NIST

Thursday, Sept 24, 2026

18 minutes

MIDRC: Contributions in Metrology and Standards (focus on data and AI)

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https://profiles.uchicago.edu/profiles/display/37081

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- MLG is a stockholder in R2/Hologic, shareholder in Qview, and receives royalties from patents through licenses from the UChicago Polsky Center.
- MLG was scientific advisor, co-founder, and equity holder in Quantitative Insights, [now Qlarity Imaging] makers of QuantX -- the first FDA-cleared machine learning system for aiding in cancer diagnosis.
- It is the University of Chicago Conflict of Interest Policy that investigators disclose publicly actual or potential significant financial interest that would reasonably appear to be directly and significantly affected by the research activities.

Abstract: MIDRC: Contributions in Metrology and Standards

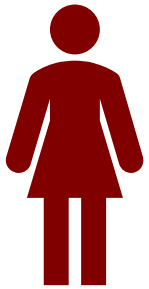
- Artificial intelligence (**AI**) is transforming medical imaging by enabling computers to extract meaningful information from images and support clinical decision-making.
- However, to develop **trustworthy AI** methods with improved repeatability and reproducibility, a recognized need is for large, publicly available, and curated/harmonized imaging **data** sets.
- Established in August 2020, **MIDRC** (midrc.org) has successfully demonstrated, at scale, its ability to securely and efficiently collect, deidentify, curate, harmonize, store, and share medical images, including an ever-expanding relational data model, reusability procedures, and an interactive user portal to enable cohort building, as it leverages secure cloud infrastructures through the MIDRC FAIR Gen3 platform.
- A summary will be presented on the various **MIDRC tools on metrology and the standardization of data**, which are openly available, to demonstrate their role in the development of AI.

Everyone is doing AI

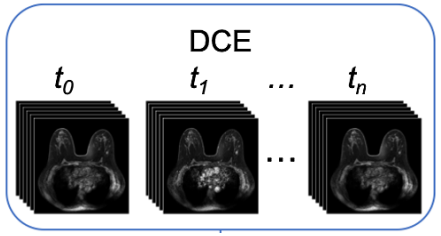
- If AI picks the wrong movie, I might have a bad night but if AI picks the wrong drug or misses a cancer on a radiograph, …..
- Need to hold medical AI to a higher standard -- “See the big picture”
  - **Clinical Problem** – Is it clinically relevant?
  - **Data** – usually not enough
    - Especially in terms of the intended population
    - Distribution of various diseases, acquisition techniques, cures, …
    - Cost $$ to “donate” data
  - **Algorithms** – understand them and customize to the clinical task; reduce bias
  - People/Users – **multiple domain experts**
    - Multidisciplinary teams playing nicely in the sandbox — sharing data, sharing expertise, …
    - Technical infrastructure, end user experience, problem solvers, medical imaging scientists/medical physicists/bioengineers, radiologists, data scientists, biostatisticians, ethicists, regulatory experts

Clinical workflow for AI implementation

Patient undergoes imaging

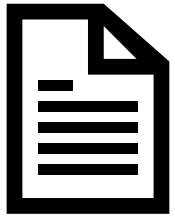


The images are evaluated using an **FDA-approved AI system** for a specific clinical task & intended population

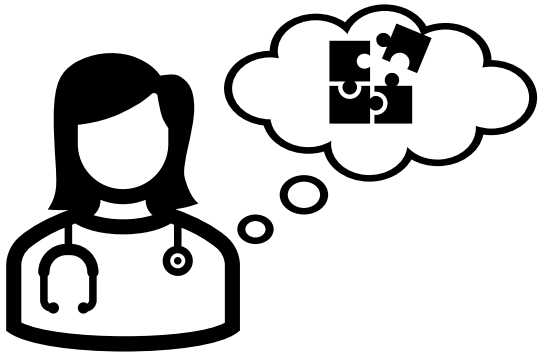




A report provides the AI system's **prediction** on the patient's outcome & the computer's **uncertainty** (sureness)



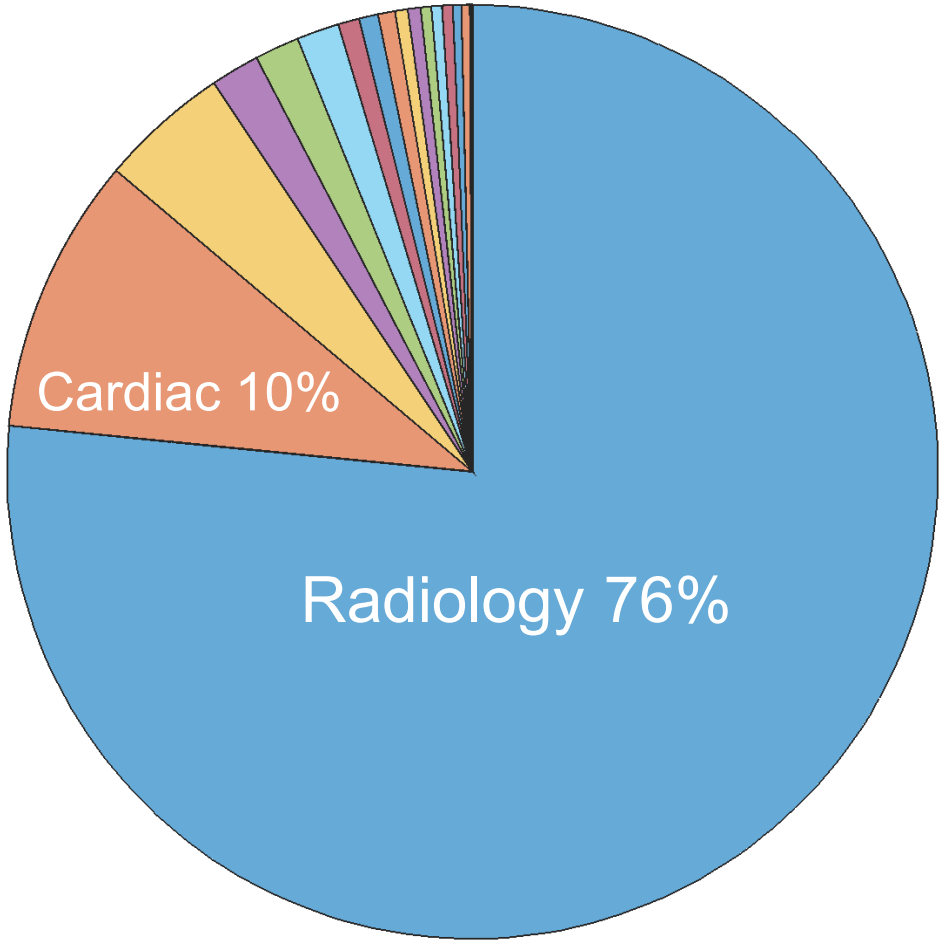
Clinician uses the AI system prediction as one component in their decision-making



- Need representative data to yield trustworthy AI systems.
- Need to understand how the end user will use the AI output
- Responsibilities of the AI system and the AI user
- Do NOT use AI "off label"

- A predictive aid used by radiologists
- A primary reader – help in triage or rule out "normals"

Medical Imaging Leads the Way in FDA Cleared AI Algorithms [N = 1,357]



Medical Imaging AI investigators have a responsibility to conduct high-quality, rigorous AI development, evaluation, and translation.

Medical Specialty	FDA Devices
Radiology	1039
Cardiovascular	130
Neurology	61
Anesthesiology	23
Gastroenterology-Urology	21
Hematology	20
Ophthalmic	10
Clinical Chemistry	9
Pathology	8
General and Plastic Surgery	6
Microbiology	6
Clinical Toxcicology	5
Dental	5
Orthopedic	5
General Hospital	4
Obstetrics and Gynecology	4
Immunology	1
Total	1357

AI software as a Medical device

Updated Jan 2026

https://www.fda.gov/medical-devices/software-medical-device-samd/artificial-intelligence-and-machine-learning-aiml-enabled-medical-devices

To really translate to clinical practice, we need more curated, diverse, representative, re-usable data

AND

Rigorous methods for evaluation for ethical, trustworthy, and reproducible AI

- How do we collect real-world, representative data?
- How do use real-world data to rigorously evaluate AI and to monitor the performance of AI?

Medical Imaging and Data Resource Center

Established by:

RSNA Radiological Society of North America · AAPM American Association of Physicists in Medicine · ACR American College of Radiology · The University of Chicago · GEN3 Data Commons · NIH National Institute of Biomedical Imaging and Bioengineering

2020



NIH NIBIB

Acute COVID

AI / ML

- Identify infection
- Diagnose disease
- Assess extent
- Monitor therapy
- Detect complications
- Predict outcome / PASC

2023

ARPA-H

Biomedical Data Fabric

NAIRR (N3C)

2024

DoD MTEC (TBI)

2025

CHAN ZUCKERBERG INITIATIVE

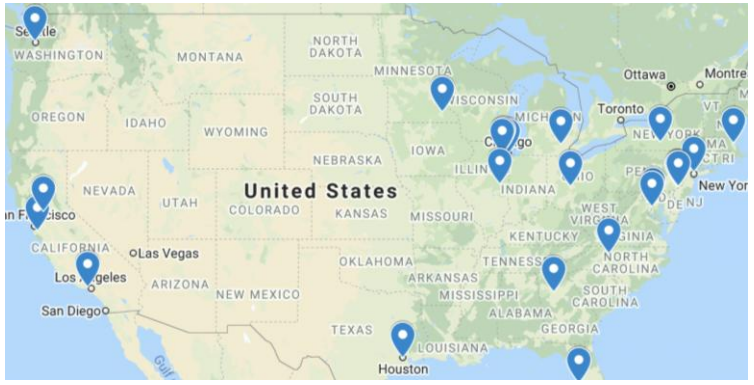
MIDRC Global

Kenya, Ghana

2026

NIH U24 Theranostics

AoU-MIDRC pilot



24 core institutions
100+ investigators



Contributors of imaging/meta data & tools/resources

Established, efficient, tested infrastructure, with optimized **flexibility and scalability**

User-ready solutions for the scientific community

Users



Hospitals & Medical Centers



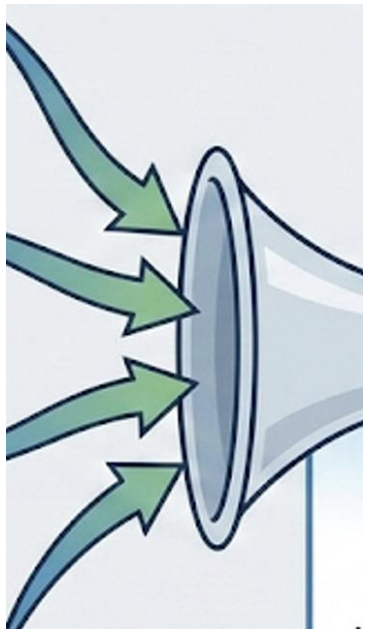
Academic Institutions



Government Institutions



Diverse Imaging Data
(CT, MRI, X-ray, etc.)



MIDRC

MEDICAL IMAGING AND DATA RESOURCE CENTER.



