

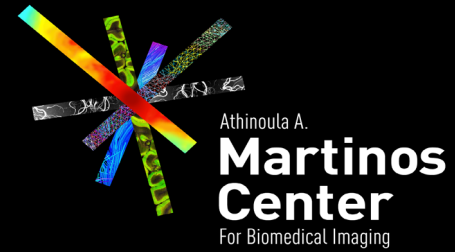
Athinoula A.
**Martinos
Center**
For Biomedical Imaging

MedICI HelpDesk Status Update (and other projects)

Samarth Nandekar, Andrew Beers, Jayashree Kalpathy-Cramer,
Athinoula A. Martinos Center for Biomedical Imaging
MGH/Harvard Medical School

Agenda

- What is MedICI?
- Past, ongoing and future challenges
- New features
- Crowds Cure Cancer



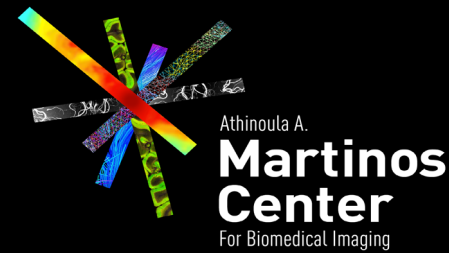
MedICI Challenge Ecosystem

- Developed (in part) with funding from a previous contract and NIH grants
- Infrastructure to host challenges in the community
- Built on open-source CodaLab platform
- Integrates with ePAD and Cornerstone web viewers (radiology)
 - For ground truth generation
 - Results viewing
- Integrates with caMicroscope (digital pathology)
- System for assigning annotation tasks to experts for ground truth generation
- Been used for ~ two dozen challenges , over 2000 participants have signed up in the system

Past challenges

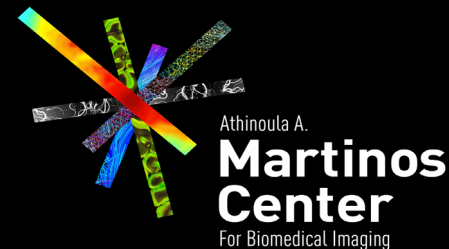
- MICCAI 2015, 2016, 2017
 - Brain tumor segmentation
 - Digital pathology (segmentation and classification)
 - Joint radiology/pathology challenge
 - Digital mammography
 - Liver metastases survival prediction
- QIN
 - BMMR (breast MR response prediction)
 - CT feature challenge
- QIBA lung nodule challenge
- SPIE ProstateX
- SPIE/AAPM/NCI ProstateX-2

Recent Challenges



Challenge Name	Dates
1) ISBI 2018 - Lung Nodule Malignancy Prediction, Based on Sequential CT Scans	January 18 - March 18
2) Pancreatic Cancer Survival Prediction	May 18 - August 18
3) 18F-FDG PET Radiomics Risk Stratifiers in Head and Neck Cancer	June 18 - August 18
4) Combined Radiology and Pathology Classification	June 18 - August 18
5) Digital Pathology: Segmentation of Nuclei in Images	June 18 - August 18
6) Pediatric Bone Age Challenge	Aug 2017 - Oct. 2018
7) AAPM Thoracic Auto-segmentation Challenge	May 2017 - on going

Lung Nodule challenge



Venue: ISBI 2018

Title: Lung Nodule Malignancy Prediction,
Based on Sequential CT Scan

Organizer: Yoga Balagurunathan/QIN

Training : Jan. 8, 2018

Test : March 12, 2018

Competition Ends : March 22, 2018

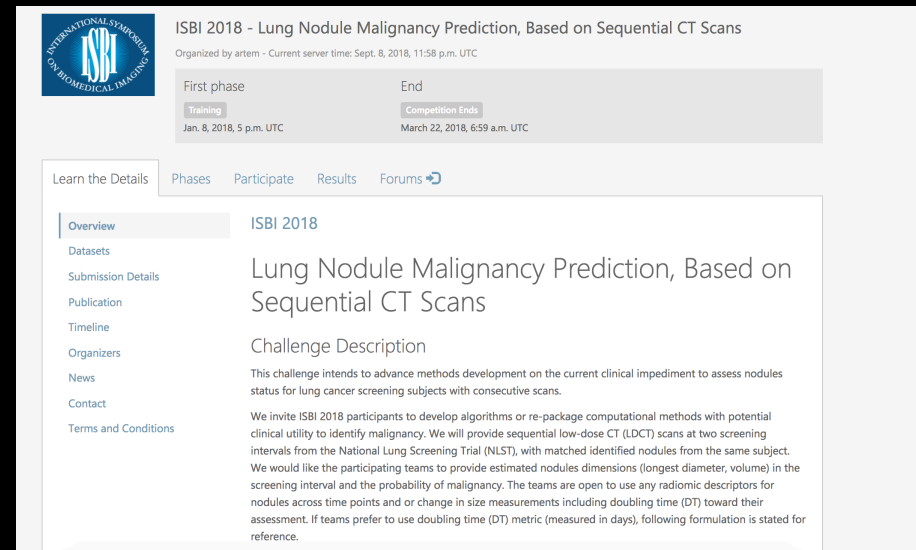
Participants : 121

Link :

<http://isbichallenges.cloudapp.net/competitions/15>

Challenge summary presented at ISBI,
April 2018

Manuscript in preparation



ISBI 2018 - Lung Nodule Malignancy Prediction, Based on Sequential CT Scans

Organized by artem - Current server time: Sept. 8, 2018, 11:58 p.m. UTC

First phase	End
Training Jan. 8, 2018, 5 p.m. UTC	Competition Ends March 22, 2018, 6:59 a.m. UTC

Learn the Details | Phases | Participate | Results | Forums

ISBI 2018

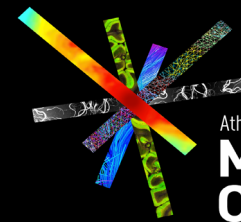
Lung Nodule Malignancy Prediction, Based on Sequential CT Scans

Challenge Description

This challenge intends to advance methods development on the current clinical impediment to assess nodules status for lung cancer screening subjects with consecutive scans.

We invite ISBI 2018 participants to develop algorithms or re-package computational methods with potential clinical utility to identify malignancy. We will provide sequential low-dose CT (LDCT) scans at two screening intervals from the National Lung Screening Trial (NLST), with matched identified nodules from the same subject. We would like the participating teams to provide estimated nodules dimensions (longest diameter, volume) in the screening interval and the probability of malignancy. The teams are open to use any radiomic descriptors for nodules across time points and or change in size measurements including doubling time (DT) toward their assessment. If teams prefer to use doubling time (DT) metric (measured in days), following formulation is stated for reference.

