MedICI Project summary (Supplemental material)

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Challenges supported

- We supported a number of challenges between 2017-2019
  - Over 3000 participants signed up for these challenges
- Cancer related challenges
  - SPIE-AAPM-NCI Prostate MR classification challenge
  - SPIE-AAPM-NCI Gleason grade challenge
  - SPIE-AAPM-NCI BreastPathQ cancer cellularity challenge
  - MICCAI 2018 Pancreatic survival prediction challenge
  - MICCAI 2018 Combined radiology pathology classification challenge
  - AAPM Thoracic auto-segmentation challenge
  - AAPM RT-MAC challenge
  - MICCAI 2019 Combined radiology pathology classification challenge
- Other challenges
  - AAPM CTVIE19 challenge
  - RSNA bone age challenge (not cancer)

SPIE-AAPM-NCI Prostate MR classification challenge

- Goal: Classification of prostate cancer from multiparametric MR
- Dates: 11/2016-11/2018
- Dataset: ~350 MRI cases, each from a single examination from a distinct patient (60/40% training/test set)
  - four sets of MRI scan data: two sets of T2-weighted images (transaxial and sagittal; DICOM format), Ktrans images (computed from dynamic contrast-enhanced (DCE) images; mhd format), and apparent diffusion coefficient (ADC) images (computed from diffusion-weighted (DWI) imaging; DICOM format).
- Metrics: ROC analysis
- Participants: 361 registered
- A special session at the 2017 SPIE Medical Imaging Symposium will focus on the PROSTATEx Challenge

Previous	▶ Current	End
Training	Test	Competition Ends
Nov. 21, 2016, 6 p.m. UTC	Dec. 12, 2016, 6 p.m. UTC	Nov. 17, 2018, 8 a.m. UTC

SPIE-AAPM-NCI Prostate MR Classification Challenge

SPIE, along with the support of the American Association of Physicists in Medicine (AAPM) and the National Cancer Institute (NCI), will conduct a "Grand Challenge" on quantitative image analysis methods for the diagnostic classification of clinically significant prostate cancers. As part of the 2017 SPIE Medical Imaging Symposium, the PROSTATEx Challenge will provide a unique opportunity for participants to compare their algorithms with those of others from academia, industry, and government in a structured, direct way using the same data sets.

A special session at the 2017 SPIE Medical Imaging Symposium will focus on the PROSTATEx Challenge; the two top-performing participants will receive a waiver of the conference registration fee in order to present their methods during this session and will also be presented with a certificate at the Symposium's plenary session. Challenge participants who submit test set classification results by the January 16 deadline will be invited to present a poster and demonstrate their algorithm at the live demonstration CAD Workshop during the Symposium. Participants are encouraged to submit their work to the SPIE CAD conference proceedings volume as well as for peer review to the SPIE's Journal of Medical Imaging.

Release date of training set cases with truth: **November 21, 2016**
Release date of test set cases without truth: **December 12, 2016**
Submission date for participants' test set classification output: **January 16, 2017**
Challenge results released to participants: **January 20, 2017**
SPIE Medical Imaging Symposium: **February 13-16, 2017**

PROSTATEx Challenge Format

The database for this challenge will contain a total of approximately 350 MRI cases, each from a single examination from a distinct patient. Approximately 60% of the cases will serve as the training set, and the remaining 40% of the cases will serve as the test set, with each case consisting of four sets of MRI scan data: two sets of T2-weighted images (transaxial and sagittal; DICOM format), Ktrans images (computed from dynamic contrast-enhanced (DCE) images; mhd format), and apparent diffusion coefficient (ADC) images (computed from

SPIE-AAPM-NCI Gleason grade challenge

- Goal: Classification of prostate cancer from multiparametric MR
- Dates: 5/2017-6/2018
- Dataset: ~162 MRI cases, each from a single examination from a distinct patient (112/70 findings in training/test set)
  - four sets of MRI scan data: two sets of T2-weighted images (transaxial and sagittal; DICOM format), Ktrans images (computed from dynamic contrast-enhanced (DCE) images; mhd format), and apparent diffusion coefficient (ADC) images (computed from diffusion-weighted (DWI) imaging; DICOM format).
- Metrics: quadratic weighted Cohen's kappa
- Participants: 315 registered

