TCIA Sessions at RSNA 2019

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TCIA-Initiated

- **All Day | AI050 | AI Community, Learning Center**
  - **Crowds Cure Cancer: Help Annotate Data from the Cancer Imaging Archive**
    - Attendees at this year's RSNA meeting are encouraged to participate in an exciting new activity that will provide valuable data to cancer researchers working in deep learning, radiomics and radiogenomics. This kiosk offers radiologist attendees an opportunity to participate in a 'crowd-sourcing' experiment to accelerate quantitative imaging research. Images are provided by The National Cancer Institute's Cancer Imaging Archive (http://www.cancerimagingarchive.net/), which is a massive public-access resource of cancer radiology images linked to genetic/proteomic, pathology images and clinical data. Many of these cases lack the tumor-location labels needed by computer scientists to jump-start their work on machine learning and quantitative imaging radiomics. Participants will be asked to spend a few minutes anonymously reviewing cases and visually marking their tumor locations. Upon completion, they will receive a ribbon to add to their RSNA badge acknowledging their participation. The data resulting from this process will be openly shared on TCIA with the radiology and computer science communities to accelerate cancer research.
- **Sunday 4:00-5:30 PM** | RCC13 | Room:
  - **Creating publicly-accessible radiology imaging resources for Machine Learning and AI**
    - Learn from leaders in the fields of radiology and AI about their experiences developing and leveraging publicly-accessible data resources for AI.
- **Monday 8:30-10:00 AM** | RCA21 | Room:
  - **An Introduction to Using the NIH/NCI's Cancer Imaging Archive (TCIA) (Hands-on)**
    - Access to large, high quality data is essential for researchers to understand disease and precision medicine pathways, especially in cancer. However HIPAA constraints make sharing medical images outside an individual institution a complex process. The NCI's Cancer Imaging Archive (TCIA) addresses this challenge by providing hosting and de-identification services which take the burden of data sharing off researchers. TCIA now contains over 100 unique data collections of more than 30 million images. Recognizing that images alone are not enough to conduct meaningful research, most collections are linked to rich supporting data including patient outcomes, treatment information, genomic / proteomic analyses, and expert image analyses (segmentations, annotations, and radiomic / radiogenomic features). This hands-on session will teach the skills needed to fully access our existing data as well as learn how to submit new data for potential inclusion in TCIA.
- **Monday 10:30-12:00 PM** | RCC22 | Room:
  - **Novel Discoveries Using the NCI's Cancer Imaging Archive (TCIA) Public Data Sets**
    - This didactic session will highlight popular data sets and major projects utilizing TCIA with presentations from leading researchers and data contributors. Attendees will also learn about a number of new, major NIH data collection initiatives that are ongoing or coming in the near future which they can leverage in their own research.
- **Wednesday 4:30-6:00 PM** | RCC45 | Room:
  - **Imaging in Proteogenomics Research**
    - Highlight research trends and major NIH new data programs in proteogenomics, and the potential contribution of imaging
- **Thursday 8:30-10:00 AM** | RC625 | Room:

- **Radiomics: Informatics Tools and Databases**
  - 1) Understand the role of challenges in facilitating reproducible radiomics research. 2) Learn about past challenges and lessons learned. 3) Learn about best practices based on experiences from multisite challenges. 4) Review the meaning and importance of interoperability for quantitative image analysis tools. 5) Review specific use cases motivating interoperable communication of the analysis results. 6) Learn about the tools that support interoperable communication of the analysis results using the DICOM standard. 7) Understand the importance of open science methods to facilitate reproducible radiomics research. 8) Become familiar with publicly available sites where you can download existing radiomic data sets, request to upload new radiomic/radiogenomic data sets, and manage your research projects, and learn about data citations and new data-centric journals which help enable researchers to receive academic credit for releasing well-annotated data sets to the public.

- **Thursday 4:30-6:00 PM** | RCC55 | Room:
  - **Deep Learning-An Imaging Roadmap**
    - Deep Learning,' an independent self-learning computational environment that uses multilayered computational neural nets, has generated considerable excitement (as well as concerns and misperceptions) in medical imaging. Deep learning computational techniques, such as convolutional neural networks (CNNs) generate multiple layer feature classifiers that extract disease relevant features from entire regions of medical images without the need for localization or pre-segmentation of lesions. Although CNNs require training on very large image datasets that encompass particular disease expressions, they can be diagnostically effective since no human input of segmentation features such as size, shape, margin sharpness, texture, and kinetics are required. But their immediate and future applicability as tools for unsupervised medical decision-making are, as yet, not well understood by most clinical radiologists. This overview session of Deep Learning will provide a clearer picture by presenters who are active in that field and who can clarify how the unique characteristics of Deep Learning could impact clinical radiology. It will address how radiologists can contribute to, and benefit from, this new technology. Topics of this multi-speaker session will cover: 1) the general principles of deep learning computational schemas and their mechanisms of handling image inputs and outputs. 2) new technology including hardware shifts in microprocessors from CPU's to GPU devices that offer significant computational advantages 3) how to ensure that Deep Learning results are consistently clinically relevant and meaningful including nodal element tuning and provability so as to assure medical care consistency and reproducibility. 4) how to develop and leverage datasets for deep learning on archives such as the NIH The Cancer Imaging Archive (TCIA) including requirements for input image dataset magnitude and completeness of disease spectrum representation. 5) how to embed essential non-imaging data needed as inputs, (e.g. EHR, outcome, cross-disciplinary metadata, and the data pre-processing required to make DICOM ready for Deep Learning. The presentations will be at a level understandable and relevant to the RSNA radiologist audience.