Active Forums



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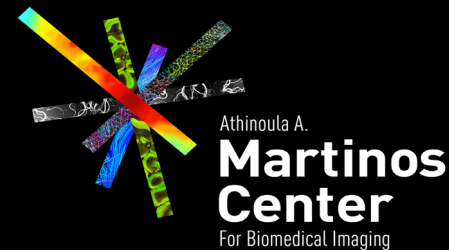
ISBI 2018 - Lung Nodule Malignancy Prediction, Based on Sequential CT Scans Forum

[Go back to competition](#)

[Start a new topic](#)

Title	Started by	Date created	Latest post	Posts
Test data results	Ricard	Mar 28, 2018	5 months, 2 weeks	1
Where to Submit Train data probabilities	pranjalsahu	Mar 21, 2018	5 months, 3 weeks	1
Where to Submit Train data probabilities	pranjalsahu	Mar 21, 2018	5 months, 3 weeks	1
Submission closed before the time	Ricard	Mar 21, 2018	5 months, 3 weeks	3
Test submission failed -- is anyone able to submit test results successfully?	superman	Mar 16, 2018	5 months, 3 weeks	5
Updates from Organizers:	YogaB	Jan 26, 2018	5 months, 3 weeks	4
ISBI Testing Set -- Nodule Location Amendment	artem	Mar 15, 2018	5 months, 3 weeks	5
Lung Challenge Session at ISBI	farahank	Mar 15, 2018	5 months, 3 weeks	1
Updates on challenge training dataset, test result submissions, and evaluation	farahank	Mar 10, 2018	5 months, 4 weeks	7
Cannot download any files from moffitt	MykolaSharhan	Feb 06, 2018	6 months	4
Test data download link	mehrtash	Mar 12, 2018	6 months	2
Submission down?	Ricard	Feb 25, 2018	6 months, 1 week	3
Where to submit the Abstract?	Ricard	Feb 25, 2018	6 months, 1 week	2
Abstract detail	Ricard	Feb 22, 2018	6 months, 2 weeks	1
Issues for multiple nodule annotations for one single patient	superman	Feb 14, 2018	6 months, 3 weeks	2
Test data	GuilhermeAresta	Jan 26, 2018	6 months, 4 weeks	6
I cannot connect to the second link about the nodules and slice	hushunda	Feb 02, 2018	7 months, 1 week	2
I cannot download dataset. and also cannot connect to moffitt.org	pgb	Jan 24, 2018	7 months, 1 week	5
Submission Form	uthoff	Jan 23, 2018	7 months, 2 weeks	3

Pancreatic Cancer



Venue: MICCAI 2018

Pancreatic Cancer Survival Prediction

Organizer: Amber Simpson

Training: May 16, 2018

Test: Aug. 1, 2018

Ends Date: Aug. 16, 2018

Participants :- 267

Link:

<http://miccai.cloudapp.net/competitions/84>

Challenge summary to be presented at CPM workshop at MICCAI

Pancreatic Cancer Survival Prediction

Organized by cpm.organizing.committee - Current server time: Sept. 9, 2018, 12:05 a.m. UTC

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

Learn the Details | Phases | Participate | Results | Forums →

Overview

Evaluation

Terms and Conditions

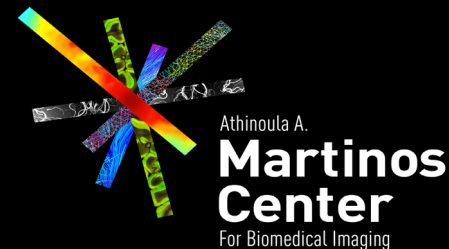
Submission

References

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

Rad/Path challenge



Venue: MICCAI 2018

Combined Radiology and Pathology Classification

Organizer: Tahsin Kurc

Training: June 28, 2018

Test: July 31, 2018

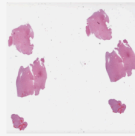
Competition Ends : Aug. 17 ,2018

Participants : 220

Link:

<http://miccai.cloudapp.net/competitions/82>

Challenge summary to be presented at CPM workshop at MICCAI



Combined Radiology and Pathology Classification

Organized by cpm.organizing.committee - Current server time: Sept. 9, 2018, 12:18 a.m. UTC

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

[Learn the Details](#) [Phases](#) [Participate](#) [Results](#) [Forums](#) ↗

Overview

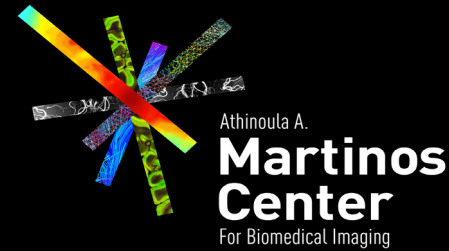
[Evaluation](#)

[Terms and Conditions](#)

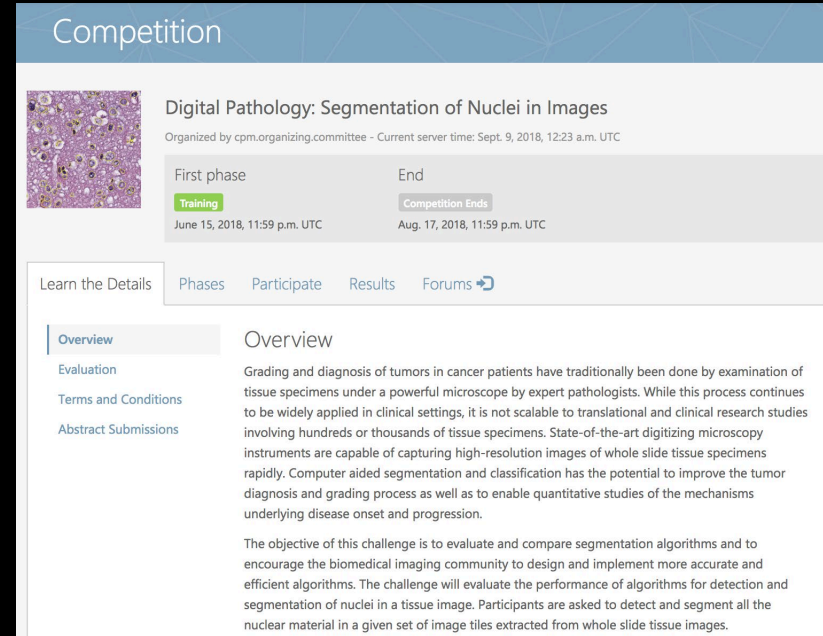
Grading and diagnosis of tumors in cancer patients have traditionally been done by examination of tissue specimens under a powerful microscope by expert pathologists. While this process continues to be widely applied in clinical settings, it is not scalable to translational and clinical research studies 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.

Digital Pathology Challenge



Venue: MICCAI 2018
Digital Pathology: Segmentation of Nuclei in Images
Organizer: Tahsin Kurc
Training: June 15, 2018
Test: July 31, 2018
Competition Ends : Aug. 17 ,2018
Participants : 304
Link:
<http://miccai.cloudapp.net/competitions/83>
Challenge summary to be presented at CPM workshop at MICCAI



The screenshot shows the competition page for "Digital Pathology: Segmentation of Nuclei in Images". It includes a header with the title, a sub-header with the organizing committee and server time, and a table showing the training and competition phases. Below this is a navigation bar with links for "Learn the Details", "Phases", "Participate", "Results", and "Forums". The main content area features a sidebar with "Overview", "Evaluation", "Terms and Conditions", and "Abstract Submissions". The "Overview" section contains a detailed description of the challenge's purpose and objectives.

Competition

Digital Pathology: Segmentation of Nuclei in Images

Organized by [cpm.organizing.committee](#) - Current server time: Sept. 9, 2018, 12:23 a.m. UTC

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

[Learn the Details](#) | [Phases](#) | [Participate](#) | [Results](#) | [Forums](#) ↗

Overview

Evaluation

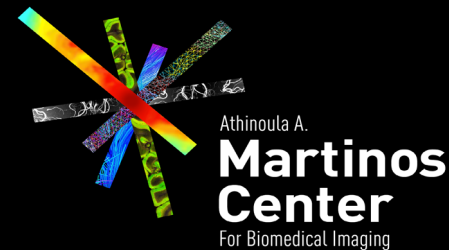
Terms and Conditions

Abstract Submissions

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.