Curation & Harmonization



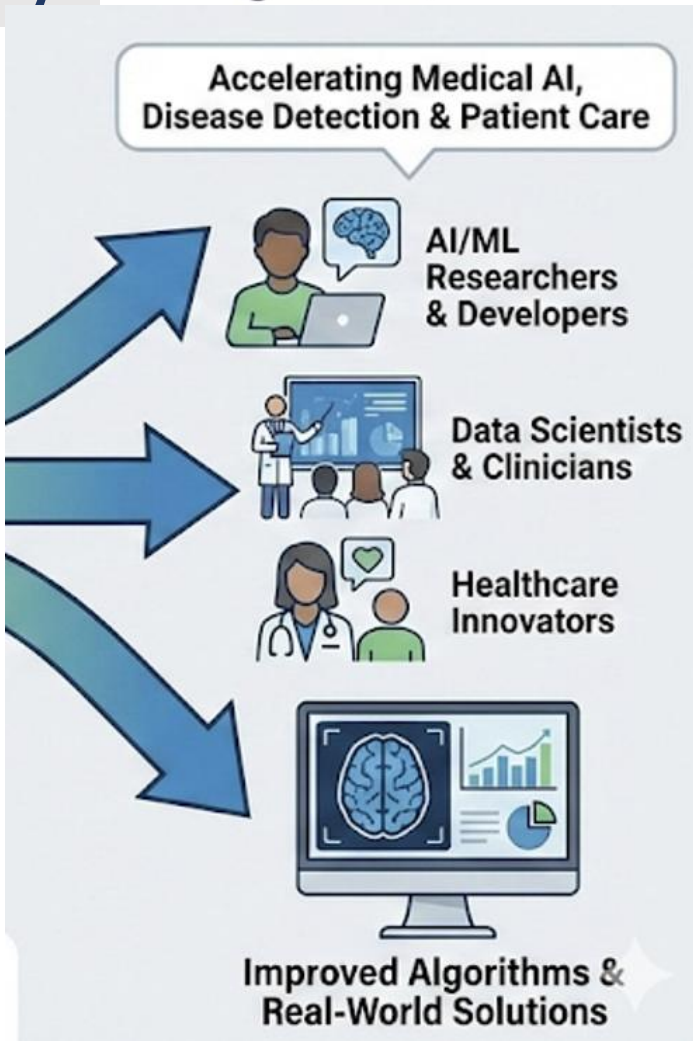
Privacy Protection
(De-identification)



Standardized, AI-Ready Datasets



Tools & Resources



Slide created in part with Gemini

MIDRC: Security, and Expertise

MIDRC's **secure**, **FISMA-moderate** Gen3 platform integrates security and privacy-preserving federated learning capabilities, with **demonstrated interoperability** and commitment to FAIR principles.

- **Centralized Open Data Commons** with curated, diverse, representative, reusable data
- **Biomedical Imaging Hub** to index **distributed** imaging repositories
- **Sequestered data commons** to benchmark AI algorithms for translation to benefit clinical care.
- **State-of-art AI integrated** throughout the MIDRC data chain and in various resources and tools





Centralized Data Commons

Distributed/Federated Data Hub

Centralized data: MIDRC repository

Distributed data: BDF imaging hub

data.midrc.org

imaging-hub.data-commons.org



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Centralized data: MIDRC repository

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Distributed/Federated Data Hub

Distributed data: BDF imaging hub

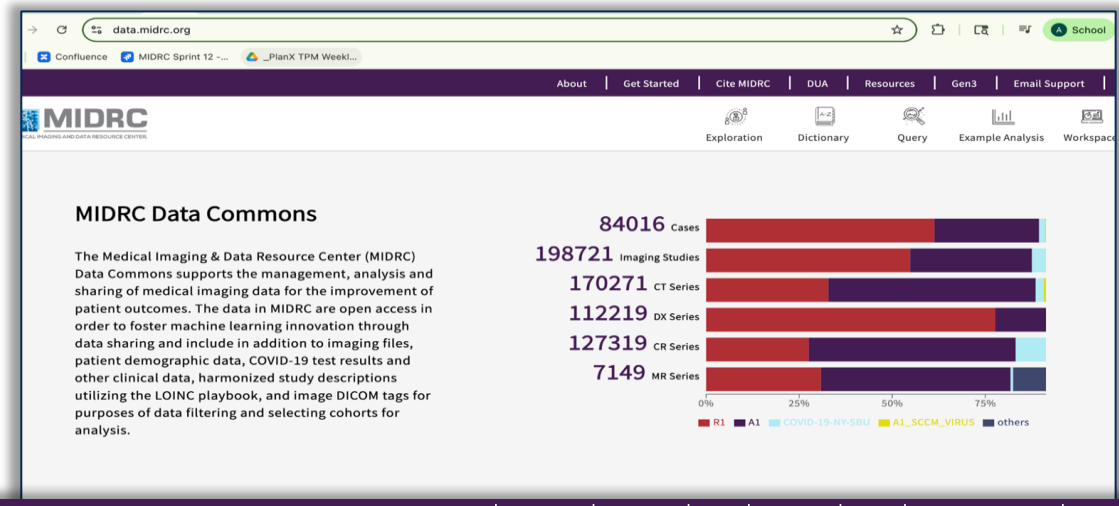
imaging-hub.data-commons.org

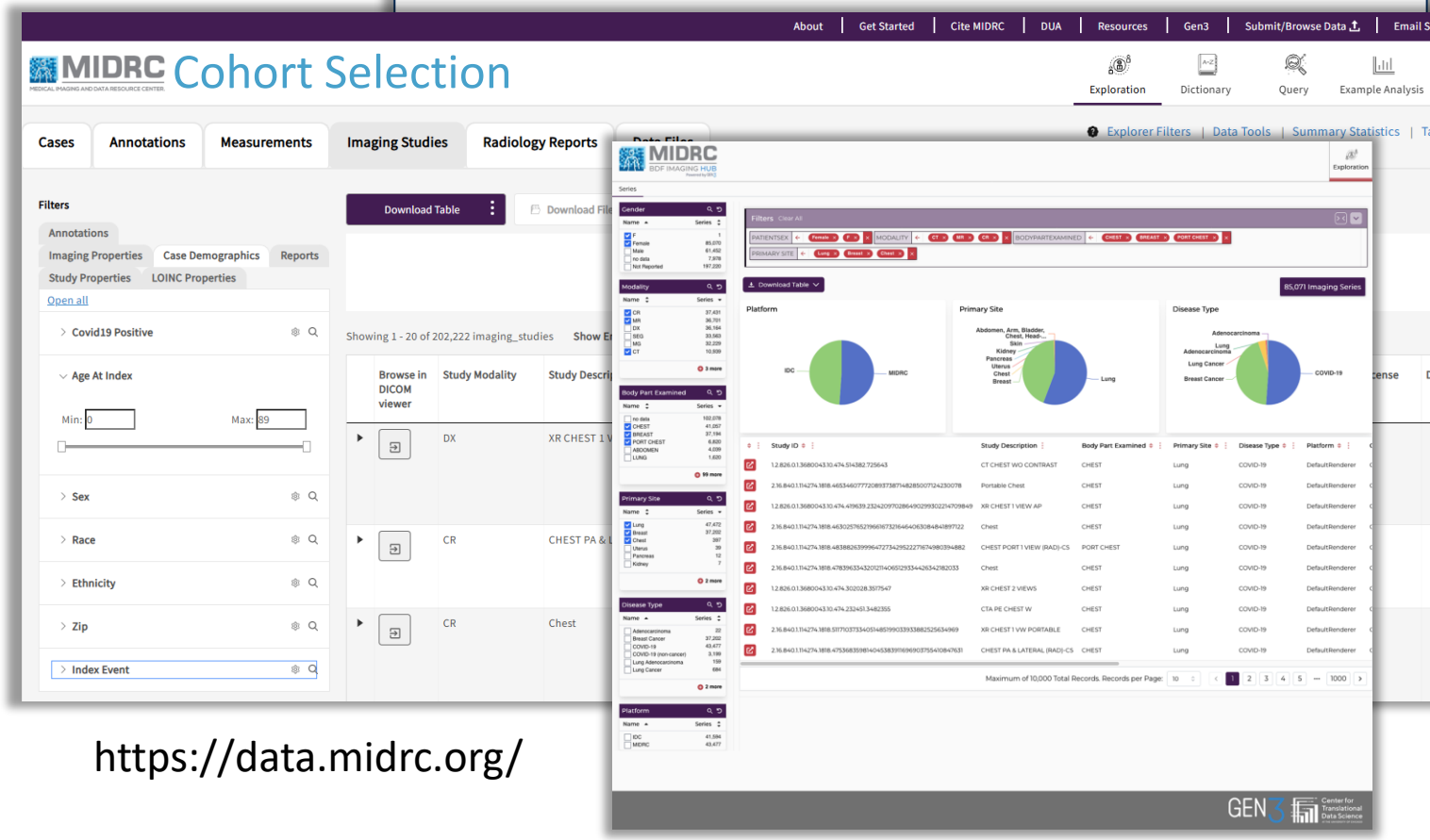
MIDRC Centralized Data Commons

MIDRC operates a Gen3-based de-identified data commons enabling:

- Interactive data exploration
- Creation of virtual cohorts of curated imaging data
- Transfer of data to cloud-based environments, or download.
- Integrated DICOM image viewing
- **> 500,000 imaging studies ingested**
- **> 200,000 imaging studies to the public**
- Imaging and data from over **84,000+ patients** [~22 states in the MIDRC pipeline from ingestion to released]

Data Explorer

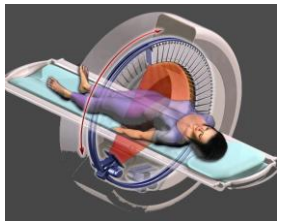




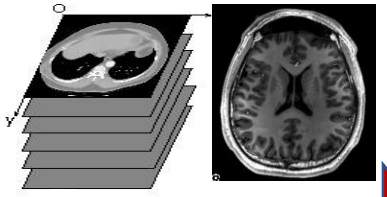
https://data.midrc.org/

MIDRC
MEDICAL IMAGING AND DATA RESOURCE CENTER

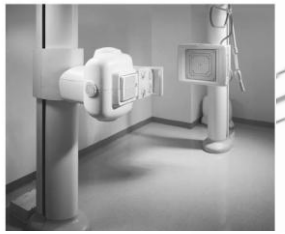
Collection from Various Medical Centers (USA & Global)

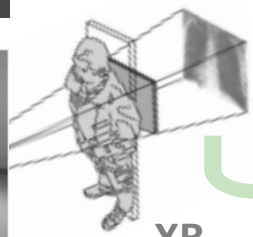


CT



DICOM images





XR



De-identification & Intake

e.g., RSNA RICORD

Curation & Harmonization

AAPM

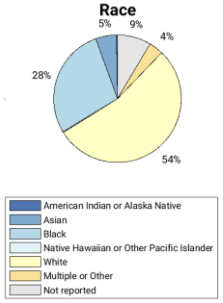
- Standards
- LOINC mapping
- Annotations and Labeling
- Bias Assessment
- Model Selection
- Diversity Assessment

RSNA Informatics
RadLex® Playbook
LOINC® from Regenstrief

Data Model Enabling Cohort Building

Gen3





Interoperability Pilots

Biomedical Research Hub
Powered by Gen3

BioData CATALYST
Powered by Gen3

National COVID Cohort Collaborative

For multi-modal research

Open Commons & User Portal (80% of data)



> 200,000 imaging studies to the public

midrc.org & data.midrc.org

Public facing DATA

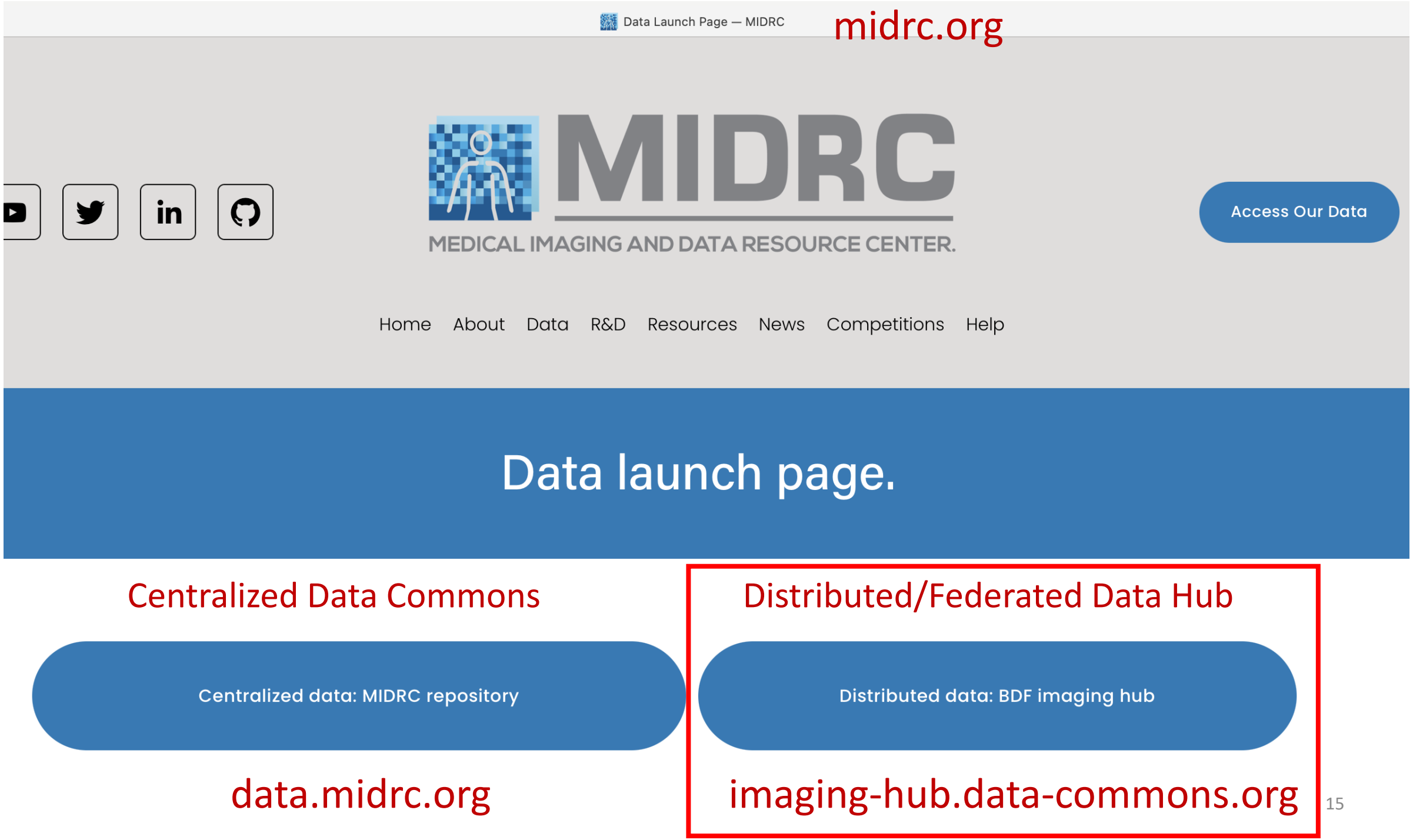
- AI/ML ready
- FAIR
- Representative
- Searchable
- Sharable
- Reusable