Organized by organizing.committee - Current server time: Sept. 2, 2019, 8:23 p.m. UTC

Previous	▶ Current	End
Training	Test	Competition Ends
May 15, 2017, 6 p.m. UTC	June 5, 2017, 6 p.m. UTC	June 26, 2018, 7 p.m. UTC

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SPIE-AAPM-NCI Prostate MR Gleason Grade Group Challenge

The American Association of Physicists in Medicine (AAPM), along with the SPIE (the international society for optics and photonics) and the National Cancer Institute (NCI), will conduct a part 2 "Grand Challenge" on the development of quantitative multi-parametric magnetic resonance imaging (MRI) biomarkers for the determination of Gleason Grade Group in prostate cancer. As part of the 2017 AAPM Annual Meeting, the PROSTATEx-2 Challenge will provide a unique opportunity for participants to compare their algorithms with those of others from academia, industry, and government in a structured, direct way using the same data sets.

A session at the 2017 AAPM Annual Meeting will focus on the PROSTATEx-2 Challenge; an individual from each of the two top-performing teams will receive a waiver of the meeting registration fee in order to present their methods during this session. Challenge participants are encouraged to submit their work for peer review to the AAPM's scientific journal Medical Physics.

Release date of training set cases with truth: **May 15, 2017**
Release date of test set cases without truth: **June 5, 2017**
Submission date for participants' test set Gleason Grade Group output: **June 23, 2017**
Challenge results released to participants: **June 30, 2017**
AAPM Annual Meeting: **July 30 – August 3, 2017 (PROSTATEx-2 session: August 1)**

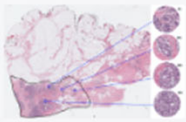
PROSTATEx-2 Challenge Format

The database for this challenge contains a total of 162 MRI cases, each from a single examination from a distinct patient, with each case consisting of four sets of MRI scan data: two sets of T2-weighted images (transaxial and sagittal; DICOM format), Ktrans images (computed from dynamic contrast-enhanced (DCE) images; mhd format), and apparent diffusion coefficient (ADC) images (computed from diffusion-weighted (DWI) imaging; DICOM format). These cases contain a total of 182 findings (lesions); the training set contains

SPIE-AAPM-NCI BreastPathQ cancer cellularity challenge

- Goal: determination of cancer cellularity from whole slide images (WSI) of breast cancer hematoxylin and eosin (H&E) stained pathological slides
- Dates: 12/2018-1/2020
- Dataset: 96 whole slide images (WSI) stained H&E)
  - WSIs were extracted from 64 patients with residual invasive breast cancer on resection specimens following neoadjuvant therapy.
  - WSIs were scanned at 20X magnification (0.5 lm/pixel)
  - 2,579 patches (training) from 69 WSI, 1121 patches from 25 WSI
- Metrics: prediction probability (non-parametric ROC)
- Participants: 458 registered

Competition



SPIE-AAPM-NCI BreastPathQ: Cancer Cellularity Challenge 2019

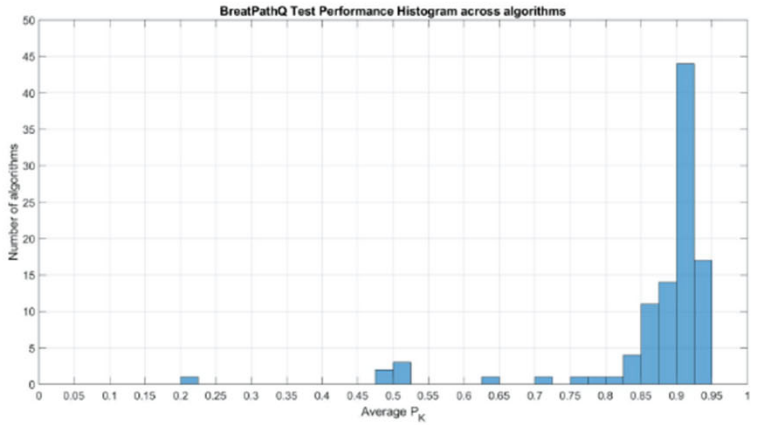
Organized by organizing.committee - Current server time: Sept. 2, 2019, 8:44 p.m. UTC

