

Challenges Hindering Implementation of Image Analysis Tools for CT Screening

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Disclosures

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 - whiterabbit
 - Nines
 - GalileoCDS
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 - Canon Medical Systems
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 - IDEXX
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A Roadmap for Foundational Research on Artificial Intelligence in Medical Imaging: From the 2018 NIH/RSNA/ACR/The Academy Workshop

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Conflicts of interest are listed at the end of this article.

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Imaging research laboratories are rapidly creating machine learning systems that achieve source methods and tools. These artificial intelligence systems are being developed to reduce, quality assurance, triage, segmentation, computer-aided detection, computer-aided diagnosis, and knowledge gaps and to develop a roadmap for future research initiatives. Key research methods that efficiently produce images suitable for human interpretation and annotation methods, including information extraction from the imaging report, automated image reporting; 3, new machine learning methods for clinical imaging data, and federated machine learning methods; 4, machine learning methods that can explain (so-called explainable artificial intelligence); and 5, validated methods for image de-identification of clinical imaging data sets. This research roadmap is intended to identify research laboratories, funding agencies, professional societies, and industry.

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ORIGINAL ARTICLE


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A Road Map for Translational Research on Artificial Intelligence in Medical Imaging: From the 2018 National Institutes of Health/RSNA/ACR/The Academy Workshop

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Publicly-Released Labeled Radiology Datasets

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Shared Datasets

LERA- Lower Extremity Radiographs


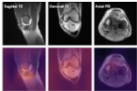

Medical ImageNet

Publications

Seed Grant Projects

Tools

Shared Datasets

CheXpert: Chest Xray's	CheXpert is a dataset consisting of 224,316 chest radiographs of 65,240 patients who underwent a radiographic examination from Stanford University Medical Center between October 2002 and July 2017, in both inpatient and outpatient centers. Included are their associated radiology reports.	
LERA: Lower Extremity Xray's	The LERA dataset contains data from 182 patients who underwent a radiographic examination at the Stanford University Medical Center between 2003 and 2014. The dataset consists of images of the foot, knee, ankle, or hip associated with each patient.	
MRNet: Knee MRI's	The MRNet dataset consists of 1,370 knee MRI exams performed at Stanford University Medical Center. The dataset contains 1,104 (80.6%) abnormal exams, with 319 (23.3%) ACL tears and 508 (37.1%) meniscal tears; labels were obtained through manual extraction from clinical reports.	
MURA: MSK Xrays	MURA (musculoskeletal radiographs) is a large dataset of bone X-rays from the Stanford University Medical Center.	

EchoNet-Dynamic Cardiac Ultrasound	EchoNet-Dynamic is a dataset of over 10k echocardiogram, or cardiac ultrasound, videos from unique patients at Stanford University Medical Center. Each apical-4-chamber video is accompanied by an estimated ejection fraction, end-systolic volume, end-diastolic volume, and tracings of the left ventricle performed by an advanced cardiac sonographer and reviewed by an imaging cardiologist.	
RSNA: CT Brain	Four research institutions provided large volumes of de-identified CT studies that were assembled to create the RSNA AI 2019 challenge dataset: Stanford University, Thomas Jefferson University, Unity Health Toronto and Universidade Federal de São Paulo (UNIFESP), The American Society of Neuroradiology (ASNR) organized a cadre of more than 60 volunteers to label over 25,000 exams for the challenge dataset.	
RSNA: Chest Xray's	From the RSNA AI Challenge 2018, a dataset labeled chest x-rays from the the National Institutes of Health (NIH).	
RSNA: Bone Age	From the RSNA AI Challenge 2017, a dataset of bone age x-ray's from Stanford University, the University of Colorado and the University of California - Los Angeles.	

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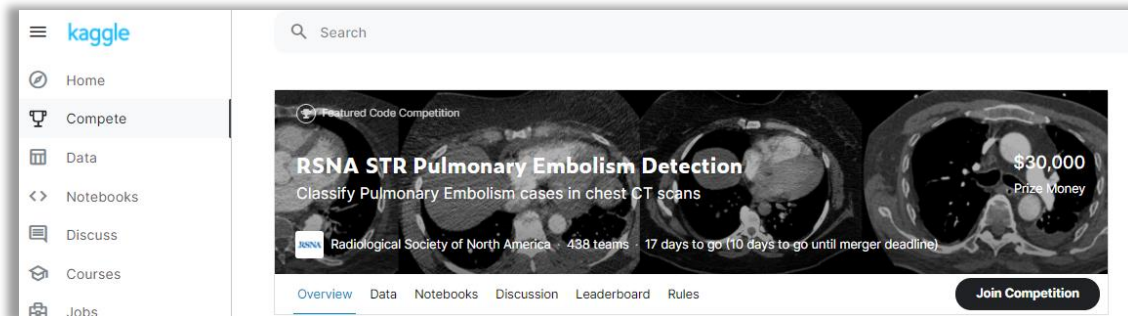
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Pediatric Bone Age Challenge