Sequestered Commons (20% of data)



Sequestered DATA

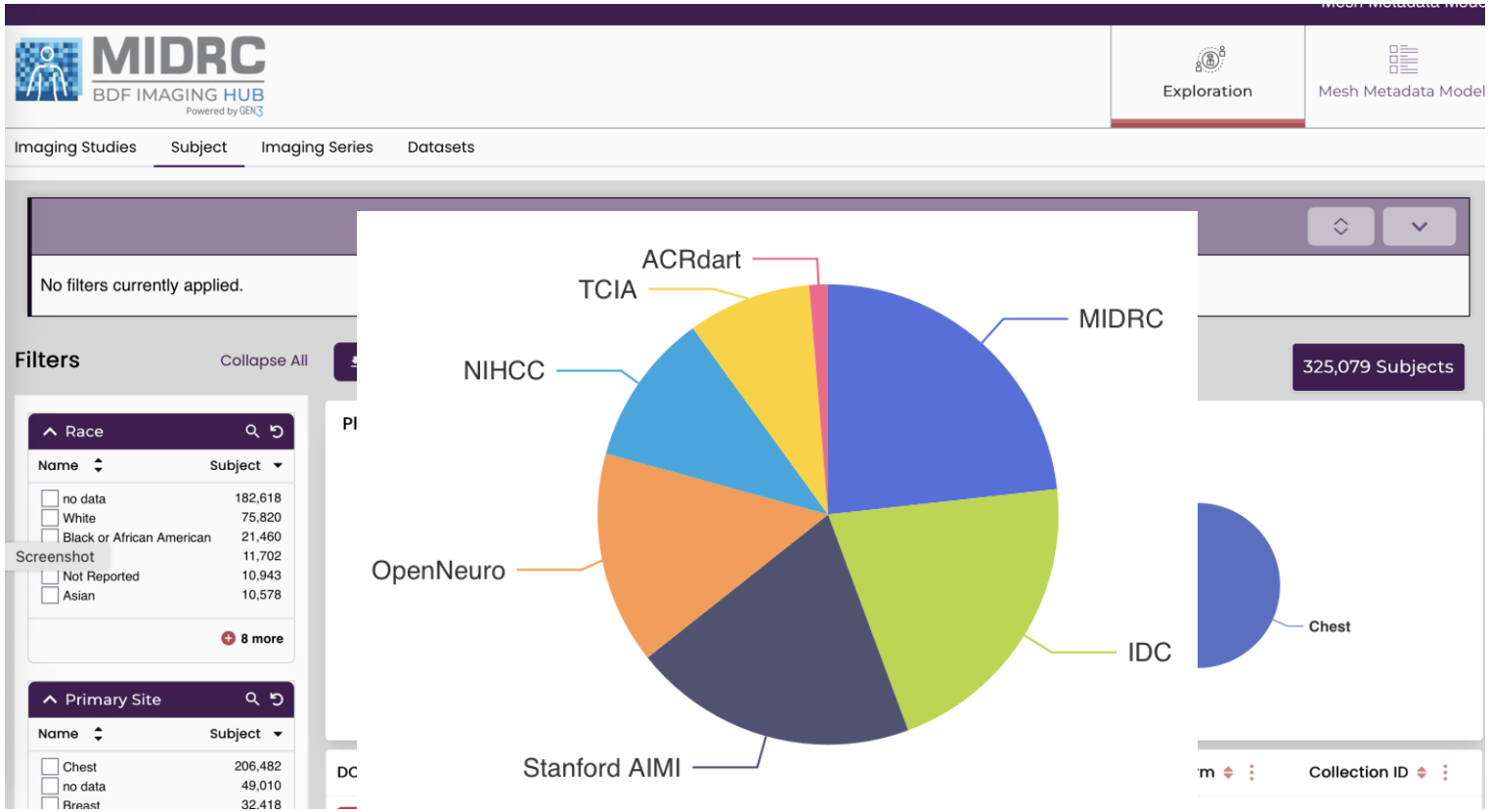
Not publicly available
Real-world testing of algorithm performance
translation


Data Launch Page — MIDRC
midrc.org
MIDRC
MEDICAL IMAGING AND DATA RESOURCE CENTER.
Access Our Data
Home About Data R&D Resources News Competitions Help
Data launch page.
Centralized Data Commons
Centralized data: MIDRC repository
data.midrc.org
Distributed/Federated Data Hub
Distributed data: BDF imaging hub
imaging-hub.data-commons.org

MIDRC BDF Imaging Hub (BIH): Indexes Distributed Images from Multiple Sources

MIDRC BDF Imaging Hub (BIH) enables researchers to:

- Search, discover, and analyze biomedical imaging data across **multiple** imaging data repositories and data commons.
- Like a shopping center (a marketplace) for medical images to enable AI investigators to find data.
- Continuing to index more imaging datasets and data commons

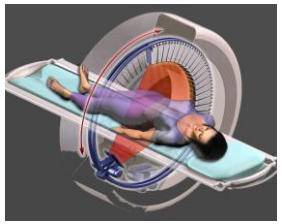


https://imaging-hub.data-commons.org

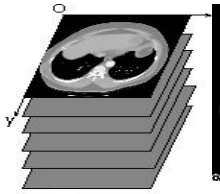
MIDRC:
Contributions in Standardization

MIDRC
MEDICAL IMAGING AND DATA RESOURCE CENTER

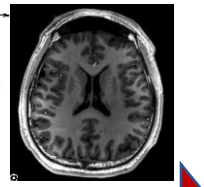
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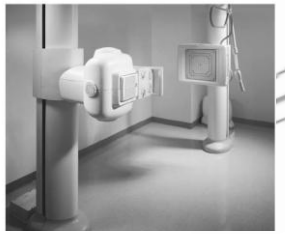


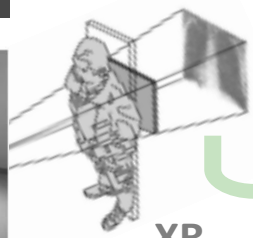
CT



MRI







XR



DICOM images

De-identification & Intake

e.g.,
RSNA
RICORD

Curation & Harmonization

AAPM

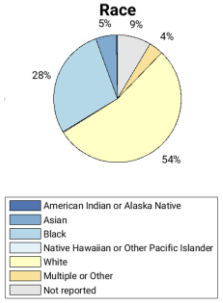
- Standards
- LOINC mapping
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RSNA Informatics
RadLex® Playbook
LOINC® from Regenstrief

Data Model Enabling Cohort Building

Gen3





Standards & Harmonization

- De-identification of DICOM images and reports using RSNA Anonymizer
- Curation of image data and text using Helper AI
- Incorporation of annotations
- Harmonization using LOINC; image quality metrics

DICOM Metadata & Data Curation

DICOM Metadata is not reliable for ML

- DICOM tags not standardized
  - Abbreviations (Axial vs. Ax, Pelvis vs. Pel,
- Machine learning needs consistent representation of DICOM tags.
- Manual review is completely unworkable and tedious.



Auto-generation of labels using pixel and report data augments efficiency in the annotation process

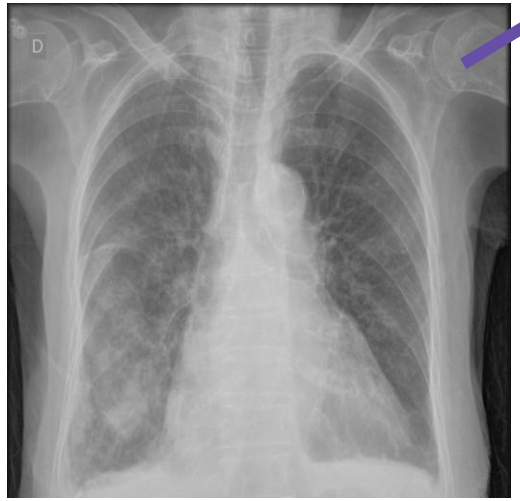
From Adam Flanders – RSNA/MIDRC

Data Curation: Helper AI Uses Pixels & Metadata

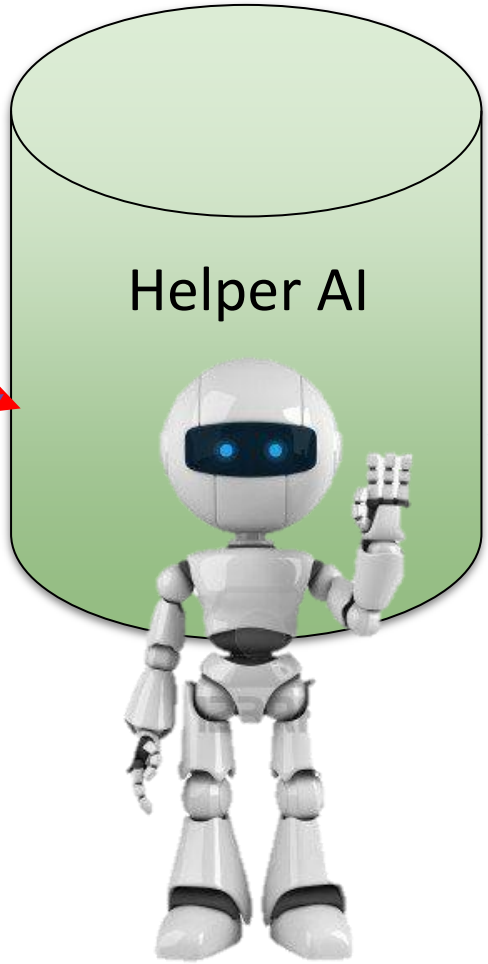
Identify the exam, body part, orientation, etc.