Previous	▶ Current	End
Test	On-going Challenge	Competition Ends
Dec. 6, 2018, midnight UTC	Jan. 18, 2019, 1:41 p.m. UTC	Jan. 1, 2020, 5 a.m. UTC

SPIE-AAPM-NCI BreastPathQ: Cancer Cellularity Challenge

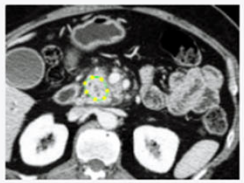
Test Performance Results as of 1/02/2019

The challenge has been closed as of 12/28/2018. The results for the test submissions have been emailed to the participants. The histogram of the submitted test results are shown below for reference.



MICCAI 2018 Pancreatic survival prediction challenge

- Goal: predict overall survival based on predictors derived from contrast-enhanced pancreas CT scans and patient clinical variables.
- Dates: 5/2018-8/2018
- Dataset: CT images + clinical data
  - portal venous phase CT (159/ 53 training/test)
- Metrics: Concordance index
- Participants: 352 registered



Pancreatic Cancer Survival Prediction

Organized by cpm.organizing.committee - Current server time: Sept. 2, 2019, 8:53 p.m. UTC

First phase	End
Training	Competition Ends
May 16, 2018, midnight UTC	Aug. 16, 2018, midnight UTC

Overview

Clinical Problem

Pancreatic ductal adenocarcinoma (PDAC) is a highly lethal cancer with a 5-year survival rate of less than 8%. For patients with resectable disease, the survival rate is only marginally better at 20%, reflecting our current inability to predict the biological aggressiveness of this cancer. A hallmark of PDAC that contributes to its aggressive biology is the variable and often extensive stromal involvement, which has previously hampered advances in molecular subtyping as well as chemotherapy delivery. Recent RNA sequencing studies highlight prognostic subtypes of PDAC based on separate stromal (normal or activated) and tumoral (classical or basal-like) gene-expression signatures. While RNA expression-determined subtypes may better capture the molecular landscape of PDAC, they may not adequately capture the intratumoral heterogeneity of PDAC in vivo. Thus validated prognostic biomarkers of survival are of paramount importance to improving patient survival of this deadly disease.

The Challenge

The challenge focuses on the quantitative assessment of pancreas cancer using a consecutive series of 212 patients undergoing pancreas resection at Memorial Sloan Kettering Cancer Center with clinical variables and high-quality annotated CT imaging. The aim of this challenge is to:

- **predict overall survival based on predictors derived from contrast-enhanced pancreas CT scans and patient clinical variables**.

Survival Analysis

Survival analysis is used to analyze data in which the time until the event is of interest. A good overview of survival analysis can be found here. Our challenge is inspired by the Prostate DREAM Challenge subchallenge 1, in which overall survival was predicted from clinical variables. An overview paper for subchallenge 1 has been published at Lancet Oncology. You can find the accepted manuscript here.