Pediatric Bone Age Challenge



Venue: RSNA 2017

Prediction of pediatric bone age from x-rays

Organizer: RSNA

Training: Aug 5, 2017

Test: Oct 7, 2017

Competition Ends : Oct. 17, 2017 (site open)

Participants : 496

Link:

<http://rsnachallenges.cloudapp.net/competitions>

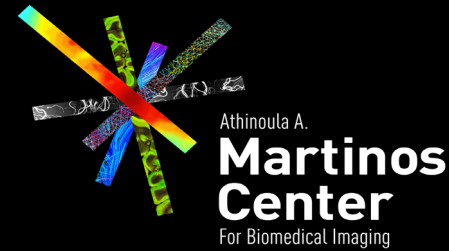
4

Challenge summary presented RSNA

Manuscript submitted to Radiology-AI

The screenshot shows the RSNA Pediatric Bone Age Challenge website. At the top, there is a navigation bar with the RSNA logo and links for 'Search Competitions', 'My Competitions', 'Help', 'Sign Up', and 'Sign In'. Below the navigation bar, the main heading is 'Pediatric Bone Age Challenge', followed by the text 'Organized by RSNA.organizing.committee - Current server time: Sept. 9, 2018, 12:26 a.m. UTC'. A 'Current' section contains two buttons: 'Test' (with the date 'Oct. 7, 2017, midnight UTC') and 'Leaderboard' (with the date 'Sept. 1, 2017, midnight UTC'). Below this, there are tabs for 'Learn the Details', 'Phases', 'Participate', 'Results', and 'Forums'. The 'Learn the Details' tab is active, showing a sidebar with 'Overview', 'Evaluation', 'Terms and Conditions', 'Organizers', and 'News'. The main content area displays the 'Goal' (to develop an algorithm for skeletal age determination), 'Background' (describing the datasets from Stanford and Colorado Children's Hospital), and 'Description' (discussing the role of AI in medical imaging).

AAPM Thoracic Auto-segmentation Challenge



Venue: AAPM 2017/ongoing

Thoracic auto-contouring

Organizer: AAPM

Pre-AAPM Challenge: June 19, 2017

AAPM Live Challenge: Aug. 2, 2017

Competition Ends: Never

Participants : 274

Link:

<http://aapmchallenges.cloudapp.net/competitions/>

Challenge summary presented AAPM 2017

Manuscript accepted

The screenshot shows the AAPM Pediatric Bone Age Challenge page. At the top, there is a navigation bar with the RSNA logo and links for Search Competitions, My Competitions, Help, Sign Up, and Sign In. The main heading is "Pediatric Bone Age Challenge", with a sub-heading "Organized by RSNA.organizing.committee - Current server time: Sept. 9, 2018, 12:26 a.m. UTC". Below this, there are two tabs: "Current" and "Next". The "Current" tab is active and shows a "Test" button for Oct. 7, 2017, midnight UTC, and a "Leaderboard" button for Sept. 1, 2017, midnight UTC. The "Next" tab is inactive. Below the tabs, there is a navigation menu with "Learn the Details", "Phases", "Participate", "Results", and "Forums". The "Overview" section is selected, showing a "Goal" to develop an algorithm for determining skeletal age, a "Background" section mentioning three datasets from Stanford Children's Hospital and Colorado Children's Hospital, and a "Description" section about AI in medical imaging.

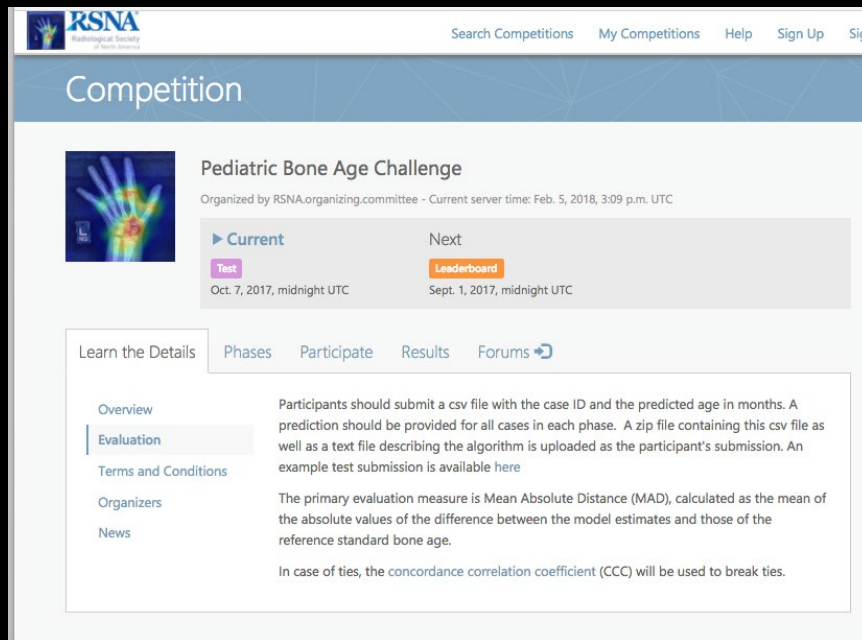
Helpdesk support

- Numerous meetings with challenge organizers to provide advice on setting up a challenge (if first time organizer)
- Gather requirements for challenge
 - Data
 - Evaluation metrics
 - Visualization
 - Statistical analysis

Support to set up the challenge

- Set up an instance of the challenge
 - Basic template with required pages
 - Work with organizers to customize pages and tabs per requirement
- Work with organizers to add content
- Work with organizers to share data
 - Format conversion
 - QA
 - Linking with datastores on Azure, Dropbox, Box etc
- Set up phases and deadlines
- Develop and validate evaluation code with test submission

Statistical evaluation



The screenshot shows the RSNA website for the Pediatric Bone Age Challenge. At the top, there is a navigation bar with the RSNA logo and links for 'Search Competitions', 'My Competitions', 'Help', 'Sign Up', and 'Sign In'. Below this is a blue header with the word 'Competition'. The main content area features a large image of a hand with a bone age overlay, the title 'Pediatric Bone Age Challenge', and the text 'Organized by RSNA.organizing.committee - Current server time: Feb. 5, 2018, 3:09 p.m. UTC'. There are two main sections: 'Current' (Oct. 7, 2017, midnight UTC) and 'Next' (Sept. 1, 2017, midnight UTC). Each section has a 'Test' button and a 'Leaderboard' button. Below this is a 'Learn the Details' section with tabs for 'Phases', 'Participate', 'Results', and 'Forums'. The 'Evaluation' tab is selected, showing the following text: 'Participants should submit a csv file with the case ID and the predicted age in months. A prediction should be provided for all cases in each phase. A zip file containing this csv file as well as a text file describing the algorithm is uploaded as the participant's submission. An example test submission is available here. The primary evaluation measure is Mean Absolute Distance (MAD), calculated as the mean of the absolute values of the difference between the model estimates and those of the reference standard bone age. In case of ties, the concordance correlation coefficient (CCC) will be used to break ties.'

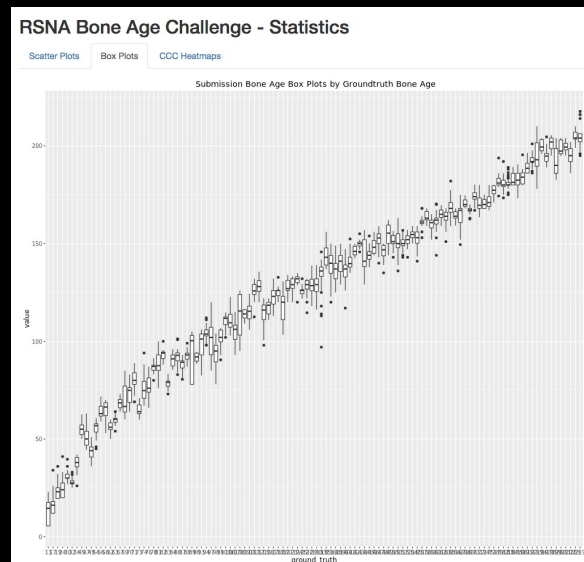
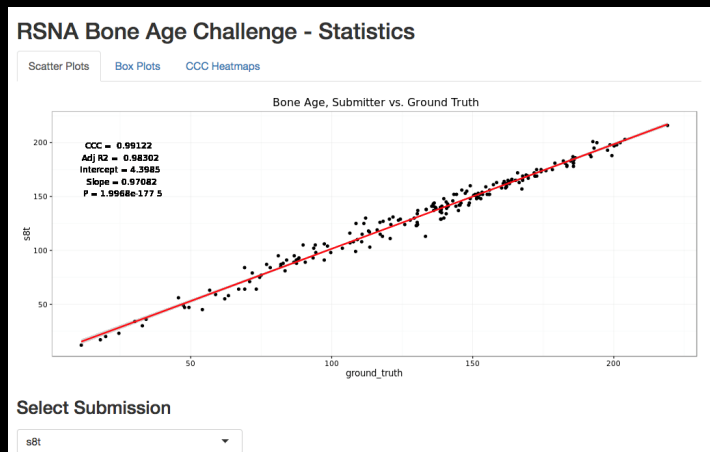
Ongoing/post challenge support