Abdomen and pelvis CT



Chest x-ray



LOINC 36813-4
RPID145 CTAPE CT Abd/Pelv w IV Contrast
CT Abdomen/Pelvis w

exam: CT
series: Abdomen
series: Contrast
series: Axial

LOINC 36813-4
RPID2502 XRCH1V XR Chest 1V
XR Chest 1 View

series: Chest
series: Frontal
exam: XR
series: PA

Helper-AI tools can intelligently “fix” incorrect/incomplete/inconsistent DICOM labels

From Adam Flanders – RSNA/MIDRC

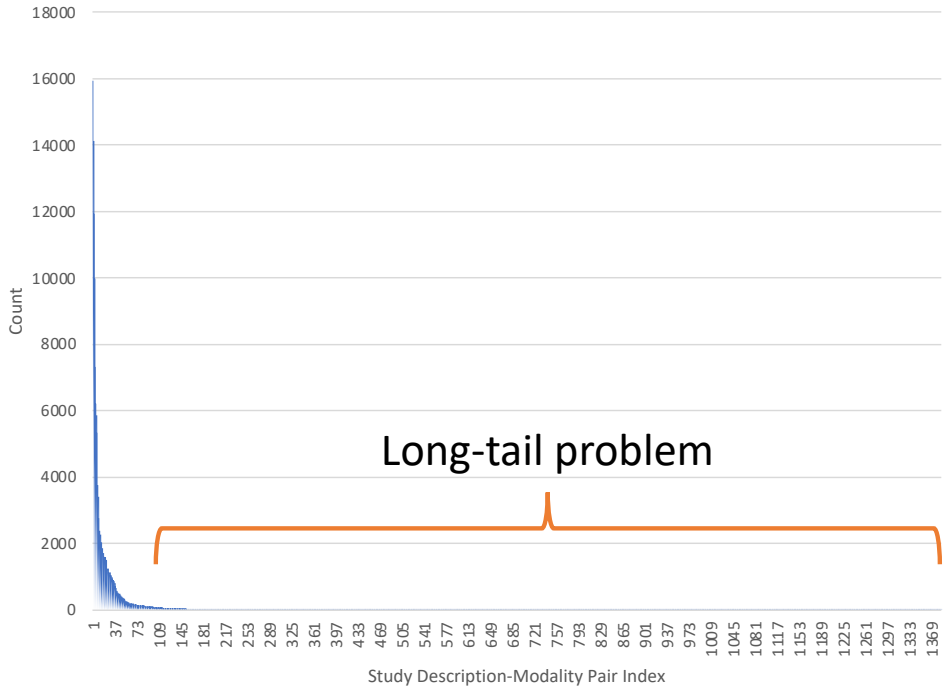
Harmonization of DICOM Metadata for Cohort Selection

The challenge with cohort selection

- How can users select cohorts using the highly variable DICOM Study Descriptions supplied by the providing imaging centers?
- Example: The first 138,000 studies are described by only 97 pairs of modality + study description, but the remaining 8,600 studies need 1,300 s modality + study description pairs to describe: A very long-tail problem

Modality	Study Description	Count	Cumulative %
DX	XR CHEST 1 VIEW AP	15945	10.9%
DX	XR CHEST 1 VW, FRONTAL	14137	20.5%
CR	XR PORT CHEST 1V	11941	28.6%
DX	XR CHEST PORTABLE 1 VIEW	9978	35.4%
CR	CHEST PORT 1 VIEW (RAD)-CS	7326	40.4%
CR	XR CHEST 2 VIEWS	6212	44.6%
CR	XR CHEST 1 VW PORTABLE	5873	48.6%
CR	XR CHEST 1 VIEW AP	5335	52.2%

Modality + Study Description of Contributed Data



Histogram of Modality + Study Description Pairs

AAPM/MIDRC CRP12; Kinahan et al.

RadLex/LOINC Playbook

Important efforts to describe radiology procedures

- RadLex Ontology
  - Widely used in study mapping and registries
  - Study Descriptions defined in the “RadLex Playbook”
- Logical Observation Identifiers Names and Codes (LOINC)
  - Vocabulary for lab medicine ordering and reports
  - Part of the Unified Medical Language System (UMLS)
- Merged efforts in 2018 to create the RadLex/LOINC Playbook

AAPM/MIDRC CRP12; Kinahan et al.

MIDRC-LOINC Mapping Table

DICOM → *LOINC*

Modality	Study Description	LOINC code	LOINC Long Common Name
CT	CT CHEST WITHOUT CONTRAST	29252-4	CT Chest WO contrast
CT	CHEST WITHOUT IV CONTRAST	29252-4	CT Chest WO contrast
CT	CT CHEST WO	29252-4	CT Chest WO contrast
CT	CT CHEST WO CONTRAST	29252-4	CT Chest WO contrast
CT	CT CHEST WO IV CONT	29252-4	CT Chest WO contrast
CT	CT CHEST WO IV CONTRAST	29252-4	CT Chest WO contrast
CT	Thorax^CHEST_WITHOUT (Adult)	29252-4	CT Chest WO contrast
CT	Thorax^CHEST_WO (Adult)	29252-4	CT Chest WO contrast
CT	Thorax^CT_CHEST_WITHOUT (Adult)	29252-4	CT Chest WO contrast
…	…	…	…

LOINC = Logical Observation Identifiers Names and Codes, part of the Unified Medical Language System

AAPM/MIDRC CRP12; Kinahan et al.

Harmonization: Mapping from DICOM Metadata to LOINC codes for CT

https://www.midrc.org/subcommittees/DQH

DICOM metadata

LOINC term

	A	B	C	D	E	F	G	H
1	**Modality**	**cleaned_StudyDescription**	**studies_count**		LOINC code	L-Long Common Name	L-Method	L-System
2	CT	CT CHEST WO IV CONT	190		29252-4	CT Chest WO contrast	CT	Chest
3	CT	N/A	137		29252-4	CT Chest WO contrast	CT	Chest
4	CT	CTA CHEST (PE STUDY) W CONTRAST	134		79077-4	CTA Pulmonary arteries for pulmonary embolus W contrast IV	CT.angio	Chest
5	CT	CT CHEST PULMONARY ANGIO WITH IV CON	126		79077-4	CTA Pulmonary arteries for pulmonary embolus W contrast IV	CT.angio	Chest
6	CT	CT ABD AND PELVIS WITH IV CONT	124		36813-4	CT Abdomen and Pelvis W contrast IV	CT	Abdomen+Pelvis
7	CT	CT CHEST WITH CONTRAST	110		24628-0	CT Chest W contrast IV	CT	Chest
8	CT	CT ABD AND PELVIS WO IV CONT	93		36952-0	CT Abdomen and Pelvis WO contrast	CT	Abdomen+Pelvis
9	CT	Vascular^PE_STUDY (Adult)	85		79077-4	CTA Pulmonary arteries for pulmonary embolus W contrast IV	CT.angio	Chest
10	CT	CT CHEST WITHOUT CONTRAST	83		29252-4	CT Chest WO contrast	CT	Chest
11	CT	CT CHEST PULMONARY EMBOLISM (CTPE)	75		79077-4	CTA Pulmonary arteries for pulmonary embolus W contrast IV	CT.angio	Chest
12	CT	THORAX PE	34		79077-4	CTA Pulmonary arteries for pulmonary embolus W contrast IV	CT.angio	Chest
13	CT	CT CHEST WITHOUT IV CONTRAST	22		29252-4	CT Chest WO contrast	CT	Chest
14	CT	Thorax^PE (Adult)	21		79077-4	CTA Pulmonary arteries for pulmonary embolus W contrast IV	CT.angio	Chest
15	CT							
16	CT							
17	CT							
18	CT							
19	CT	THORAX/ABDOMEN/PELVIS + CONT	14		72254-6	CT Chest and Abdomen and Pelvis W contrast IV	CT	Chest+Abdomen+
20	CT	CT ABD PELVIS(WITH CHEST IMAGES)				trast	CT	Chest+Abdomen+
21	CT	CT ANGIO ABD AND PEL WWO IV CON				WO and W contrast IV	CT	Abdomen>Abdom
22	CT	Thorax^FLASH_PE (Adult)				olus W contrast IV	CT.angio	Chest

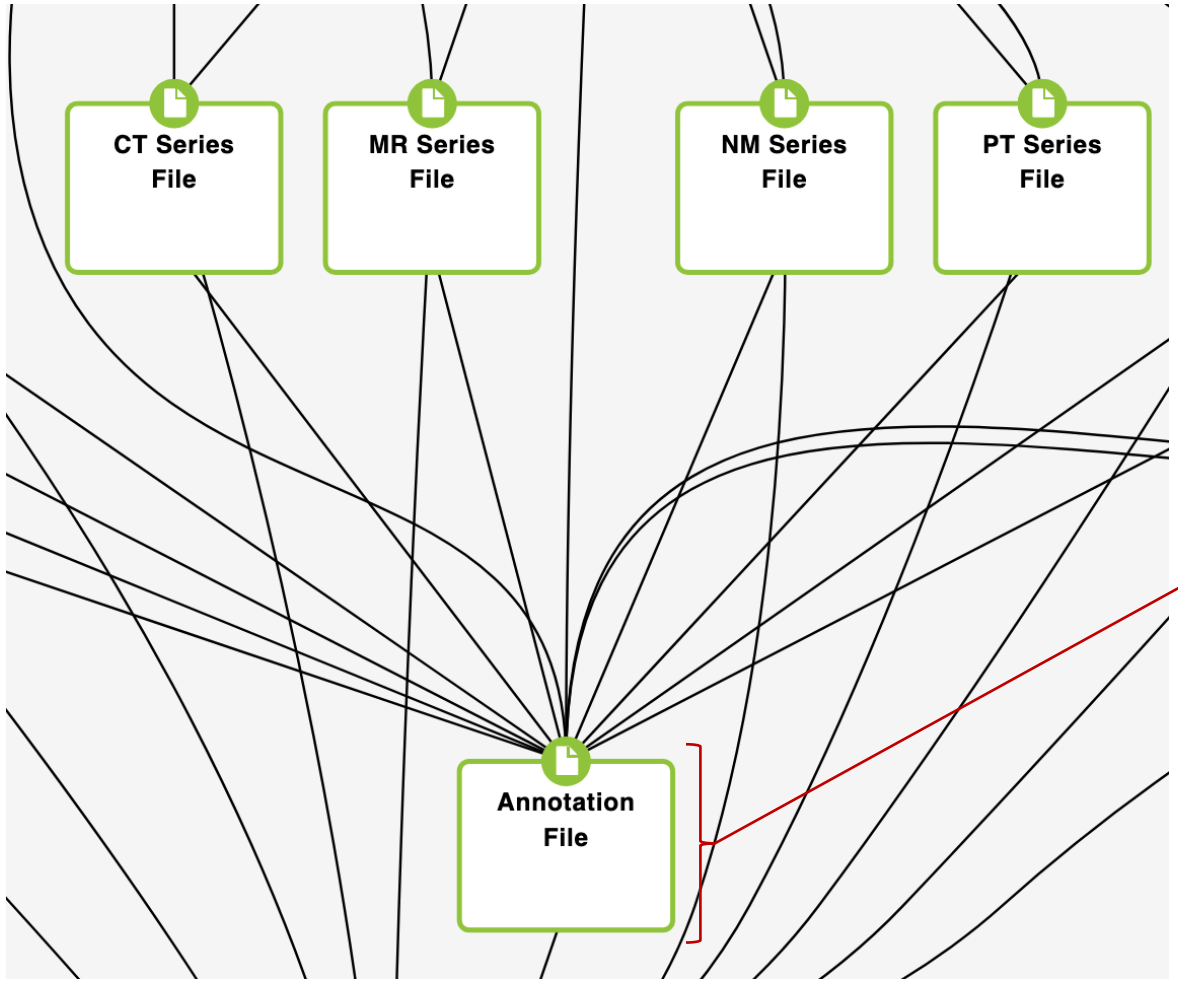
97% mapped to LOINC-RadLex playbook for harmonization enabling cohort building;
Now close to 99% after incorporating AI

Mappings are on the MIDRC public Github

AAPM/MIDRC CRP12; Kinahan et al.

Image Quality Tracking

Image quality tracking (developing)



MIDRC meta data structure

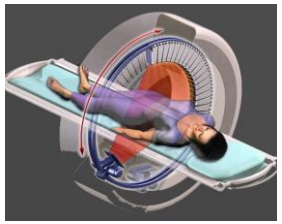
MIDRC Image quality structure for inclusion in data model
Category
Study / protocol level
MR pulse sequence class
Field strength
Complete study protocol (all expected series)
Image data quality
image modifications (e.g., altering burned-in information)
MTF (MTF 10, MTF50, continuous)
Chest CT dose categories per Corgi protocol (low med high)
CT slice thickness categories (TBD) - thin, medium, thick
d' (task-based)
global noise
linearity
MR uniformity
Large area contrast ratios
Noise
Noise type definition
SNR
SNR type definition

AAPM/MIDRC CRP12; Kinahan et al.