Community Sessions using TCIA Data

Do you have a TCIA-related presentation at RSNA that's not listed below? Contact the **helpdesk** to request it be added!

- **Sunday 10:55-11:05 AM** | SSA12-02 | Room:
  - **FalcoNet-GMC: A 3D Convolutional Neural Network Module for Instance Segmentation and Quantification of Distant Recurrence from Gynecological Cancers**
    - A multifunctional web-based auxiliary system for distant recurrence from gynecologic cancer will enhance the early detection for salvage treatment, with better segmentation by compartment weight maps.
- **Sunday 1:00-1:30 PM** | IN006-EB-SUB | Room:
  - **Reproducibility of Quantitative Features in Prostate mpMRI**
    - Multiparametric magnetic resonance imaging (mpMRI) has emerged as a non-invasive modality to diagnose and monitor prostate cancer. Quantitative metrics on the regions of abnormality in prostate mpMRI has shown to be predictive of clinically significant cancer defined by Gleason grade groups. In this study we evaluate the reproducibility of quantitative imaging features using repeated mpMRI on the same patients. We have shown that some quantitative imaging features are reproducible across sequential prostate mpMRI acquisition at a preset level of filters. A validated set of reproducible image features in mpMRI will allow us to develop a clinically reliable malignance risk stratification score. This will enable the possibility of using imaging as a surrogate to invasive biopsies
- **Monday 10:30-10:40 AM** | SSC03-01 | Room:
  - **Impact of Interobserver Variability in Manual Segmentation of Non-small Cell Lung Cancer (NSCLC) on Computed Tomography**
    - Discovery of predictive and prognostic radiomic features in cancer is currently of great interest to the radiologic community. Since there is no reliable automated means of segmenting lung cancer, tumor labeling is typically performed by imaging analysts, physician trainees and attending physicians. Here we examine the impact of level of specialty training on interobserver variability in manual segmentation of non-small cell lung cancer (NSCLC).
- **Monday 10:50-11:00 AM** | SSC03-03 | Room:
  - **Correlation-Incorporated Hierarchical Clustering of High-Dimensional Radiomic Features for Prognostic Phenotype Identification of EGFR-mutated Non-Small Cell Lung Cancer**
    - We propose a correlation-incorporated unsupervised hierarchical clustering algorithm and evaluate it in identifying computed tomography (CT) radiomic phenotypes of EGFR-mutated non-small cell lung cancer (NSCLC) in association with patient overall survival. CHCA effectively reduces the high dimensionality of radiomic features while allowing for robust identification of CT-based phenotypes of EGFR-mutated NSCLC that are associated with patient survival.
- **Tuesday 9:20-9:30 AM** |RC305-04 | Room:
  - **A Radiomics Nomogram Based on Multiregional Features Might Predict MGMT Promoter Methylation of Glioblastoma Patients**
    - To investigate multiregional features from multimodal MRI in reflecting O6-methylguanine methyltransferase (MGMT) promoter methylation status, and to establish visualized nomogram for MGMT methylation prediction of glioblastomas (GBM) patients. The radiomics nomogram based on multiregional features from multimodal MRI was proposed in our study, and could individually and visually predict MGMT status of GBM patients. In addition, the rEA and rNec areas of GBM play an important role in the prediction of MGMT methylation.
- **Wednesday 12:45-1:15 PM** | NR386-SD-WEB2 | Room: N/A

  - **Radiogenomic Analysis of Glioblastoma on Pre-treatment Gd-T1w MRI Reveals Gender-specific Imaging Features and Signaling Pathways**
    - Recent epidemiological studies suggest that gender differences in Glioblastoma (GBM) influence the prognostic outcome of patients, and thus should be considered for targeted treatment. We hypothesize that (1) radiomic features from GBM sub-compartments (peri-tumoral edema, enhancing tumor, non-enhancing and necrotic core) on pre-treatment Gadolinium(Gd)-T1w MRI will have distinct imaging attributes that are prognostic of gender-specific survival, and (2) corresponding transcriptomic data can reveal signaling pathways that drive gender-specific tumor biology and treatment response.
- **Thursday 11:30-11:40 AM** | SSQ15-07 | Room: N/A
  - **Classification of IDH Mutation Status in Brain Tumors using Deep Learning**
    - Isocitrate dehydrogenase (IDH) mutation status is a widely recognized biomarker in diagnosing and treating primary brain tumors. Currently, it is determined using immunohistochemistry or gene sequencing on tissue specimens, acquired through biopsy or surgery. In this work, we developed a fully automated deep-learning network for non-invasive prediction of IDH mutation status using MRI.
- **Friday 8:30-10:00 AM** | RC825 | Room:
  - **Radiomics: From Image to Radiomics**
    - 1) Learn about the role of image annotations in radiology and their relevance to enabling interoperability and for communicating results and value for machine learning and decision support. 2) Become acquainted with important standards and tools that support the creation, management, and use of image annotations. 3) See case examples of image annotations in practice to enable developing applications that help the practice of radiology. 4) Understand the categories of, and the specific radiomic image features that can be computed from images. 5) Understand the effect and implications of image acquisition and reconstruction on radiomic image features. 6) Learn about workflows that drive the creation of predictive models from radiomic image features. 7) Understand the methods for and the potential value of correlating radiological images with genomic data for research and clinical care. 8) Learn how to access genomic and imaging data from databases such as The Cancer Genome Atlas (TCGA) and The Cancer Imaging Archive (TCIA) databases, respectively. 9) Learn about methods and tools for annotating regions within images and link them with semantic and computational features.10) Learn about methods and tools for analyzing molecular data, generating molecular features and associating them with imaging features. 11) Learn how deep learning can revolutionize interpretation of medical images.