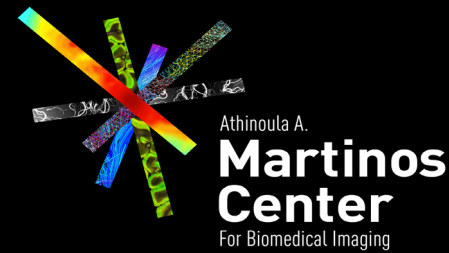
- Monitor forums
- Work with organizers to resolve issues
- Work with participants to resolve issues
- Work with participants who might be unfamiliar with data formats to provide support (e.g. converters, scripts, resources)
- Update codebase to reflect new requirements/feature requests

Post-challenge support

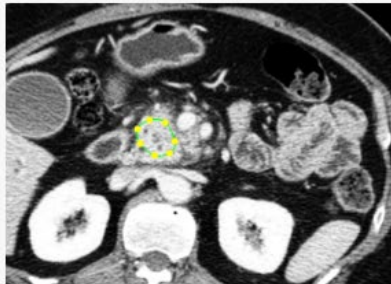
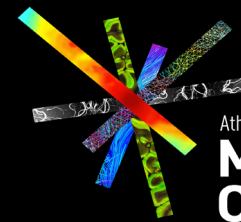
- Interactive results visualization
 - http://cbibop.cloudapp.net:3838/BoneAge_ShinyApp/



Help Desk features (issues)



- Provide basic skeleton pages for all challenges.
 - Organizer information provided –participants could contact organizer with issues
 - There was no ability in MedICI to report an issue and keep count of reported issue.
- Enhancements in MedICI for issue reporting
 - Users have ability to report issues
 - Once user reports issue, registered email ids receive email.
- Organizer can check the reported issues in MedICI and can check reported date and close date.
- Team works on reported issues and communicate with users.



Pancreatic Cancer Survival Prediction

Organized by cpm.organizing.committee - Current server time: Sept. 7, 2018, 7:44 p.m. UTC

First phase

Training

May 16, 2018, midnight UTC

End

Competition Ends

Aug. 16, 2018, midnight UTC

[Learn the Details](#)

[Phases](#)

[Participate](#)

[Results](#)

[Forums](#) →

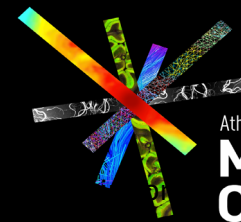
[Report Issue](#) →

Overview

Evaluation

Overview

Clinical Problem



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Report Issue

Pancreatic Cancer Survival Prediction

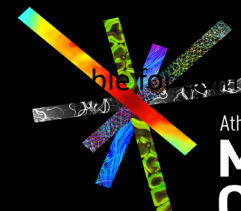
[Go back to competition](#)

[Help](#)

Title

Content

Submit



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**Martinos
Center**

For Biomedical Imaging



Pancreatic Cancer Survival Prediction

Organized by cpm.organizing.committee - Current server time: Sept. 7, 2018, 7:50 p.m. UTC

First phase

Training

May 16, 2018, midnight UTC

End

Competition Ends

Aug. 16, 2018, midnight UTC

[Learn the Details](#)

[Phases](#)

[Participate](#)

[Results](#)

[Forums](#) ➔

[Report Issue](#) ➔

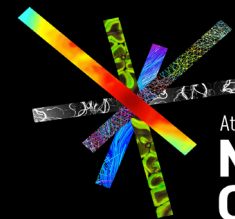
[Issue Status](#) ➔

Overview

Evaluation

Overview

Clinical Problem



All Issues Details and Status

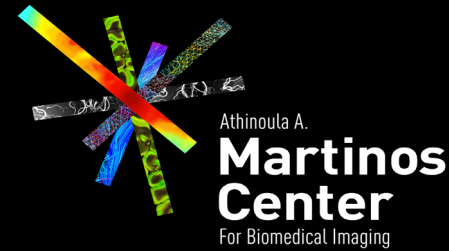
Pancreatic Cancer Survival Prediction

[Go back to competition](#)

[Help](#)

#	Issue Title	Issue Description	Reported On	Status	Closed On *	Action
1	Picture 4 and 5 are switched	The image5 corresponds to mask4 and poly4 and vice versa.	6/15/2018	<input type="text" value="Closed"/>	<input type="text" value="6/18/2018"/>	<input type="button" value="Update"/>
2	Evaluation Script	Since the evaluation script use the Cindex proposed by MITHAT GONEN does it mean we must use the Cox Regression to get the global risk score Otherwise the Cindex may not indicate the performance of the results. For example if I multiply every value in the MICCAICPMPDACChallengeSubmissionTraining.csv with 10 then the result will be larger than the original one.	6/20/2018	<input type="text" value="Closed"/>	<input type="text" value="6/25/2018"/>	<input type="button" value="Update"/>
3	Differences in Cindex scores	Hi The Cindex score obtained using the evaluation script provided in the downloads varies from the one that is generated by the system after uploading the result. Please let us know if there is any change in the evaluation script.	7/24/2018	<input type="text" value="Closed"/>	<input type="text" value="7/29/2018"/>	<input type="button" value="Update"/>

Abstract Submission



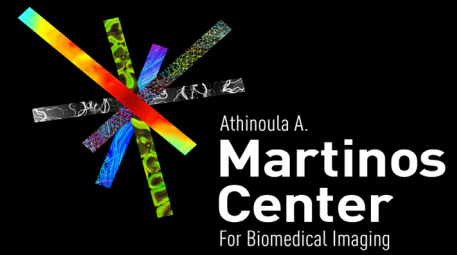
- Abstract submissions are required for some challenges
- Created Dropbox file request.
- In file request, set start date and end date, allow late submissions and can share folders with organizers.
- File request link available in MedICI

Ongoing/Future Challenges

- AAPM head & neck segmentation (continuous phase)
- RSNA bone age (officially concluded at RSNA but site still open)
- MICCAI 2018
- QIN challenges (in planning stages)
 - Proposal to QIN CC re: ECOG-ACRIN data sets
- SPIE/AAPM (in planning stages)
 - Pathology challenge, basic template set up

Current status of project

- Providing support for ongoing challenges
- Working with potential organizers on new challenges
- Helpdesk
 - Support organizers
 - Support participants



Crowds Cure Cancer

Collaborators

- Erik Ziegler/Gordon Harris (OHIF/MGH/ITCR)
- Steve Pieper (ITCR)
- Lawrence Tarbox, Jeff Tobler, Fred Prior (UAMS/ITCR)
- Ashish Sharma (Emory/ITCR)
- Jayashree Kalpathy-Cramer/Artem Mamonov (MGH/ITCR)
- Justin Kirby, Brenda Fevrier-Sullivan, John Freyman (FNL)
- Erich Huang, Paula Jacobs (NCI)
- RSNA (Informatics)



BACKGROUND



Many cancers routinely identified by imaging haven't yet benefited from recent advances in computer science. Approaches such as machine learning and deep learning can generate quantitative tumor 3D volumes, complex features and therapy-tracking temporal dynamics. However, cross-disciplinary researchers striving to develop new approaches often lack disease understanding or sufficient contacts within the medical community. Their research can greatly benefit from labeling and annotating basic information in the images such as tumor location, which are obvious to radiologists.