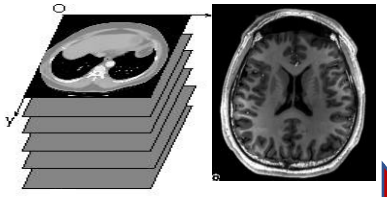
Data Interoperability

MIDRC
MEDICAL IMAGING AND DATA RESOURCE CENTER

Collection from Various Medical Centers (USA & Global)

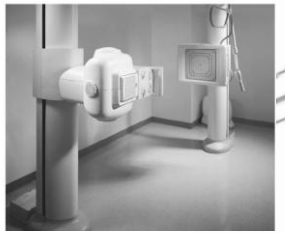


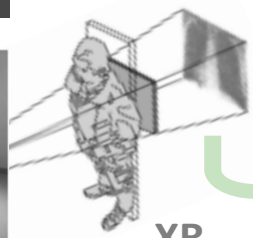
CT



MRI

DICOM images





XR



De-identification & Intake

RSNA
RICORD
or
ACR
CIRR

Curation & Harmonization

AAPM

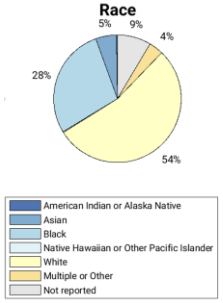
- Standards
- LOINC mapping
- Annotations and Labeling
- Bias Assessment
- Model Selection
- Diversity Assessment

RSNA Informatics
RadLex® Playbook
LOINC®
from Regenstrief

Data Model Enabling Cohort Building

Gen3





Interoperability Pilots

Biomedical Research Hub
Powered by Gen3

BioData CATALYST
Powered by Gen3

National COVID Cohort Collaborative

For multi-modal research

Open Commons & User Portal (80% of data)

MIDRC
MEDICAL IMAGING AND DATA RESOURCE CENTER

Public commons
Available on data.midrc.org
~80% of all cases

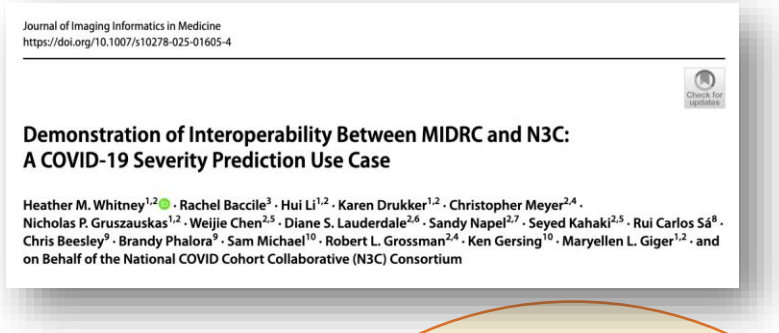
> 200,000 imaging studies to the public

midrc.org & data.midrc.org

Public facing DATA

- AI/ML ready
- FAIR
- Representative
- Searchable
- Sharable
- Reusable

Two MIDRC Interoperability Pilots with NIH repositories



Journal of Imaging Informatics in Medicine
https://doi.org/10.1007/s10278-025-01605-4

Demonstration of Interoperability Between MIDRC and N3C: A COVID-19 Severity Prediction Use Case

Heather M. Whitney[1,2] · Rachel Baccile[3] · Hui Li[1,2] · Karen Drukker[1,2] · Christopher Meyer[2,4] · Nicholas P. Gruszauskas[1,2] · Weijie Chen[2,5] · Diane S. Lauderdale[2,6] · Sandy Napel[2,7] · Seyed Kahaki[2,5] · Rui Carlos Sá[8] · Chris Beesley[9] · Brandy Phalora[9] · Sam Michael[10] · Robert L. Grossman[2,4] · Ken Gersing[10] · Maryellen L. Giger[1,2] · and on Behalf of the National COVID Cohort Collaborative (N3C) Consortium

Privacy Preserving Record Linkage
Honest Broker

NIH National Heart, Lung, and Blood Institute | BioData CATALYST

Red Coral study
1,480 patients
Comorbidities
Medications
Vital signs
Laboratory results
etc.

1,223 with imaging

MIDRC
MEDICAL IMAGING AND DATA RESOURCE CENTER.

> 84,000 patients
> 200,000 released imaging studies

AI-ready
Medical Imaging data

Pilot: 2,124 patients with imaging

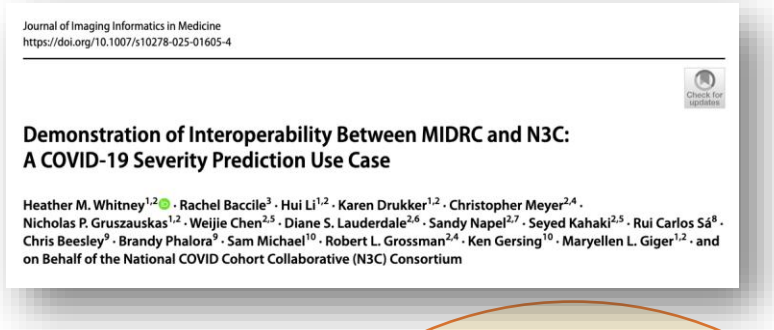
NIH National Center for Advancing Translational Sciences | N3C

> 8 Million COVID+ patients
Clinical observations
Medications
Vital signs
Procedures
etc.

Use Case: Creating multi-omics association studies and enriching data to build AI models

Use Case: Cohort building for developing computer vision AI of medical images

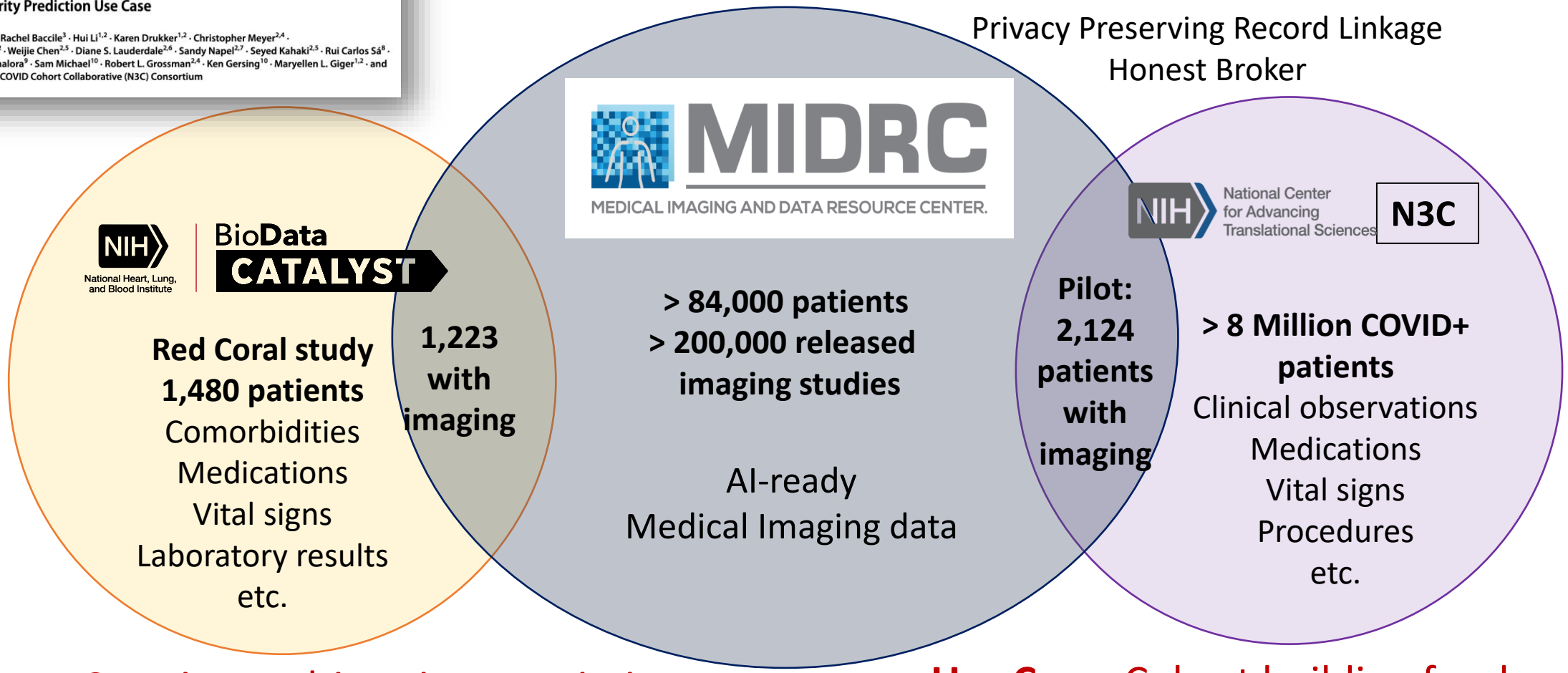
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NEW: Third interoperability study – MIDRC with All of Us



Use Case: Creating multi-omics association studies and enriching data to build AI models

Use Case: Cohort building for developing computer vision AI of medical images

MIDRC:
Contributions in Metrology

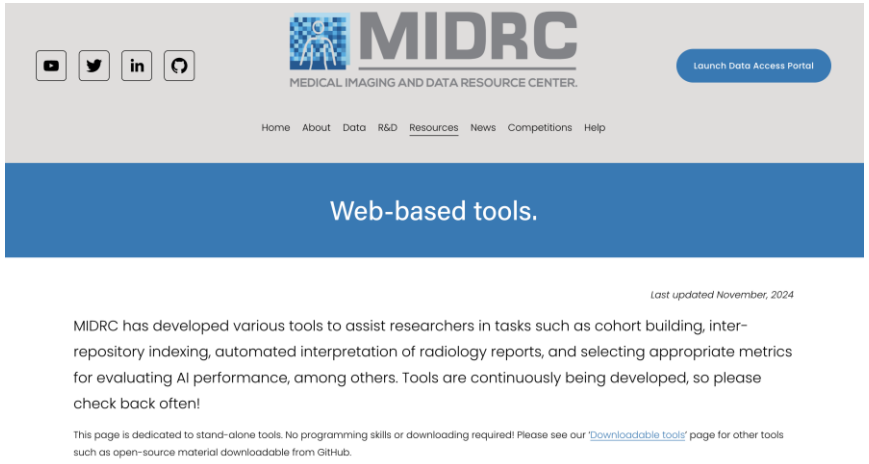
However, to really translate to clinical practice, we need more curated, diverse, representative, re-usable data AND Rigorous methods for evaluation for ethical, trustworthy, and reproducible AI

- Concerns on Robustness, Reproducibility, Data drift, Bias, Short cuts, Off-label use, Responsibilities of the end user
- How do we know when the AI is not working?
- Efficient and effective methods to help go through FDA
  - Appropriate metrics to assess performance
  - Independent testing sets
  - Post-market monitoring