Organized by RSNA.org/organizingcommittee - Current server

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



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Featured Code Competition

RSNA STR Pulmonary Embolism Detection

Classify Pulmonary Embolism cases in chest CT scans

\$30,000 Prize Money

RSNA Radiological Society of North America · 438 teams · 17 days to go (10 days to go until merger deadline)

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RSNA Pneumonia Detection Challenge

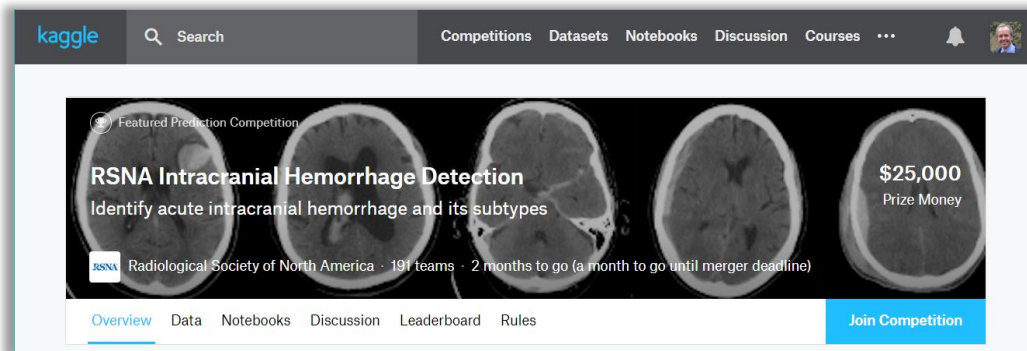
Can you build an algorithm that automatically detects potential pneumonia cases?

\$30,000 Prize Money

RSNA Radiological Society of North America · 1,499 teams · 2 years ago

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Featured Prediction Competition

RSNA Intracranial Hemorrhage Detection

Identify acute intracranial hemorrhage and its subtypes

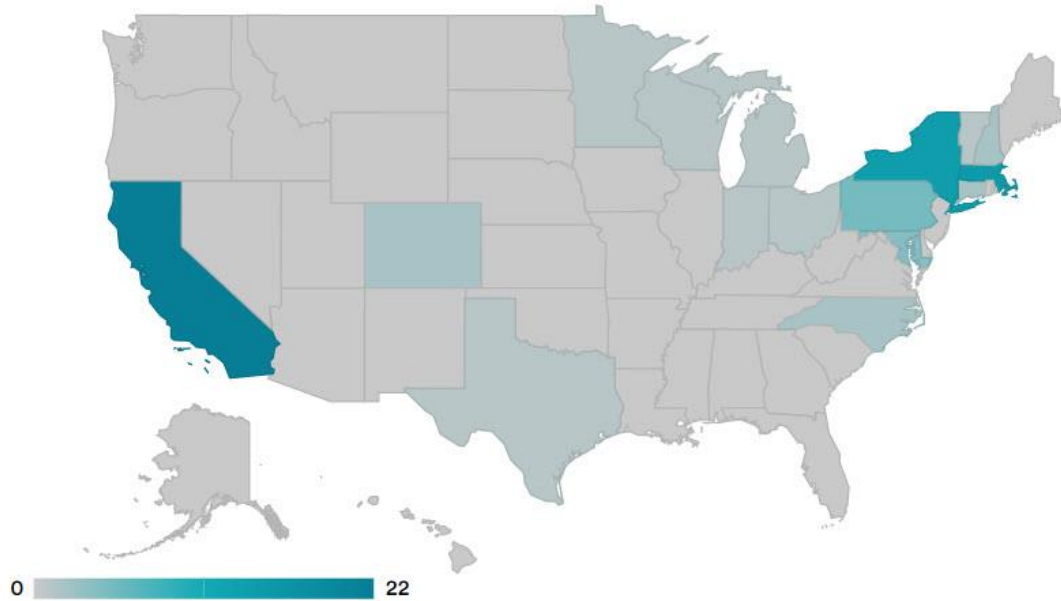
\$25,000 Prize Money

RSNA Radiological Society of North America · 191 teams · 2 months to go (a month to go until merger deadline)

