take advantage of RadLex in the development of radiology applications.

ABSTRACT

The purpose of the RadLex lexicon is to provide a uniform framework for indexing and retrieval of a variety of radiology information sources, including teaching files, research data, and radiology reports. The RadLex lexicon unifies radiology terms from other medical lexicons, such as the ACR Index from the American College of Radiology, the Unified Medical Language System (UMLS) from the National Library of Medicine, SNOMED-CT from the College of American Pathology, and the DICOM Content Mapping Resource. This session will explain the motivations for the creation of the RadLex imaging lexicon and describe RadLex-based applications in structured reporting, radiology information retrieval, image annotation, image navigation and decision support. RadLex technical experts will describe the formats in which RadLex is distributed, and will demonstrate some of the tools available to incorporate RadLex into the development of useful software applications. The RadLex Playbook system for standardized radiology procedure names and codes will also be reviewed.

RCC55B 'RadLex Inside': Information Retrieval, Radiology Reporting, and Beyond

Participants
Charles E. Kahn JR, MD, MS, Philadelphia, PA, (charles.kahn@uphs.upenn.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Learn how the RadLex lexicon enables applications in radiology research, education, and clinical practice. 2) Describe how RadLex enables information retrieval. 3) Define the role of RadLex in RSNA's structured reporting initiative. 4) Discover new applications of RadLex in radiology education and decision support.

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Charles E. Kahn JR, MD, MS - 2012 Honored Educator

RCC55C ACR Usage of RadLex® Playbook for CT Dose Registry

Participants
Kalpana M. Kanal, PhD, Seattle, WA, (kkanal@uw.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Identify the challenge related to procedure code matching across institutions. 2) Describe the RadLex Playbook. 3) Explain how the RadLex Playbook can be used to harmonize data across institutions.

RC825

Radiomics Mini-Course: Informatics Tools and Databases

Friday, Dec. 4 8:30AM - 10:00AM Location: S404AB

BQ IN PH

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
Sandy Napel, PhD, Stanford, CA (*Director*) Medical Advisory Board, Fovia, Inc; Consultant, Carestream Health, Inc; Scientific Advisor, EchoPixel, Inc

LEARNING OBJECTIVES

ABSTRACT

Sub-Events

RC825A The Role of Challenges and Their Requirements

Participants
Jayashree Kalpathy-Cramer, MS, PhD, Charlestown, MA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand the role of challenges and benchmarks in image analysis, radiomics and radiogenomics. 2) Learn about challenge infrastructure and requirements to host and participate in challenges. 3) Learn about past and upcoming challenges that focus on topics in radiology, radiomics and radiogenomics.

ABSTRACT

Challenges and benchmarks have been used successfully in a number of scientific domains to make signfiicant advances in the field by providing a common platform for collaboration and competition. By provide a common dataset and common set of evaluation metrics, they also facilitate a fair and rigorous evaluation of algorithms. Challenge organizers often sequester the test data from the training data, further enhancing the rigor of the evalation. These efforts can introduce problems in medical imaging to experts in other domains such as image processing and machine learning and serve as a means to bring in to medical images a range for expertise from other domains. They also serve to allow computer scientists access to clinical data which they may not otherwise have. Many challenges have also highlighted the need for collaboration as the best results are often obtained by combining a range of complementary techniques. We will discuss recent challenges from a number of domains including imaging and bioinformatics, explore the informatics infrastructure to host and participate in challenges and discuss the needs for future challenges including those in radiomics and radiogenomics.

RC825B Quantitative Image Analysis Tools: Communicating Quantitative Image Analysis Results

Participants
Andriy Fedorov, PhD, Boston, MA, (andrey.fedorov@gmail.com) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Review the meaning and importance of interoperability for quantitative image analysis tools. 2) Review specific use cases motivating standards-based interoperable communication of the analysis results. 3) Learn about free open source tools that can facilitate interoperable communication of analysis results using DICOM standard.