Bias

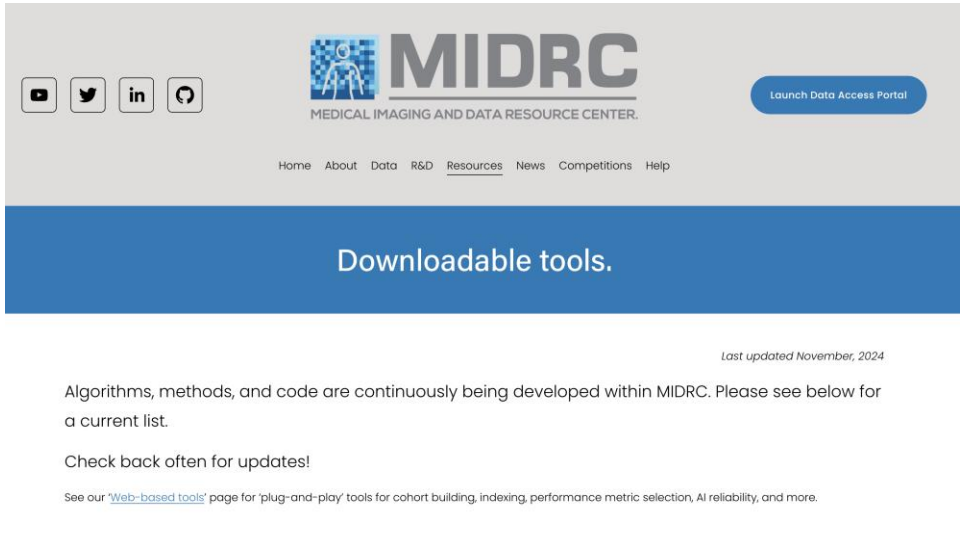
Open Resources: Tools & Algorithms on MIDRC.org

to help AI investigators understand their data & evaluate their AI algorithms



https://www.midrc.org/tools-1

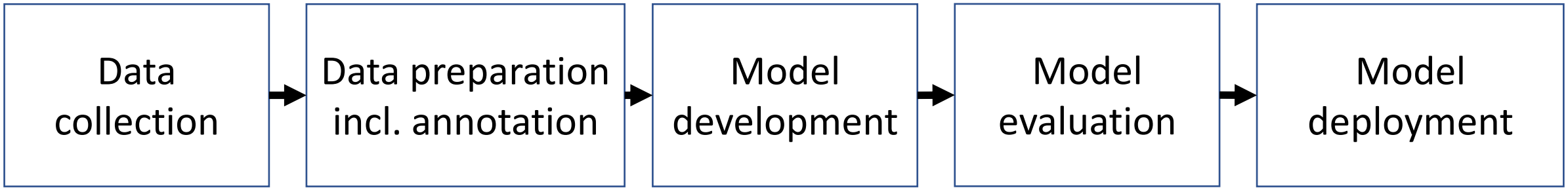




https://www.midrc.org/algorithms

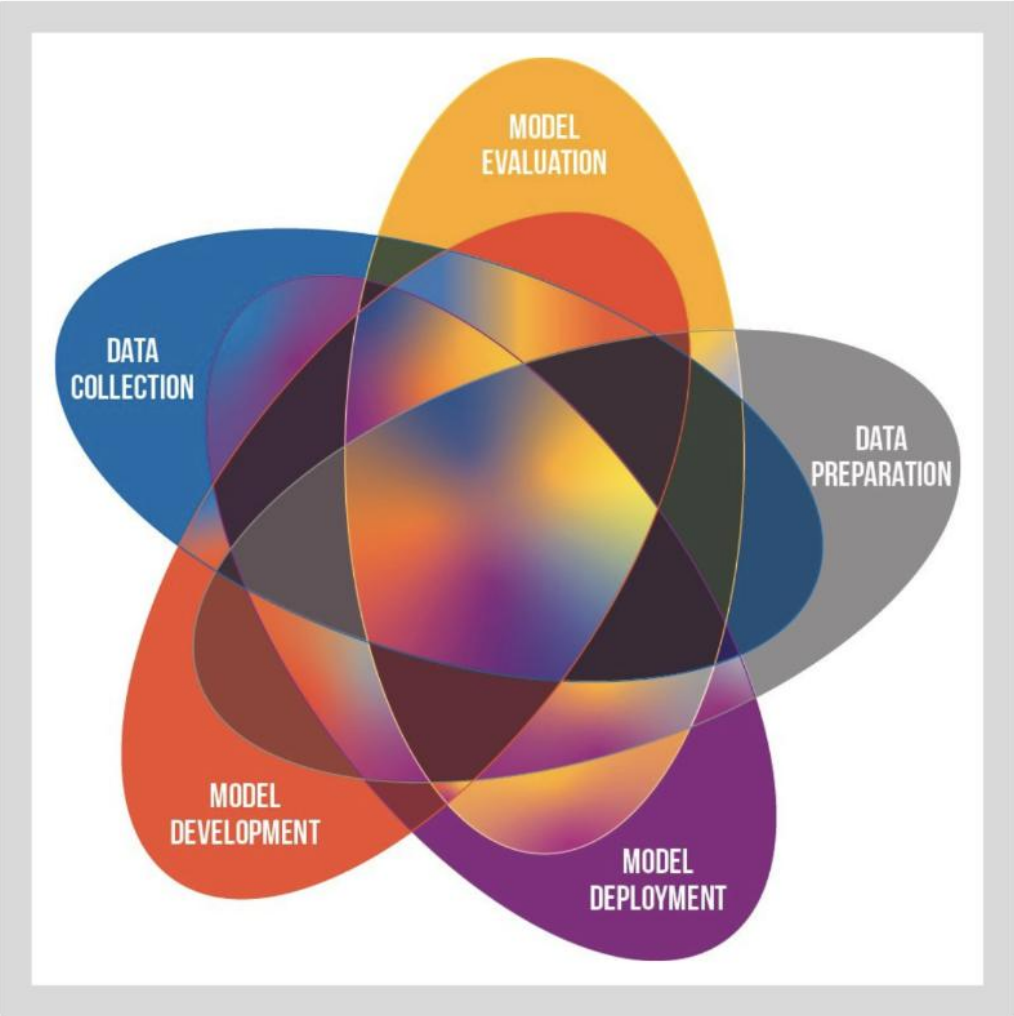
MIDRC Public GitHub

The artificial intelligence pipeline



Bias in AI arises when an algorithm outputs predictions from a consequence of erroneous and unfair "*assumptions*" in the AI pipeline.

MIDRC AI Reliability Tool



The MIDRC AI reliability tool helps users:

- Find and fix potential biases in AI and machine learning models
- Spot sources of bias and suggests ways to reduce them
- Employ best practices for creating reliable AI/ML systems.

MIDRC Tool Name	MIDRC AI Reliability Tool
GitHub link or Web-facing link	https://www.midrc.org/ai-reliability-tool-1
Publication	https://doi.org/10.1117/1.JMI.10.6.061104

MIDRC AI Reliability Tool

Learn more about a possible mathematical bias, including how to measure and how to mitigate it, and review cross-references to other parts of the tree.

What it is: Population bias arises when statistics, demographics, and user characteristics differ between the original target population and the user population represented in the actual dataset or platform.

Why it occurs: Population bias occurs when the characteristics of a training data population are different from the characteristics of a testing data population. The characteristics may include biological differences, demographic differences, social differences (such as the impacts of socioeconomic differences to access to health care), or technical differences in image acquisition that correlate to demographic difference.

Why it's important: Algorithms can be overtrained to one group, reducing their ability to be applied in a useful way to other groups. This impacts decision-making if drawn from the algorithms developed with population bias, for example increasing the numbers of false positive/false negative classification decisions. It may also foster a lack of confidence in the algorithm's utility for some populations and discourage further development and resourcing

Real-world example(s): Some socioeconomic groups may not have sought care for COVID-19 as soon as some others, and this may have resulted in their illness being more advanced before imaging was conducted. Some populations may not have had CT scanning as a part of their care, and thus their data may not be included in training models, when otherwise this would have made the dataset more diverse. More significant and serious outcomes from COVID-19 have been observed in some age ranges, races, and/or ethnicities than others.

How it's measured: Cross-population modeling.[2]

Mitigation strategies: The results of cross-population modeling can help a user identify if some kind of data harmonization procedure is needed to account for systematic differences in the population that are relevant to AI modeling.

Summary: Population bias in medical imaging occurs when the characteristics of a population from which data is used for training an algorithm are different from the characteristics of a population for which data is used for testing or decision making-from an algorithm. The characteristics may include biological differences, demographic differences, social differences (such as the impacts of socioeconomic differences in access to health care), or technical differences in image acquisition that correlate to demographic difference.

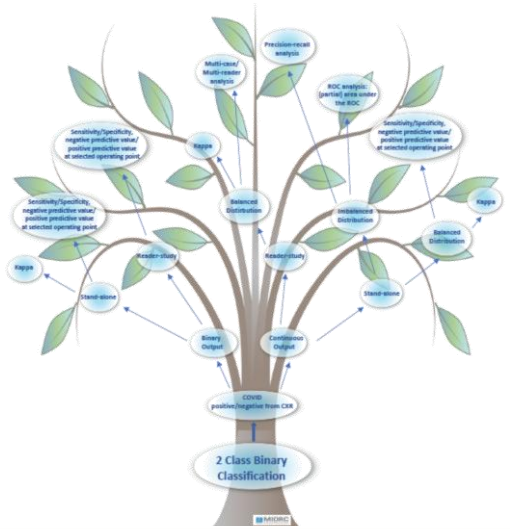
Please note, Population Bias may also occur during the Model Development and Model Evaluation Stages

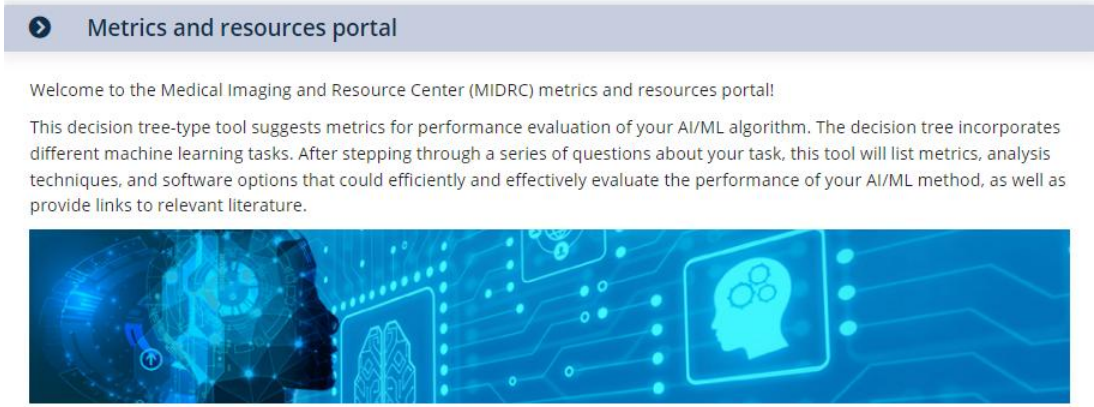
- Data Acquisition and Aggregation Bias
- Biased Synthetic Data
- Exclusion Bias
- Institutional / Systemic Bias
- Popularity / Patient-based Bias
- Temporal Bias
- Sampling / representation / selection Bias
- **Population Bias**
- Activity Bias

Appropriate performance metrics are crucial

Metrology Decision Tree

- Developed a decision tree to assist MIDRC users in selecting metrics and reporting performance
  - Ask users a series of questions to guide them through a decision tree for metric selection
    - Final leaf: Metrics and suggested resources
- Utility:
  - Help researchers from different fields who employ MIDRC data select task-based performance metrics
  - Encourage use of consistent metrics for similar tasks
    - Help comparison of results from different studies
  - Help stakeholders put reports from MIDRC data into proper perspective
  - Now noted in the FDA MIC-MET Tree: Decision Tree for Medical Imaging AI/ML Classification Metrics