"Crowdsourcing" the creation of publicly-accessible reference data sets could address this challenge. In 2011 the National Cancer Institute funded development of The Cancer Imaging Archive (TCIA), a free and open-access database of de-identified medical images. Many of its data-sets are cross-linked to extensive genetic/proteomic and clinical data gathered during the NIH's 'The Cancer Genome Atlas (TCGA) as well as other sources. However, most of these collections lack the labeling and annotations needed by computer image researchers for progress in deep learning and radiomics.

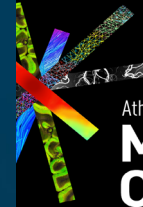


With this booth the NCI and RSNA seek to harness the vast knowledge of meeting attendees to generate these tumor markups. Data resulting from this experiment will be openly shared with the radiology and the computer science community.

[HTTP://BIT.LY/CROWDCURE](http://bit.ly/crowdcure)



HELP US LOCATE TUMORS IN CANCER IMAGING DATA



PARTICIPATE

IN THIS CROWD-SOURCING EXPERIMENT



Unlabeled data from The Cancer Imaging Archive has been loaded into a web-based annotation environment. It contains numerous subjects with proven cancer diagnoses spanning a variety of cancer types (brain, renal, lung, etc). The tumor is usually fairly obvious to an experienced imager.



Find the slice that shows the maximum dimension of the tumor. With the linear pencil tool draw a line across the tumor's maximum diameter and save your work. Any individual case will probably take you less than a minute or two. It's just like a "RECIST" measurement commonly used in clinical trials.



Don't agonize about getting it perfect. Do as many or as few cases as you like – but of course more would always be welcome! The booth docent would enjoy hearing your comments.



Let us know if you want to stay in the loop! Markups from this booth are saved and will be made public to the broad image science community. Leave us your email address if you'd like to be notified when they're released. Or sign up for one of TCIA's social media options (LinkedIn, Twitter, Facebook) to get push notifications any time new data sets are added to the site.

[HTTP://BIT.LY/CROWDCURE](http://bit.ly/crowdcure)



HELP US LOCATE TUMORS IN CANCER IMAGING DATA



ACKNOWLEDGED FOR YOUR PARTICIPATION



As a token of appreciation for participation you will receive a badge ribbon. It may stimulate some further interesting conversations with your colleagues.



At any time you can explore the **NCI Cancer Imaging Archive** large image data collections and their linked clinical and genetic/proteomic metadata. We encourage you to check out The Cancer Imaging Archive (TCIA) to learn about the other available data on the site, and to [stop by our hands-on workshop on Thursday from 2:30-4:00 in S401CD.](#)



<http://www.cancerimagingarchive.net>

Exhibit Contributors:

Frederick National Laboratory for Cancer Research: Justin Kirby, Carl Jaffe, Brenda Fevrier-Sullivan and John Freymann

Massachusetts General Hospital: Artem Mammanov, Andrew Beers, Jayashree Kalpathy-Cramer

University of Arkansas for Medical Sciences: Lawrence Tarbox, Jeff Tobler, Fred Prior

Emory University: Ashish Sharma

Quantitative Image Informatics for Cancer Research (QICR): Steve Pieper and the QICR team

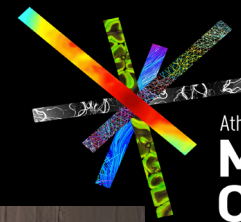
Open Health Imaging Foundation (OHIF): André Botelho Almeida, Erik Ziegler, Rob Lewis, Gordon Harris and the OHIF team

RSNA Radiology Informatics Committee

HTTP://BIT.LY/CROWDCURE



HELP US LOCATE TUMORS IN CANCER IMAGING DATA



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System Architecture

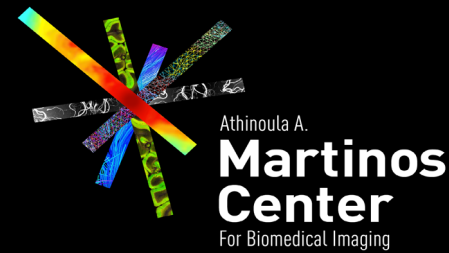
- TCIA
 - Used images with known “truth” from TCGA studies/Carl Jaffe
- Azure VM
- Cornerstone Viewer
 - Lightweight version, mobile friendly!!
- Chronicle DB (CouchDB) backend
 - DICOM aware!
- Registration system
 - Logic for next case
- JS/D3 for results (in progress)
 - Charts
 - Summary tables

General Impressions

- Overall seemed to be a success ?
- Many participants ended up spending more time than planned
- Viewer was responsive
- No major complaints about system performance
- Results are (very) promising

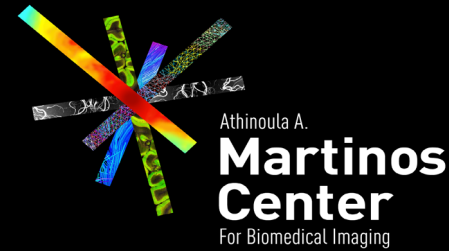
Feedback on interface

- Need to start with a click through tutorial
- Window/Level presets
- Ability to change category mid session
 - Also important when multiple cancer types are chosen.
- Mobile support?
- Flag button for quality with text box for comments
- No log in when username is empty
- Logout button
- Need metrics - time per session, scores per session
- People asked to see the number of cases they annotated somewhere on the screen.
- Add sagittal and coronal views for measurement accuracy
- A few did not like the randomization of the images if they selected 3 or 4 cancer types – they complained about getting a bunch of all liver or all lung cases at a time; and said they would have preferred being given the options of which to do next.
- System stalled if images for only one cancer type was selected and all the cases were completed.
- Reorder buttons – keep essentials only for mobile
- Teaching interface – provide immediate feedback compared to “consensus”?



Logistics

- Better location?
 - Near case of the day
- Coffee, water, cookies, chocolate
- Wipes or alcohol wash for hands
- Integration with RSNA app



Annotators

- Over 250 signed up
 - 211 had at least 1 annotation
 - 112 were radiologists
- Selected
 - Liver: 189
 - Lung: 211
 - Renal: 165
 - Ovarian: 133
- Selected
 - 4: 120
 - 3: 27
 - 2: 29
 - 1: 78

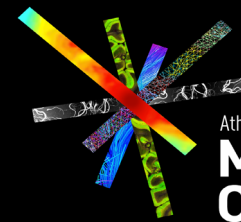
Dashboard



Leader Board

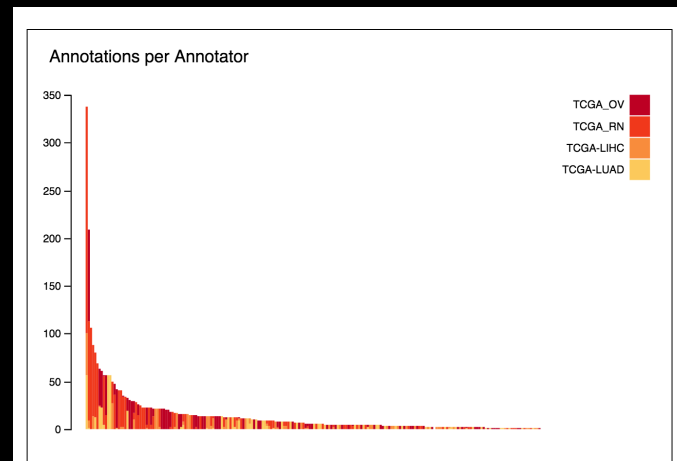
Annotators with at least one Measurement	211
Total Number of Cases Annotated (including Skips)	3059
Total Number of Cases Skipped	705