ABSTRACT

Quantitative imaging holds tremendous but largely unrealized potential for objective characterization of disease and response to therapy. Quantitative imaging and analysis methods are actively researched by the community. Certain quantitation techniques are gradually becoming available both in the commercial products and clinical research platforms. As new quantitation tools are being introduced, tasks such as their integration into the clinical or research enterprise environment, comparison with similar existing tools and reproducible validation are becoming of critical importance. Such tasks require that the analysis tools provide the capability to communicate the analysis results using open and interoperable mechanisms. The use of open standards is also of utmost importance for building aggregate community repositories and data mining of the analysis results. The goal of this course is to build the understanding of the interoperability as applied to quantitative image analysis, with the focus on clinical research applications.

Handout:Andriy Fedorov

http://abstract.rsna.org/uploads/2015/15003220/rc825fedorov.pdf

RC825C Public Databases for Radiomics Research: Current Status and Future Directions

Participants
Justin Kirby, Bethesda, MD (*Presenter*) Stockholder, Myriad Genetics, Inc

LEARNING OBJECTIVES

1) Understand the importance of using digital object identifiers and public databases to facilitate reproducible radiomics research. 2) Become familiar with publicly available databases where you can. a) download existing radiomic and radiogenomic data sets. b) request to upload new radiomic/radiogenomic data sets. 3) Learn about new data-centric journals which help enable researchers to receive academic credit for releasing well-annotated data sets to the public.

ABSTRACT

Lack of reproducibility in scientific research, particularly in healthcare, has become an increasing issue in recent years. The National Insitutes of Health (NIH) and many major publishers have since called for increased sharing of raw data sets so that new findings can be easily validated in a transparent way. This is especially important in the emerging field of radiomics where large data sets and huge numbers of image features lead to an increased risk of spurious correlations which are not actually driven by biology. A number of public databases have since been created by governments and other organizations to help facilitate the sharing of data sets. Publishers have developed new 'data journals' and services specifically designed to encourage researchers to annotate and share their data sets. It is now up to the imaging research community to begin taking advantage of these resources. Other disciplines such as genomics and proteomics are significantly leading imaging in the adoption of these new open-science workflows. Significant engagement with NIH and other organizations providing open databases and related services is critical to enabling imaging researchers to successfully shift to a culture of data sharing and transparency.

RC853

Workflow Tools to Optimize Departmental Operations

Friday, Dec. 4 8:30AM - 10:00AM Location: E352

IN LM

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
Bradley J. Erickson, MD, PhD, Rochester, MN (*Moderator*) Stockholder, Evidentia Health, Inc; Stockholder, OneMedNet Corporation; Stockholder, VoiceIt Technologies, LLC

LEARNING OBJECTIVES

1) Become familiar with workflow technologies that are available and being used in other industries. 2) See how workflow terminologies can be applied in practice. 3) See how workflow engines have been applied in radiology.

ABSTRACT

Workflow is a critical element of safe and efficient practices. Workflow is usually supported by using relational databases, which tends to force a linear workflow into practice. SQL queries are also not optimal for detecting and handling error conditions.Workflow engines are used in other industries for exactly those reasons--they help enforce an agreed upon optimal pathway of events, and make it easy and clear how to deal with error and exception conditions. While they have been applied in healthcare, those experiments have usually failed because the implementation did not handle error conditions well, and did not completely model the richness and complexity of healthcare. Radiology tends to be more straightforward, and may be a good area to use workflow engines. In this session, we will describe one implementation in a clinical practice, as well as use in research and clinical trials.As we have begun to use workflow engines, it became apparent that agreeing on the names for key steps in the workflow would be helpful. Such a common lexicon would help us to assure that workflow was done in the same way in different locations. It could also allow us to measure the efficiency of workflows. This latter aspect was perceived to be of great value to practices accross the world, and led to the creation of the SIIM Workflow Initiative in Medicine (SWIM) lexicon, which is now a part of RadLEX. The basic concepts of SWIM and its connection toe IHE and the practice will be described.

Sub-Events

RC853A Managing Your Department with Workflow Engines

Participants
Bradley J. Erickson, MD, PhD, Rochester, MN (*Presenter*) Stockholder, Evidentia Health, Inc; Stockholder, OneMedNet Corporation; Stockholder, VoiceIt Technologies, LLC

LEARNING OBJECTIVES

1) Become familiar with workflow engine technology. 2) Understand how workflow engines can be used within a radiology department. 3) Understand strengths and weaknesses of workflow engines compared to alternative methods like databases.