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Geographic Distribution of Cohorts to Train Deep Learning Algorithms



REBECCA ROBBINS/STAT
 SOURCE: "GEOGRAPHIC DISTRIBUTION OF US COHORTS USED TO TRAIN DEEP LEARNING ALGORITHMS,"
 JAMA 2020.

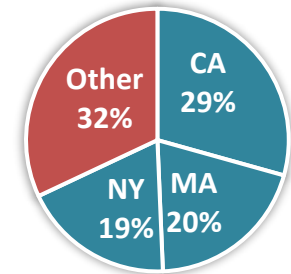
STAT

Table. US Patient Cohorts Used for Training Clinical Machine Learning Algorithms, by State^a

States	No. of studies
California	22
Massachusetts	15
New York	14
Pennsylvania	5
Maryland	4
Colorado	2
Connecticut	2
New Hampshire	2
North Carolina	2
Indiana	1
Michigan	1
Minnesota	1
Ohio	1
Texas	1
Vermont	1
Wisconsin	1

^a Fifty-six studies used 1 or more geographically identifiable US patient cohort in the training of their clinical machine learning algorithm. Thirty-four states were not represented in geographically identifiable cohorts: Alabama, Alaska, Arizona, Arkansas, Delaware, Florida, Georgia, Hawaii, Idaho, Illinois, Iowa, Kansas, Kentucky, Louisiana, Maine, Mississippi, Missouri, Montana, Nebraska, Nevada, New Jersey, New Mexico, North Dakota, Oklahoma, Oregon, Rhode Island, South Carolina, South Dakota, Tennessee, Utah, Virginia, Washington, West Virginia, and Wyoming.

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MEDICAL IMAGING AND DATA RESOURCE CENTER.

- 60,000 COVID studies released in Y1
- 5 technology development projects
- 12 collaborative research projects
- >20 organizations across the U.S.



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Biomedical Imaging
and Bioengineering

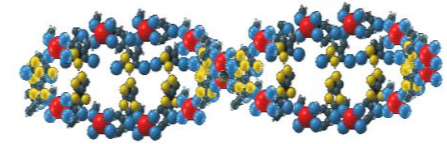
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RSNA Data
Elements

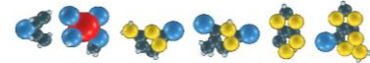
RSNA RadLex
Terminology

Reports



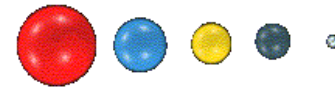
DNA

Sentences



Molecules

Words



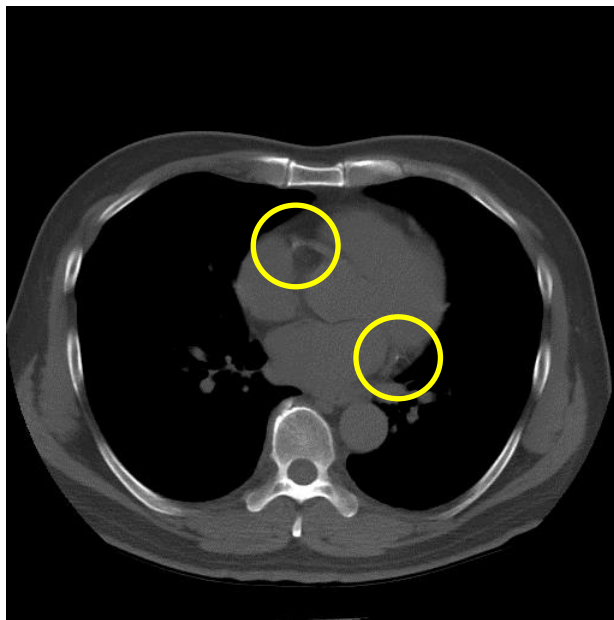
Atoms

Opportunistic Screening for Coronary Artery Disease

Gated CT

Routine CT

AI Algorithm



AI algorithm applied to all chest CTs for risk stratification

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