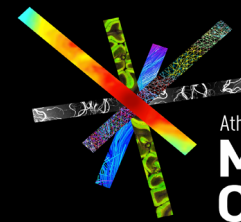
misty_mandrill	338 (13)
nocturnal_sparrow	209 (102)
rubbery_hamster	106 (20)
flippant_beaver	88 (4)
clueless_mongoose	80 (3)
untimely_goldfinch	69 (2)
impish_cat	63 (6)
unfit_weasel	61 (8)
competent_hawk	57 (4)
firm_bat	57 (34)
ethical_chicken	56 (2)
informal_panther	56 (3)
mean_mongoose	50 (5)
courteous_kingfisher	47 (2)
knowledgeable_panda	42 (5)
altruistic_seal	41 (0)
immaculate_oyster	41 (4)
shadowy_bee	35 (0)
actual_giraffe	34 (0)
poised_vulture	33 (6)



Annotations per annotator

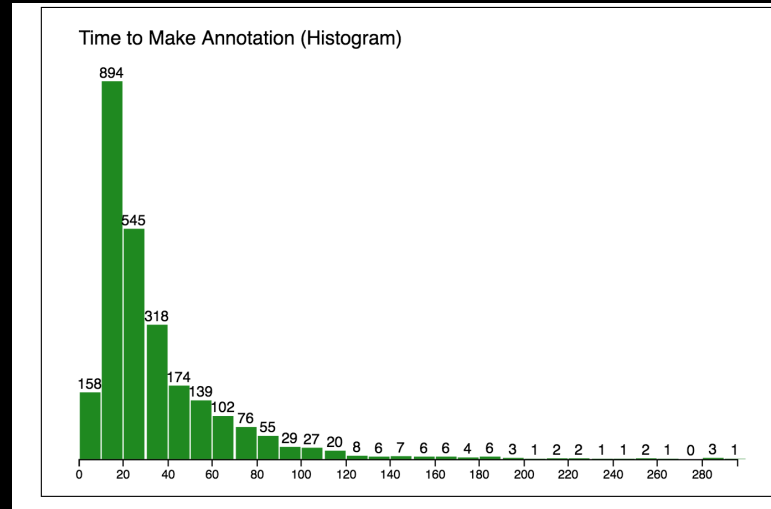
- Misty_mandrill clear winner
 - Nocturnal sparrow catchin up!
 - Rubbery_hamster close behind





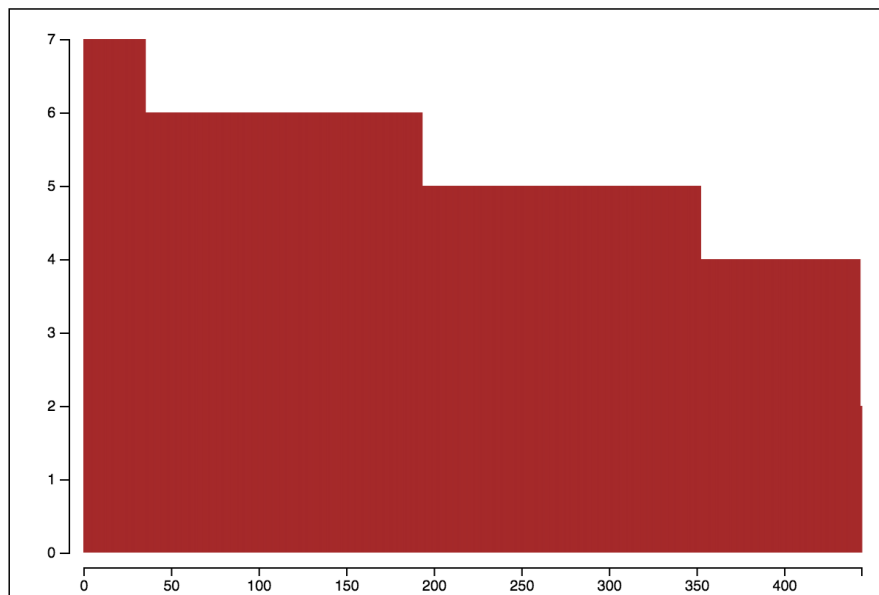
Time to make an annotation

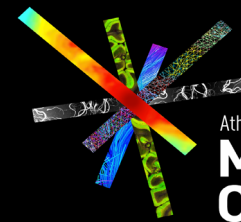
- Typically 10-30s



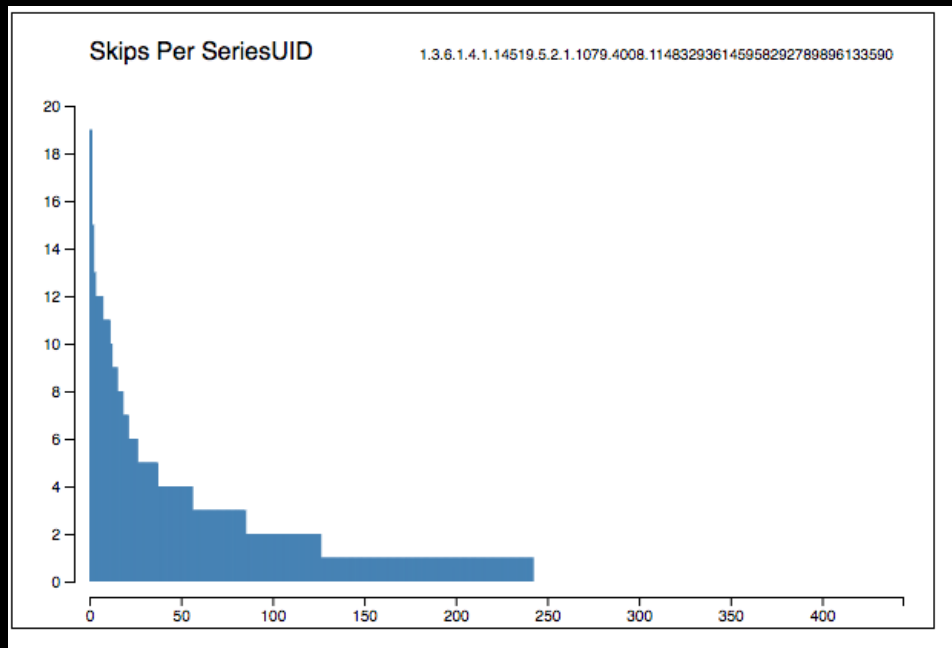
Are we done?