ABSTRACT

Workflow engines are used in a variety of industries because they can improve efficiency and quality. The same is true for radiology. Workflow engines can help assure that we routinely apply the optimal algorithms and processing steps for best quality care. They can also assure that things don't 'fall through the cracks'. Finally, they can also automate steps that don't need human intervention, both reducing cost of practice, and inceasing the timeliness of care.

RC853B Measuring Your Department with the SWIM Lexicon

Participants
Marc D. Kohli, MD, San Francisco, CA (*Presenter*) Research Grant, Siemens AG

LEARNING OBJECTIVES

1) Describe existing heterogeneity of workflow terminology. 2) Explain benefits arising use of a standard nomeclature for workflow steps. 3) Provide details regarding how the SWIM lexicon could be applied in the learner's environment.

ABSTRACT

In current practice, standard workflow steps such as the arrival of a patient to the imaging department, and completion of the exam are tracked in a very heterogenous manner with imprecise terminology. In order to better understand and compare workflow across radiology departments, a common language must be devised and deployed. The SIIM Workflow Initiave In Medicine (SWIM) lexicon aims to address this challenge. We will illustrate how the SWIM lexicon can be used to measure and compare workflow in a radiology department.

RC853C Monitoring Your Department with Dashboards

Participants
Christopher D. Meenan, Baltimore, MD, (cmeenan@umm.edu) (*Presenter*) Principal, Analytical Informatics, Inc; Stockholder, Analytical Informatics, Inc

LEARNING OBJECTIVES

1) Describe what a radiology department dashboard entails. 2) Give three examples of key performance indicators for a radiology

department. 3) Explain how dashboards have created an impact in other practices.

ABSTRACT

Leveraging dashboards and other business intelligence tools to measure and improve operational quality can be an effective way for clinical departments to navigate change. Unfortunately for many organizations, the simple acquisition of new technology or new software does not automatically translate to more efficient and effective operations. There is typically a cultural component that must be addressed, and that is essential to understand if an Imaging Department is to realize the key benefits of any technical solution. Defining clear goals around what to measure, understanding data quality issues, and ensuring organizational buy-in are all part of the journey to becoming a data-driven Department.

RC854

Growing Your Business with Social Media, Tips and Tricks for Department and Practice Managers

Friday, Dec. 4 8:30AM - 10:00AM Location: N229

IN LM

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 0

Participants
Garry Choy, MD, MS, Boston, MA (*Presenter*) Nothing to Disclose
Geraldine B. McGinty, MD,MBA, New York, NY (*Presenter*) Nothing to Disclose
Alex Towbin, MD, Cincinnati, OH, (alexander.towbin@cchmc.org) (*Presenter*) Author, Reed Elsevier; Consultant, Reed Elsevier; Shareholder, Merge Healthcare Incorporated; Consultant, Guerbet SA; Grant, Guerbet SA

Honored Educators

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Alex Towbin, MD - 2014 Honored Educator

RCA61

National Library of Medicine: Find Articles You Need: Searching PubMed/MEDLINE Efficiently (Hands-on)

Friday, Dec. 4 8:30AM - 10:00AM Location: S401AB

IN

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
Chris Childs, MS, Iowa City, IA (*Presenter*) Nothing to Disclose
Holly Ann Burt, MLIS, Chicago, IL (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand how PubMed constructs a query and how to develop and refine effective search strategies in radiology. 2) Use PubMed tools including Clinical Queries, Related Articles, Single Citation Matcher and Loansome Doc. 3) Build focused searches using the Medical Subject Headings (MeSH) vocabulary for radiology and limit searches to radiology-oriented journals. 4) Understand how to save and download citations.

ABSTRACT

This hands-on workshop covers key searching techniques, changes to PubMed and how to develop effective search strategies for PubMed and MEDLINE. Topics covered include: why keywords don't always give the results you expect, how to limit to specific journals, quick searches to find evidence-based citations, how to access full-text articles, and downloading citations to reference manger programs. The National Library of Medicine (NLM) provides free web access to nearly 24 million citations for biomedical and clinical medical articles through PubMed (available online at PubMed.gov). MEDLINE is a subset of PubMed which includes links to sites providing full text articles and to other related databases and resources.

URL

Handout:Holly Ann Burt

http://abstract.rsna.org/uploads/2015/14003441/2015pubmedRSNA.pdf