Our challenge is different as it utilizes imaging data in addition to clinical variables

MICCAI 2018 Combined radiology pathology classification challenge

- Goal: classify a cohort of lower grade glioma tumor cases into Oligodendroglioma and Astrocytoma based on MRI and whole slide imaging (WSI)
- Dates: 6/2018-8/2018
- Dataset: MR images and H&E WSI (100/20 train/test)
- Metrics: classification accuracy
- Participants: 309 registered

Combined Radiology and Pathology Classification

Organized by cpm.organizing.committee - Current server time: Sept. 2, 2019, 8:55 p.m. UTC

First phase	End
Training	Competition Ends
June 29, 2018, 11:59 p.m. UTC	Aug. 17, 2018, 11:59 p.m. UTC

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Overview

Grading and diagnosis of tumors in cancer patients have traditionally been done by examination of tissue specimens under a powerful microscope by expert pathologists. While this process continues to be widely applied in clinical settings, it is not scalable to translational and clinical research studies involving hundreds or thousands of tissue specimens. State-of-the-art digitizing microscopy instruments are capable of capturing high-resolution images of whole slide tissue specimens rapidly. Computer aided segmentation and classification has the potential to improve the tumor diagnosis and grading process as well as to enable quantitative studies of the mechanisms underlying disease onset and progression.

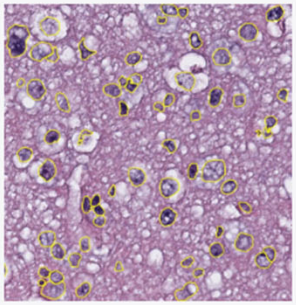
The objective of this challenge is to evaluate and compare classification algorithms and to encourage the biomedical imaging community to design and implement more accurate and efficient algorithms.

The challenge will evaluate the performance of automated classification algorithms when information from two types of imaging data – Radiology images and Pathology images – is used. Participants are asked to classify a cohort of lower grade glioma tumor cases into two sub-types: Oligodendroglioma and Astrocytoma.

The whole slide tissue images are stored in Aperio SVS format. There are open source tools and libraries that can

MICCAI 2018 Digital Pathology nuclear segmentation challenge

- Goal: segment nuclei in whole slide images (tiles) from patients with gliomas (GBM and low grade)
- Dates: 5/2018-8/2018
- Dataset: H&E stained WSI (image tiles)
- Metrics: traditional dice and ensemble dice
- Participants: 474 registered
- abstract submissions to this challenge are part of the BrainLes collection in the LNCS Springer.



Digital Pathology: Segmentation of Nuclei in Images

Organized by cpm.organizing.committee - Current server time: Sept. 2, 2019, 9:02 p.m. UTC

First phase	End
Training	Competition Ends
June 15, 2018, 11:59 p.m. UTC	Aug. 17, 2018, 11:59 p.m. UTC

Overview

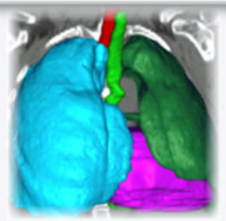
Grading and diagnosis of tumors in cancer patients have traditionally been done by examination of tissue specimens under a powerful microscope by expert pathologists. While this process continues to be widely applied in clinical settings, it is not scalable to translational and clinical research studies involving hundreds or thousands of tissue specimens. State-of-the-art digitizing microscopy instruments are capable of capturing high-resolution images of whole slide tissue specimens rapidly. Computer aided segmentation and classification has the potential to improve the tumor diagnosis and grading process as well as to enable quantitative studies of the mechanisms underlying disease onset and progression.

The objective of this challenge is to evaluate and compare segmentation algorithms and to encourage the biomedical imaging community to design and implement more accurate and efficient algorithms. The challenge will evaluate the performance of algorithms for detection and segmentation of nuclei in a tissue image. Participants are asked to detect and segment all the nuclear material in a given set of image tiles extracted from whole slide tissue images.

This challenge uses image tiles from whole slide tissue images to reduce computational and memory requirements. The image tiles are rectangular regions extracted from a set of Glioblastoma and Lower Grade Glioma whole slide tissue images. Nuclei in each image tile in the training set have been manually segmented. Note that the tiles are not of the same size.

AAPM Thoracic auto-segmentation challenge

- Goal: auto-segmentation of organs-at-risk in thoracis patients for radiation treatment planning
- Dates: 5/2017-6/2019
- Dataset: CT images (36/12/12 for training, test, live)
- Phases: on-line submission and live at AAPM
- Metrics: Dice coefficient, mean surface distance, 95% Hausdorff distance
- Participants: 366 registered
- https://w3.aapm.org/newsletter/posts/2017/sept-oct/4205_24.php.