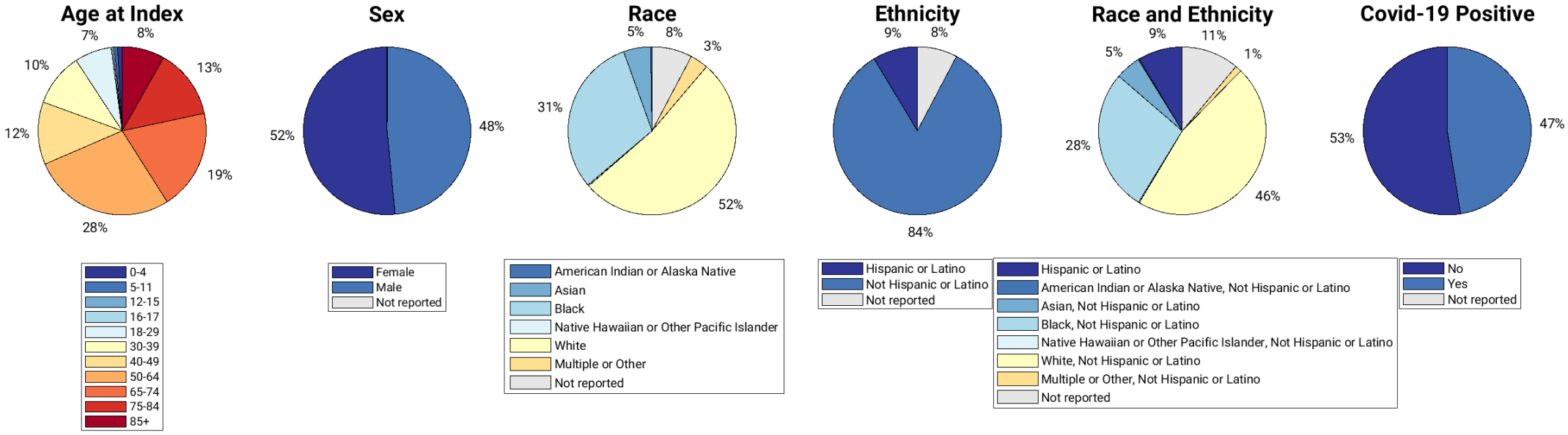


https://www.midrc.org/performance-metrics-decision-tree

Data Representativeness for understanding datasets and subgroups

Monitoring the Representativeness of MIDRC Data

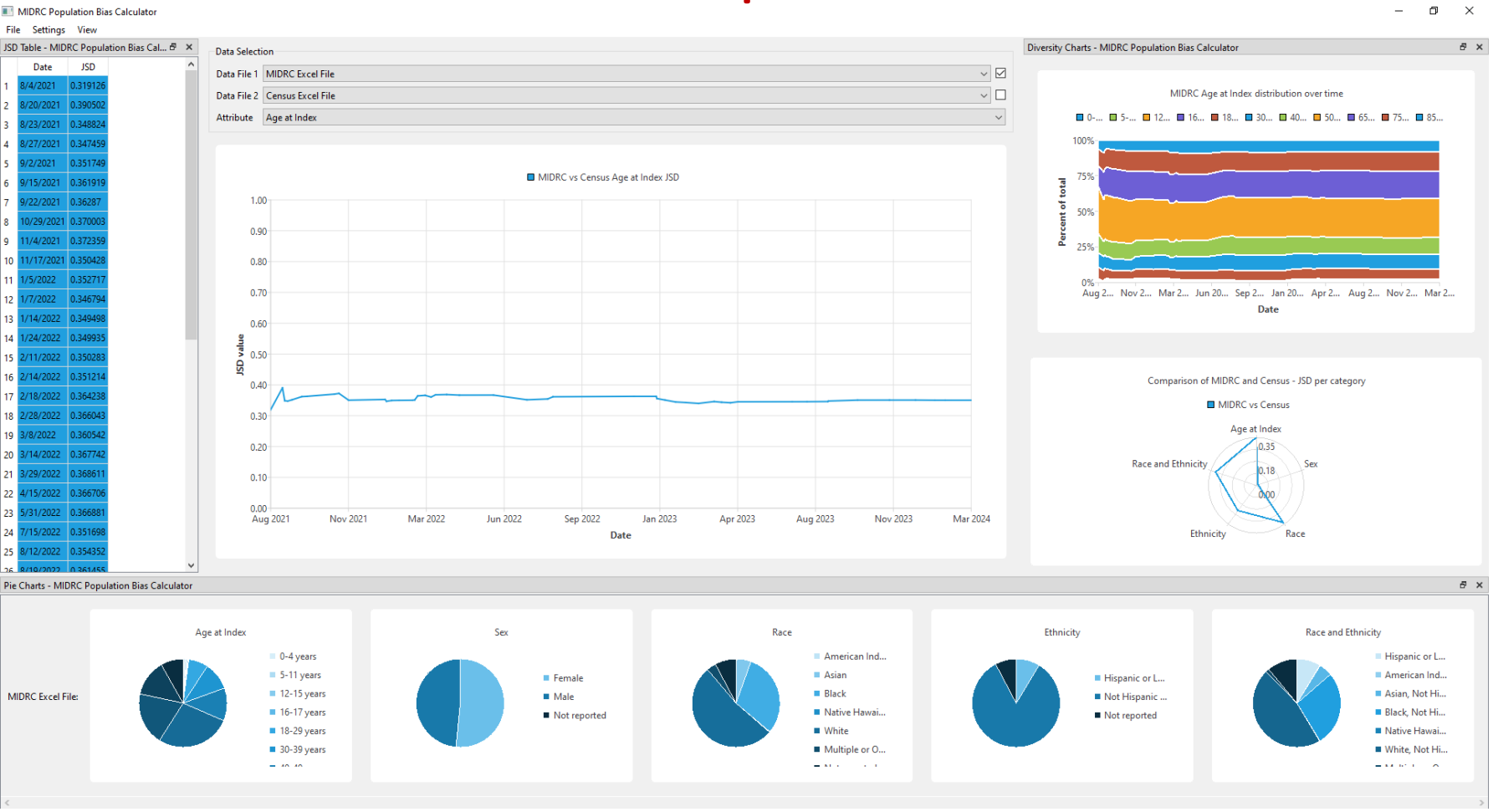
- To ensure data sets are **representative of the population** based on, for example, variations in the physical image acquisition systems or variations in the regions of data origin.
- For the development of **ethical and trustworthy machine learning algorithms** that account for and reduce data distribution errors.



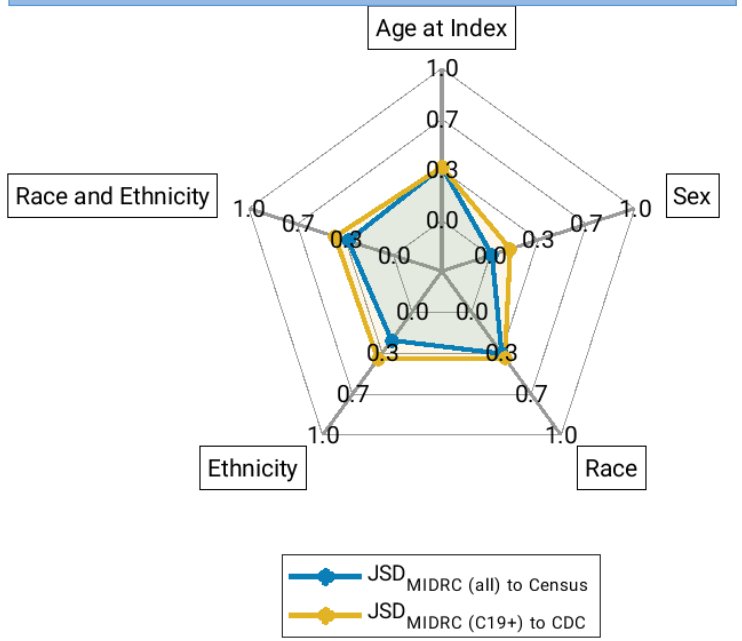
Contributions coming from 23 states

MIDRC Open Commons

MIDRC REACT Tool:
Assesses representativeness of data across datasets



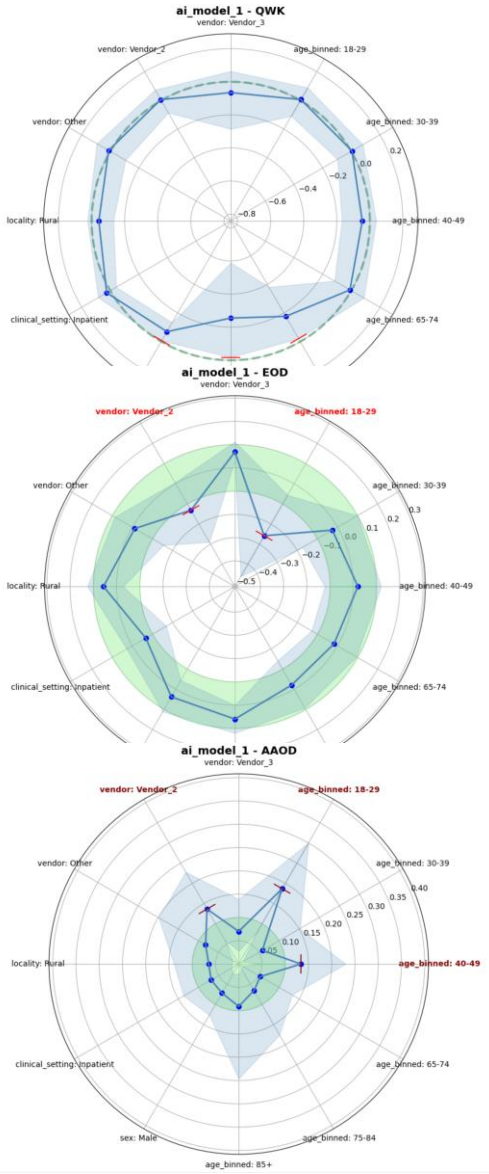
Allows comparisons of MIDRC data to US Census and CDC or to datasets in individual investigators' labs.



Assessing cohorts at subgroup levels and measuring representativeness is critical for development of trustworthy AI in medical imaging.

MIDRC MELODY

(Model EvaLuation across subgroups for cOnsistent Decision accuracY)



The MIDRC MELODY tool helps users:

- Conduct standardized evaluation of AI performance and bias across relevant subgroups
- Assess robustness of AI models developed for medical imaging analysis tasks, such as the estimation of disease severity
- Improve reliability in categorical prediction and binary classification tasks
- It enables consistent evaluation of models across predefined subgroups (e.g. manufacturer, race, scanner type) by computing intergroup performance metrics and corresponding confidence intervals.

Assess AI algorithms in terms of performance and relative to the presence of biases

GitHub Stats (since April 2026)	
42 Unique Clones	29 Total Views

MIDRC Tool Name	MIDRC MELODY Tool
GitHub link	https://github.com/MIDRC/MIDRC_MELODY
Publication	https://doi: 10.1117/1.JMI.12.5.054502

Stratified Sampling

Statistical methods for demographic **balancing** and population sampling in a multi-institutional data commons to enable robust testing of AI

Sequestered Commons to Facilitate Translation

Total ingested into MIDRC

# of Imaging Studies
309,270

Undergoing MIDRC Data Quality and Harmonization

# of Imaging Studies
192,012

Released by MIDRC

# of Imaging Studies
117,258

Public commons
Available on *data.midrc.org*
~80% of all cases

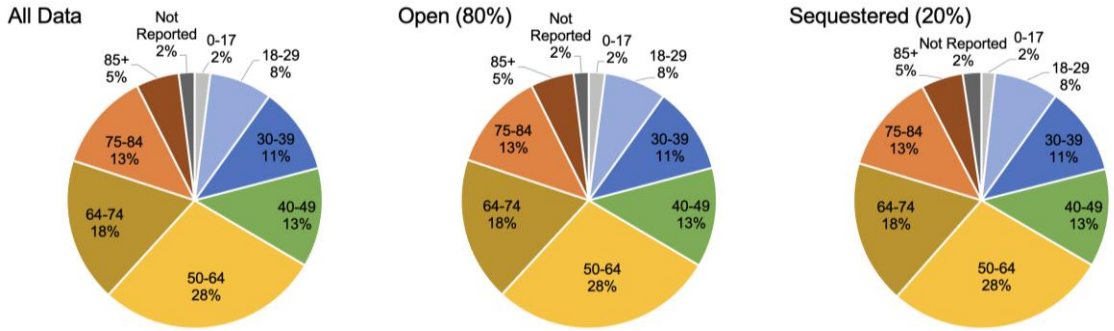
Public facing DATA
- AI/ML ready
- FAIR
- Trustworthy
- Representative
- Searchable

- De-identification
- Curation
- Quality control
- Annotation
- Harmonization

(incl. LOINC mapping)

Sequestered commons
No public access
~20% of all cases

Sequestered DATA
- Not publicly available
- Real-world testing of algorithm performance
- Translation / support of regulatory submission



Balancing & checking demographic distributions

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Combining

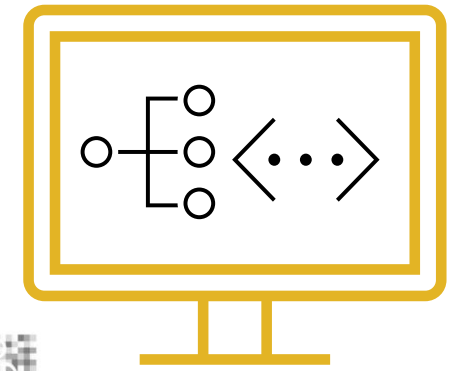
- Stratified Sampling
- Metrology Metric Tree
- Bias Assessment
- Regulatory Expertise

For rigorous evaluation and translation of AI systems to clinical impact

Leverage MIDRC's Sequestered Data and Expertise for Regulatory Submissions (Sustainability)