Case Histogram (Number of Annotations per Case)

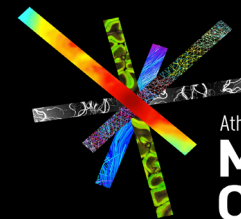
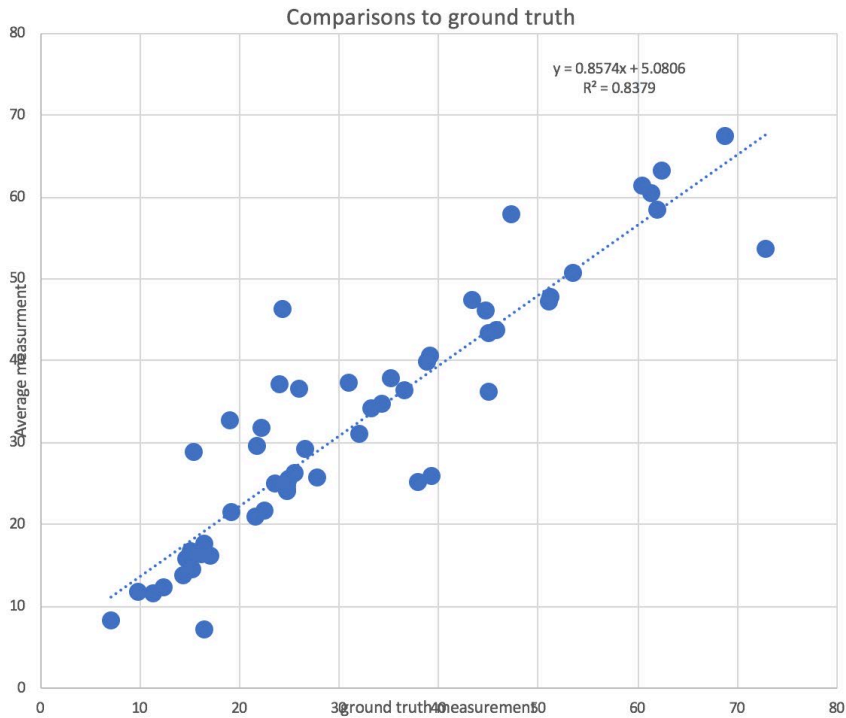


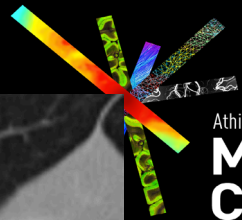
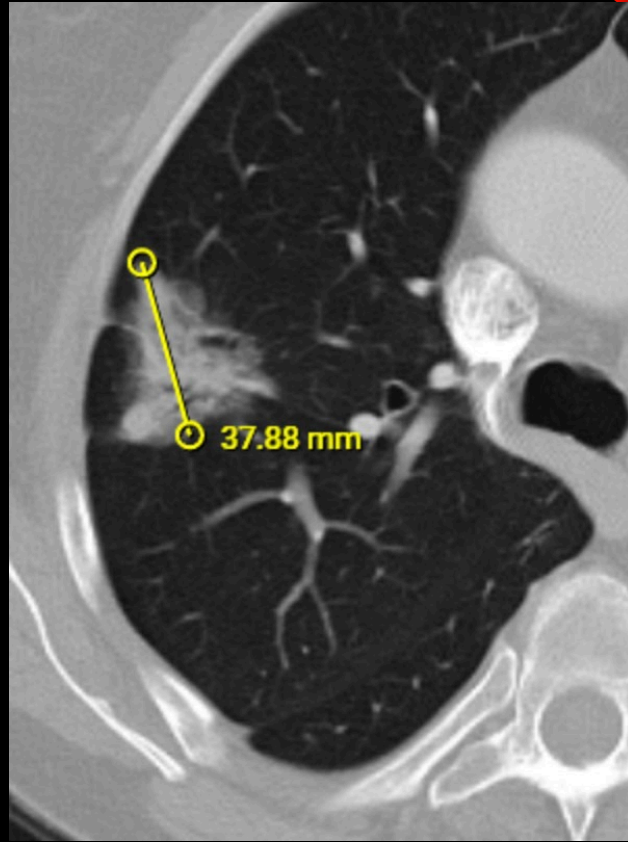
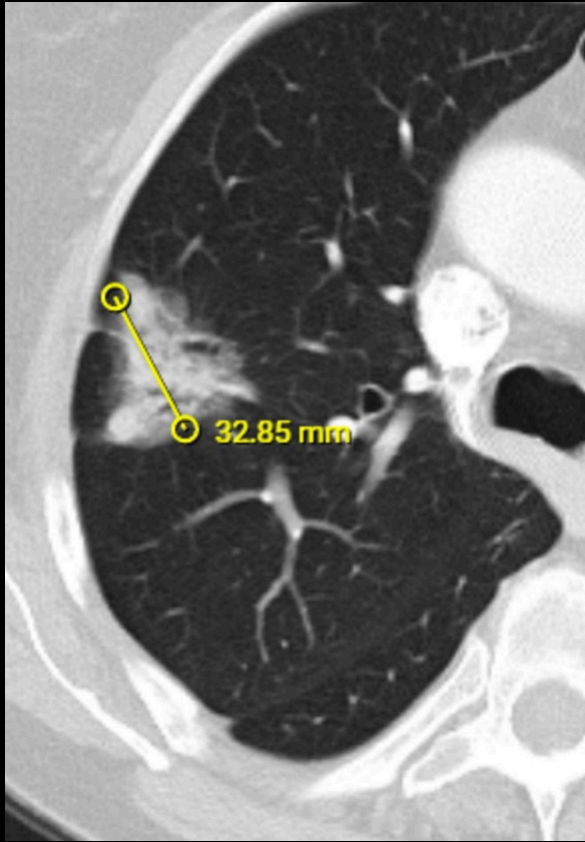


Are some cases more difficult?



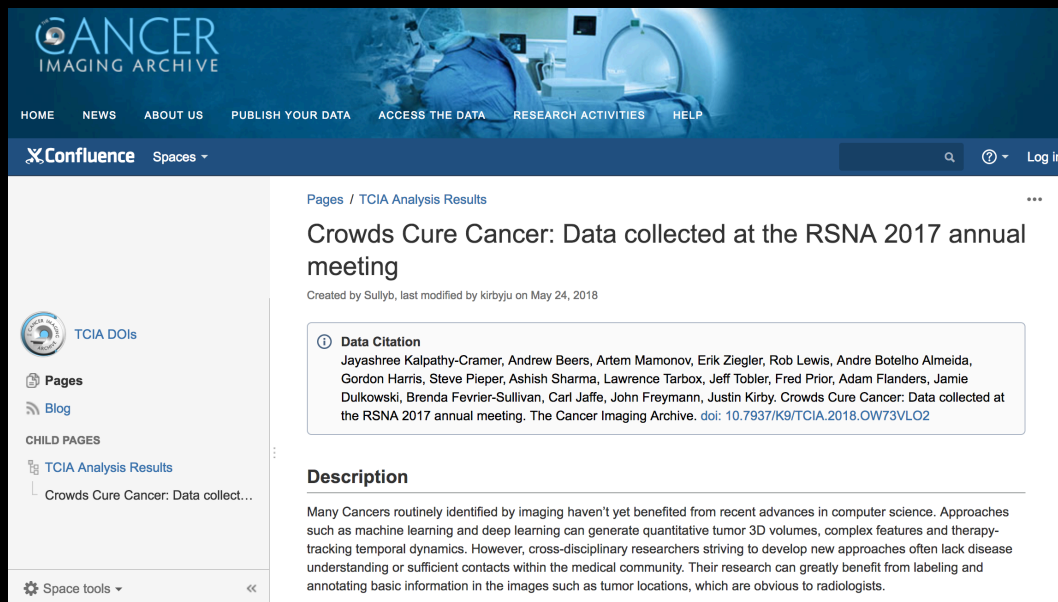
Lung results





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Results disseminated



The screenshot shows a Confluence page on the Cancer Imaging Archive website. The page title is "Crowds Cure Cancer: Data collected at the RSNA 2017 annual meeting". It includes a "Data Citation" section with a list of authors and a DOI link. The "Description" section discusses the challenges of disseminating imaging research results.