AAPM Thoracic Auto-segmentation Challenge

Organized by MarkGooding - Current server time: Sept. 2, 2019, 9:16 p.m. UTC

First phase	End
Training Phase	Competition Ends
May 18, 2017, midnight UTC	June 5, 2019, 10:16 a.m. UTC

Overview

Numerous auto-segmentation methods exist for Organs at Risk in radiotherapy. The overall objective of this auto-segmentation grand challenge is to provide a platform for comparison of various auto-segmentation algorithms when they are used to delineate organs at risk (OARs) from CT images for thoracic patients in radiation treatment planning. The results will provide an indication of the performances achieved by various auto-segmentation algorithms and can be used to guide the selection of these algorithms for clinic use if desirable. The challenge is made up of multiple phases:

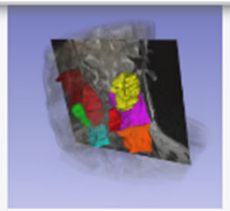
Phase 1 will conducted via this website in advance of the AAPM meeting. 12 test images will be provided and results will be submitted online. The 3 top place contestants in this phase will be invited to present at the challenge symposium at AAPM.

Phase 2 will be conducted live at the AAPM. A further 12 test images will be provided for evaluation, and participants will have 2 hours to generate results. Participants need not have participated in Phase 1 to be part of Phase 2.

Symposium Following Phase 2 a symposium will be held at which the results of both previous phases will be presented.

AAPM RT-MAC challenge

- Goal: auto-segmentation of organs-at-risk and tumors in MR images of patients with head and neck cancer for radiation treatment planning
- Dates: 6/2019-7/2019
- Dataset: MR images (36/12/10 for training, test, live)
- Phases: on-line submission and live at AAPM
- Metrics: Dice coefficient, mean surface distance, 95% Hausdorff distance
- Participants: 112 registered



AAPM RT-MAC Challenge

Organized by MarkGooding - Current server time: Sept. 2, 2019, 9:12 p.m. UTC

Previous	▶ Current	End
Pre-AAPM	AAPM Live Challenge	Competition Ends
June 7, 2019, midnight UTC	July 15, 2019, midnight UTC	Never

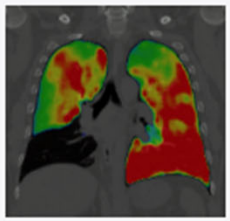
Overview

MRI is popular in radiation oncology because of its excellent imaging quality of soft tissue and tumor. With the advent of MR-Linac and MR-guided radiation therapy, there is a trend toward a MR-based radiation treatment planning. Contouring is an important task in modern radiation treatment planning and frequently introduces uncertainties in radiation therapy due to observer variabilities. Auto-segmentation has been demonstrated as an effective approach to reduce this uncertainty. The overall objective of this grand challenge is to provide a platform for comparison of various auto-segmentation algorithms when they are used to delineate organs at risk (OARs) or tumors from MR images for head and neck patients for radiation treatment planning. The results will provide an indication of the performances achieved by various auto-segmentation algorithms and can be used to guide the selection of these algorithms for clinic use if desirable. The challenge is made up of multiple phases:

Phase 1 will conducted via this website in advance of the AAPM meeting. 12 test images will be provided and results will be submitted online. An individual from each of the two top-performing teams will receive a waiver of the meeting registration fee in order to present their methods during the challenge symposium at AAPM.