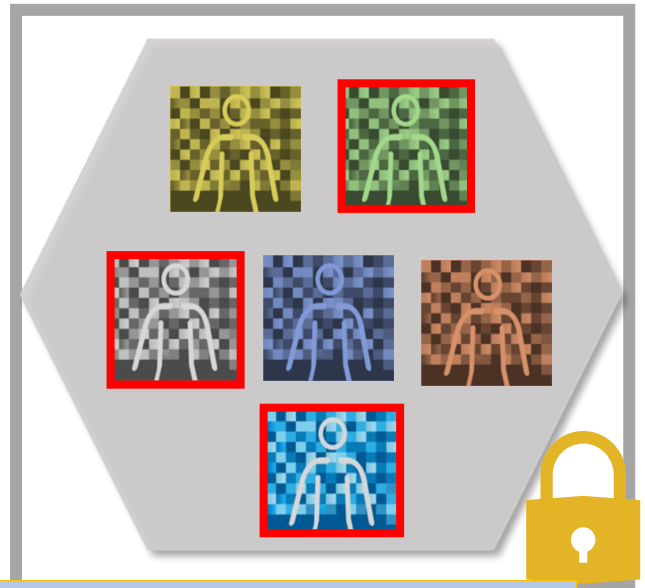
MIDRC
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Finalized user-developed algorithm for **specific clinical task** and **specific intended population**

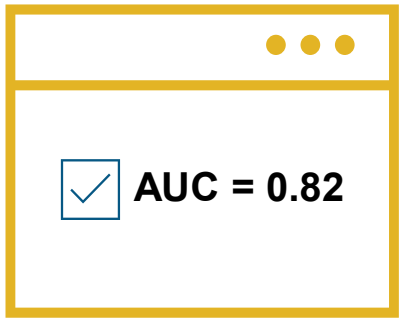


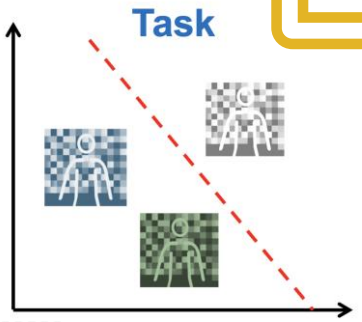
Testing request submitted

Evaluation on the **sequestered** MIDRC testing data



MIDRC provides testing advice and **independent performance assessment**





- Benefit the AI community and the public to expedite the rigorous evaluation and translation of AI systems to clinical impact
- MIDRC MDDT (Medical Device Development Tool) proposal

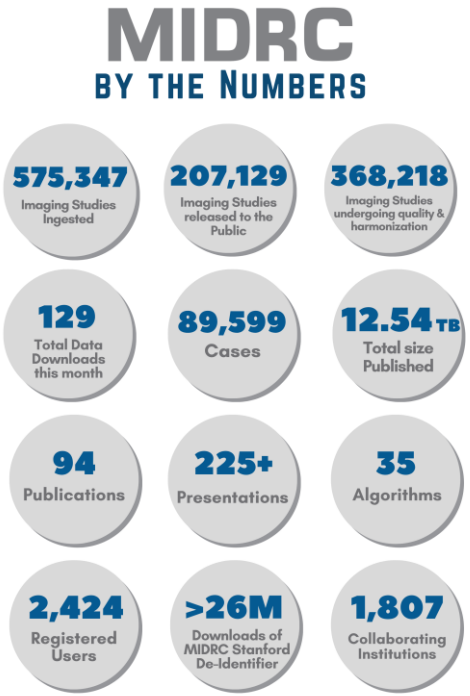
Report to developer

Report to FDA

MIDRC provided results

Impact

- We have a **Monthly Seminar Series** held on the third Tuesday of each month, featuring research highlights from MIDRC experts.
- Visit our **MIDRC Media** **YouTube channel** for recordings of scientific seminar presentations and highlights from members of the MIDRC team.
- Visit the **MIDRC GitHub** for access to algorithms and software developed by the MIDRC team.
- **94 Publications** and **225+ Presentations** from MIDRC investigators
  www.midrc.org/midrc-publications
  www.midrc.org/webinars-and-recordings
- MIDRC hosts **Town Hall meetings** and distributes **newsletters** with updates and announcements.
- For more information, visit **www.MIDRC.org**





LinkedIn	X	YouTube	MIDRC
Followers	**Followers**	**Views**	**Newsletter Subscribers**
9,888	320	9,629	2,183

Recent & **Current Graduate Students**

Joel Wilkie, PhD
Martin King, PhD
Nick Gruszauskas, PhD
Yading Yuan, PhD
Robert Tomek, MS
Neha Bhooshan, PhD
Andrew Jamieson, PhD
Hsien-Chi Kuo, PhD
Martin Andrews, PhD
William Weiss, PhD
Chris Haddad, PhD
Natasha Antropova, PhD
Adam Sibley, PhD
Kayla Robinson, PhD
Jennie Crosby, PhD
Qiyuan (Isabelle) Hu, PhD
Jordan Fuhrman, PhD
Lindsay Douglas, PhD
Natalie Baughan, PhD
Gabriel Casella, PhD
Joseph Cozzi, PhD
Joel Toledo
Robert Tomek
Ethan Stolen
Sam Fulton

Giger Lab

Thank you





Research Lab

Karen Drukker, PhD
Hui Li, PhD
Heather Whitney, PhD
Jordan Fuhrman, PhD
Chun Wai Chan, MS
Li Lan, MS
John Papaioannou, MS
Sasha (Alexandra) Edwards, MA
Madeleine Durkee, PhD
Summer medical students,
undergraduates, and
high school students

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Supported by NIH grants CA 195564, CA 189240, CA227948, and CA257652; NIH S10 OD025081 Shared Instrument Grant; and The University of Chicago CTSA UL1 TR000430 pilot awards; UChicago Comprehensive Cancer Center Koleseiki Fund & Dancing with Chicago Celebrities Fund; CDAC Grant; c3.ai Grant; NIBIB COVID-19 Contract 75N92020D00021; DOE PALISADE-X; CZI DAF

MIDRC

MEDICAL IMAGING AND DATA RESOURCE CENTER.

An AI-enabled clinical imaging research platform that accelerates the development of machine learning tools to improve patient care

- Ingests and harmonizes **real-world imaging data** from across the U.S.
- **Sequesters** data to assure reliable benchmarking of machine learning algorithms
- **Interoperates** with other data platforms through secure indexing and federation
- Leverages **experts** from the major North American imaging societies
- Upholds FISMA-moderate **security** for privacy-preserved central and federated data
- Develops and disseminates **tools** for data collection, de-identification, harmonization, analysis, and labeling
- Engages with FDA to deploy MIDRC data for **medical device development tools** (MDDTs)
- Adheres to an **efficient and scalable** governance framework for streamlined operations
- Can support the needs of NIH and other programs that include imaging data

Radlex/LOINC Structure

- LOINC Code:

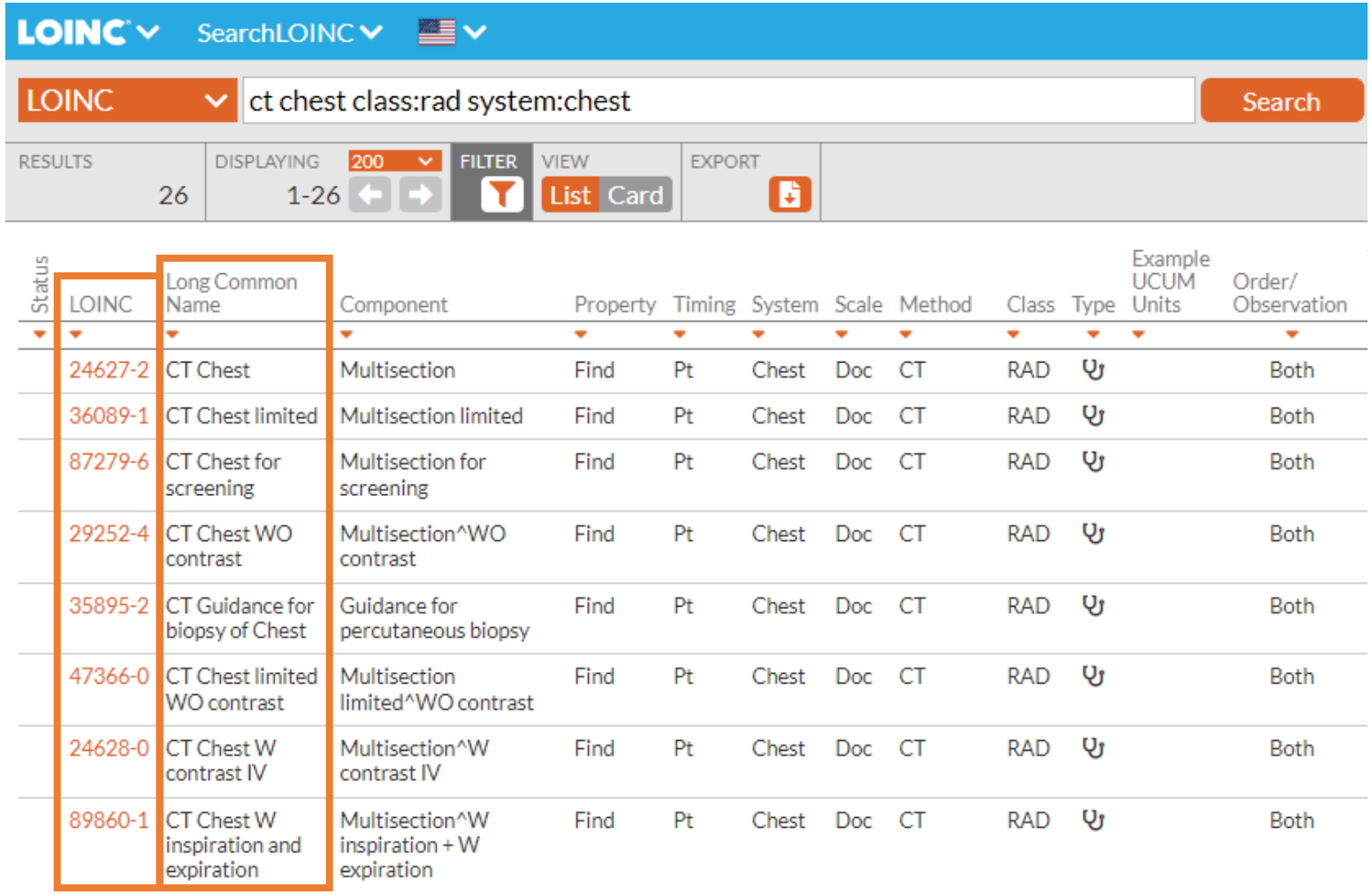
  Unique numerical identifier

- Long Common Name:

  Also unique, human readable

  Similar to a Study Description, but with modality included

- Can use other fields: modality, contrast agent, anatomy, etc.



Status	LOINC	Long Common Name	Component	Property	Timing	System	Scale	Method	Class	Type	Example UCUM Units	Order/ Observation
	24627-2	CT Chest	Multisection	Find	Pt	Chest	Doc	CT	RAD			Both
	36089-1	CT Chest limited	Multisection limited	Find	Pt	Chest	Doc	CT	RAD			Both
	87279-6	CT Chest for screening	Multisection for screening	Find	Pt	Chest	Doc	CT	RAD			Both
	29252-4	CT Chest WO contrast	Multisection^WO contrast	Find	Pt	Chest	Doc	CT	RAD			Both
	35895-2	CT Guidance for biopsy of Chest	Guidance for percutaneous biopsy	Find	Pt	Chest	Doc	CT	RAD			Both
	47366-0	CT Chest limited WO contrast	Multisection limited^WO contrast	Find	Pt	Chest	Doc	CT	RAD			Both
	24628-0	CT Chest W contrast IV	Multisection^W contrast IV	Find	Pt	Chest	Doc	CT	RAD			Both
	89860-1	CT Chest W inspiration and expiration	Multisection^W inspiration + W expiration	Find	Pt	Chest	Doc	CT	RAD			Both

AAPM/MIDRC CRP12; Kinahan et al.

Leverage MIDRC's Secure, Established, and Efficient Infrastructure to Support Investigator and NIH Data Sharing Needs

MIDRC as a DMS resource for investigators



MIDRC is listed as an NIH-Supported Scientific Data Repository

MIDRC provides efficient & reasonable budget estimates to applicants for timely grant submissions.

MIDRC listed as the DMS repository in three R01s submitted to October 2025 deadline.

For example, open-Duke-CSpineSeg is an MRI dataset

1,300 MRIs and associated segmentation masks with DOI connection to publication