CANCER IMAGING ARCHIVE

HOME NEWS ABOUT US PUBLISH YOUR DATA ACCESS THE DATA RESEARCH ACTIVITIES HELP

Confluence Spaces

Pages / TCIA Analysis Results

Crowds Cure Cancer: Data collected at the RSNA 2017 annual meeting

Created by Sullyb, last modified by kirbyju on May 24, 2018

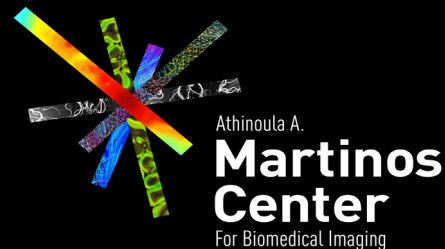
Data Citation
Jayashree Kalpathy-Cramer, Andrew Beers, Artem Mamonov, Erik Ziegler, Rob Lewis, Andre Botelho Almeida, Gordon Harris, Steve Pieper, Ashish Sharma, Lawrence Tarbox, Jeff Tobler, Fred Prior, Adam Flanders, Jamie Dulkowski, Brenda Fevrier-Sullivan, Carl Jaffe, John Freymann, Justin Kirby. Crowds Cure Cancer: Data collected at the RSNA 2017 annual meeting. The Cancer Imaging Archive. doi: [10.7937/K9/TCIA.2018.OW73VLO2](https://doi.org/10.7937/K9/TCIA.2018.OW73VLO2)

Description

Many Cancers routinely identified by imaging haven't yet benefited from recent advances in computer science. Approaches such as machine learning and deep learning can generate quantitative tumor 3D volumes, complex features and therapy-tracking temporal dynamics. However, cross-disciplinary researchers striving to develop new approaches often lack disease understanding or sufficient contacts within the medical community. Their research can greatly benefit from labeling and annotating basic information in the images such as tumor locations, which are obvious to radiologists.

<https://wiki.cancerimagingarchive.net/display/DOI/Crowds+Cure+Cancer%3A+Data+collected+at+the+RSNA+2017+annual+meeting>

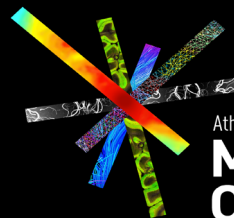
Results converted to DICOM-SR



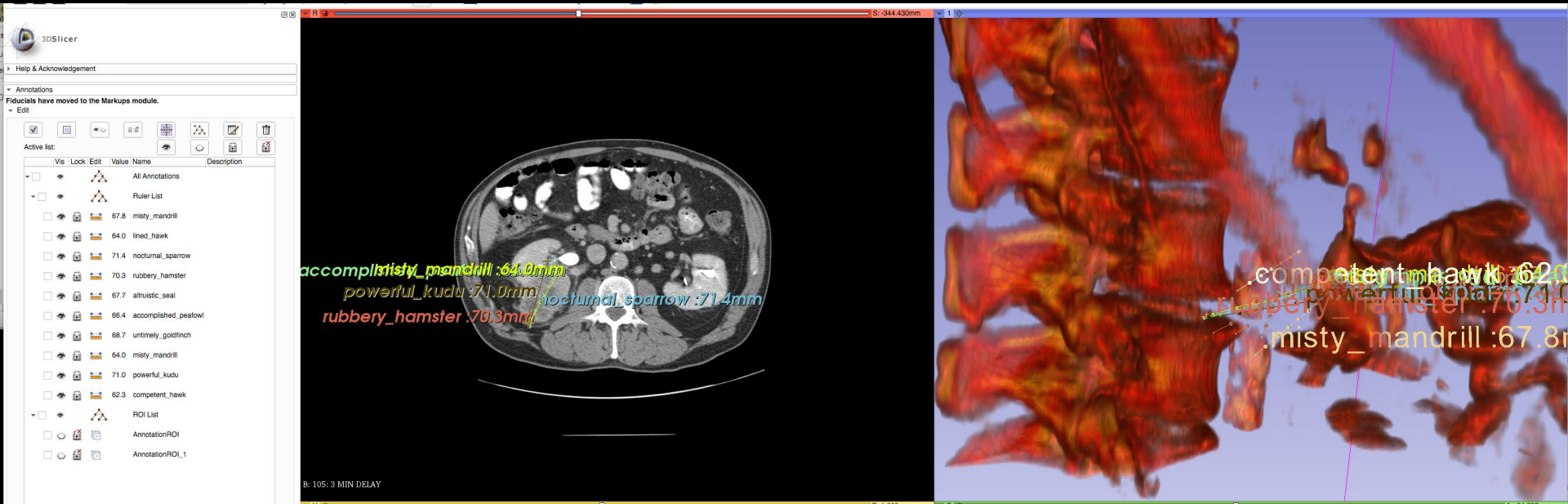
- Thanks to David Clunie!
- CSV file with all annotation coordinates and lengths, and metadata
 - including patient, study, series, instance identifiers of images
- Created two XSLT stylesheets
- Applied existing open source PixelMed toolkit XML to DICOM SR converter
- Validated DICOM SRs that had been created
- Results will be submitted to TCIA soon

Can load into 3D Slicer

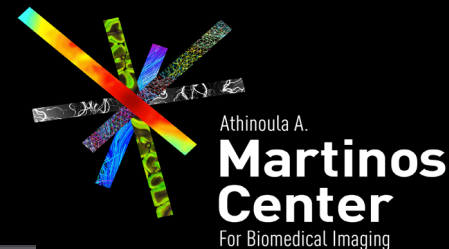
Thanks to Steve Pieper



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Data/ Kernel available at Kaggle



Kaggle interface showing the 'Crowds Cure Cancer 2017' dataset page. The page includes a search bar, navigation links (Competitions, Datasets, Kernels, Discussion, Learn), and a 'Sign In' button. The main content area displays the dataset title, author (Kevin Mader), and a 'Reviewed Dataset' badge. Below the title are three brain scan images with red annotations. The page also shows the number of voters (22) and a 'Download (374 MB)' button. The 'Data Sources' section lists the dataset name and size (2346 x 20), and the 'About this file' section indicates no description yet. The 'Columns' section lists the dataset's structure, including order, anatomy, seriesUID, patientID, instanceUID, length, and start_x.

Reviewed Dataset

Crowds Cure Cancer 2017

Using Crowd Sourcing to Find Tumors

Kevin Mader • updated 3 months ago (Version 2)

22 voters

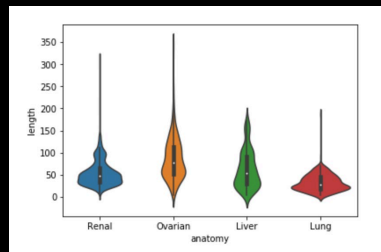
[Data](#) Overview Kernels Discussion Activity Download (374 MB)

Data (374 MB) [API](#) `kaggle datasets download -d kmader/crowds-cure-c...` [Download All](#)

Data Sources	About this file	Columns
<ul style="list-style-type: none">CrowdsCureCancer... 2346 x 20annotated_dicoms.zip<ul style="list-style-type: none">4247484911	No description yet	<ul style="list-style-type: none"># order^ anatomy^ seriesUID^ patientID^ instanceUID# length# start_x

Interesting (but flawed) analysis on Kaggle

- Converted line to bounding box



anatomy	not_radiologist	radiologist
Liver	63.330808	62.282037
Lung	33.425938	31.548763
Ovarian	75.285215	86.230868
Renal	53.837186	53.195602

Acknowledgements

- U01 CA154601 Quantitative MRI Of Glioblastoma Response
- U24 CA180927 Informatics Tools For Optimized Imaging Biomarkers For Cancer Research & Discovery
- NSF 1622542 SCH: INT: Collaborative Research: Assistive Integrative Support Tool for Retinopathy of Prematurity
- R01 EY019474 Clinical And Genetic Analysis Of Retinopathy Of Prematurity
- U24 CA180918 Quantitative Image Informatics For Cancer Research (QIICR)
- CCDS for computing resources