AAPM CTVIE19 challenge

- Goal: determine which CT ventilation imaging algorithms best correlate with reference measures across a range of pulmonary pathologies.
- Dates: 4/2019-9/2019
- Dataset: lung CT images
- Phases: on-line submission and live at AAPM
- Metrics: Dice coefficient, voxel-wise and ROI based Spearman correlation
- Participants: 97 registered



Computed tomography ventilation imaging evaluation 2019 (CTVIE19): An AAPM Grand Challenge

Organized by AAPM.Organizing.Committee - Current server time: Sept. 3, 2019, 1:02 p.m. UTC

Previous	▶ Current	End
Final Submission	Ongoing Challenge	Competition Ends
June 5, 2019, 5:01 p.m. UTC	Sept. 1, 2019, 5:01 p.m. UTC	Never

Overview

The American Association of Physicists in Medicine (AAPM) are facilitating a "Grand Challenge" on CT ventilation imaging leading up to the 2019 AAPM Annual Meeting. Computed tomography ventilation imaging evaluation 2019 (CTVIE19) will provide a unique opportunity for participants to compare their algorithms with those of other groups in a structured, direct way using the same datasets.

Objective

The overall objective of CTVIE19 is to determine which CT ventilation imaging algorithms best correlate with reference measures across a range of pulmonary pathologies. To this end, we will provide a unique and diverse patient dataset of PFTs and paired multi-inflation CT and reference ventilation images collated from data acquired prospectively by leading functional lung imaging institutions worldwide.

RSNA bone age challenge

- Goal: Develop an algorithm which can most accurately determine skeletal age on a validation set of pediatric hand radiographs
- Dates: 10/2017-12/2018
- Dataset: x-ray images of hands
- Metrics: Mean absolute distance (MAD), concordance correlation coefficient (CCC)
- Participants: 621 registered

RSNA Radiological Society of North America

My Competitions Help

Competition

Admin features

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Pediatric Bone Age Challenge

Organized by RSNA.organizing.committee - Current server time: Sept. 3, 2019, 1:27 p.m. UTC

▶ Current	Next
Test	Leaderboard
Oct. 7, 2017, midnight UTC	Sept. 1, 2017, midnight UTC

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Goal

Develop an algorithm which can most accurately determine skeletal age on a validation set of pediatric hand radiographs.

Background

The Pediatric Bone Age Challenge will utilize three skeletal age datasets acquired from Stanford Children's Hospital and Colorado Children's Hospital. A training set of hand radiographs and corresponding skeletal ages will be provided to the participants.

Description

MICCAI Brain Tumor Classification

- Goal: With information from two types of imaging data, radiology images and pathology images, participants are asked to classify a cohort of brain tumor cases into three sub-types: Glioblastoma, Oligodendroglioma, and Astrocytoma.
- Dates: 07/2019-09/2019
- Dataset: radiology/pathology images of brains
- Metrics: Balanced Accuracy Score (BAS), Cohen Kappa Score (Kappa), F1 Score (F1)
- Participants: 55 registered
- Evaluation and Submission: Participants submitted their algorithms as docker images that were run by MGH\NCI to validate online submissions. Participants were also asked to submit short papers, reporting proposed method & preliminary results.

Competition

Admin features

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Computational Precision Medicine 2019: Brain Tumor Classification

Organized by bbearce - Current server time: Sept. 3, 2019, 2:45 p.m. UTC

Previous	▶ Current	Next
Validation	Short Papers	Test
Aug. 19, 2019, midnight UTC	Aug. 30, 2019, 11:53 a.m. UTC	Sept. 3, 2019, 4:40 p.m. UTC

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Brain cancer is a fatal and complex disease. Diagnosis and grading of brain tumors is traditionally done by pathologists, who examine tissue sections fixed on glass slides under a light microscope. While this process continues to be widely applied in clinical setting, it is not scalable to translational and clinical research studies involving hundreds or thousands of tissue specimens. Computer-aided classification has the potential to improve tumor diagnosis and grading process, as well as to enable quantitative studies of the mechanisms underlying disease onset and progression.

The challenge will evaluate the performance of automated classification algorithms when information from two types of imaging data – Radiology images and Pathology images – is used. Participants are asked to classify a cohort of brain tumor cases into three sub-types: Glioblastoma, Oligodendroglioma, and Astrocytoma.

The objective of this challenge is two-fold: 1) to evaluate and compare classification algorithms and 2) to encourage the design and implementation of accurate and efficient algorithms.