National Institutes of Health
Office of Data Science Strategy

Creation of AI Working Group

Exploring NIH's Strategies, Challenges, and an AI Vision for the Future

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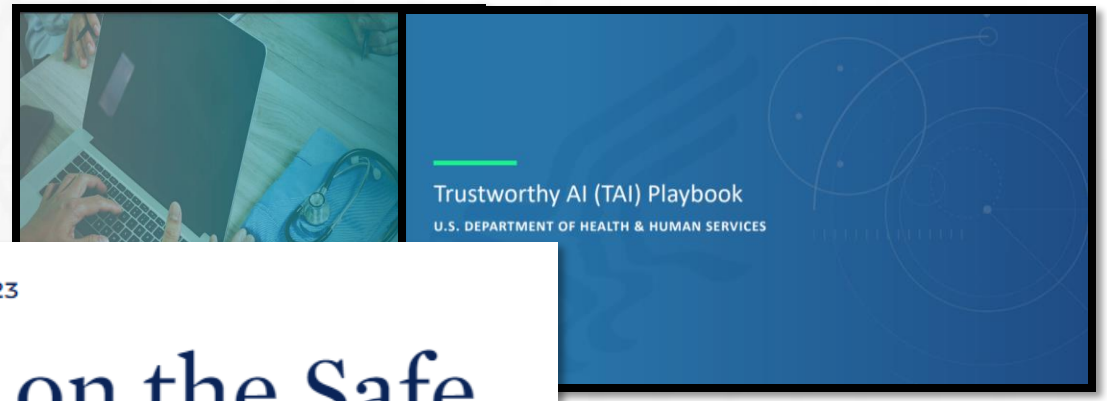
June 14, 2024

Accelerating Trustworthy AI

https://www.ai.gov/strategic-pillars/advancing-trustworthy-ai/



https://www.hhs.gov/sites/default/files/hhs-ai-strategy.pdf
https://www.hhs.gov/sites/default/files/hhs-trustworthy-ai-playbook.pdf

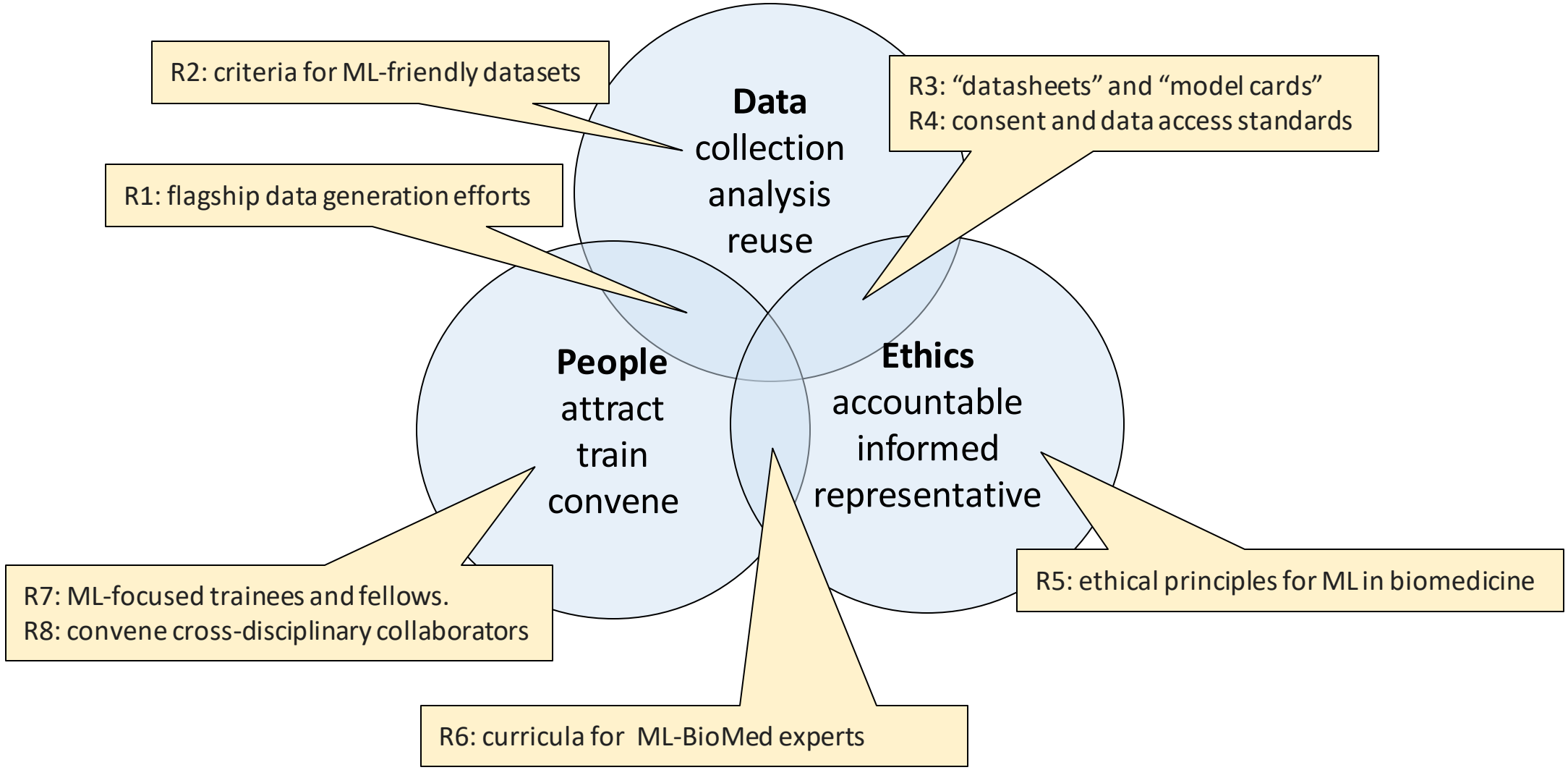
https://www.federalregister.gov/documents/2020/12/08/2020-27065/promoting-the-use-of-trustworthy-artificial-intelligence-in-the-federal-government

NIH Office of Data Science Strategy

Executive Order on the Safe, Secure, and Trustworthy Development and Use of Artificial Intelligence

- **Investments in AI-related education, training, development, research, and capacity**
- Establish a program to identify and **attract top talent in AI**, and other critical and emerging technologies, at universities, research institutions, and the private sector overseas
- Launch a pilot program **implementing the National AI Research Resource (NAIRR)**
- Support **2024 Leading Edge Acceleration Project** cooperative agreement awards to improve healthcare-data quality, support the responsible development of AI tools for clinical care, real-world-evidence programs, population health, public health, and related research
- **Accelerate the National Institutes of Health Artificial Intelligence/Machine Learning Consortium to Advance Health Equity and Researcher Diversity (AIM-AHEAD)** program

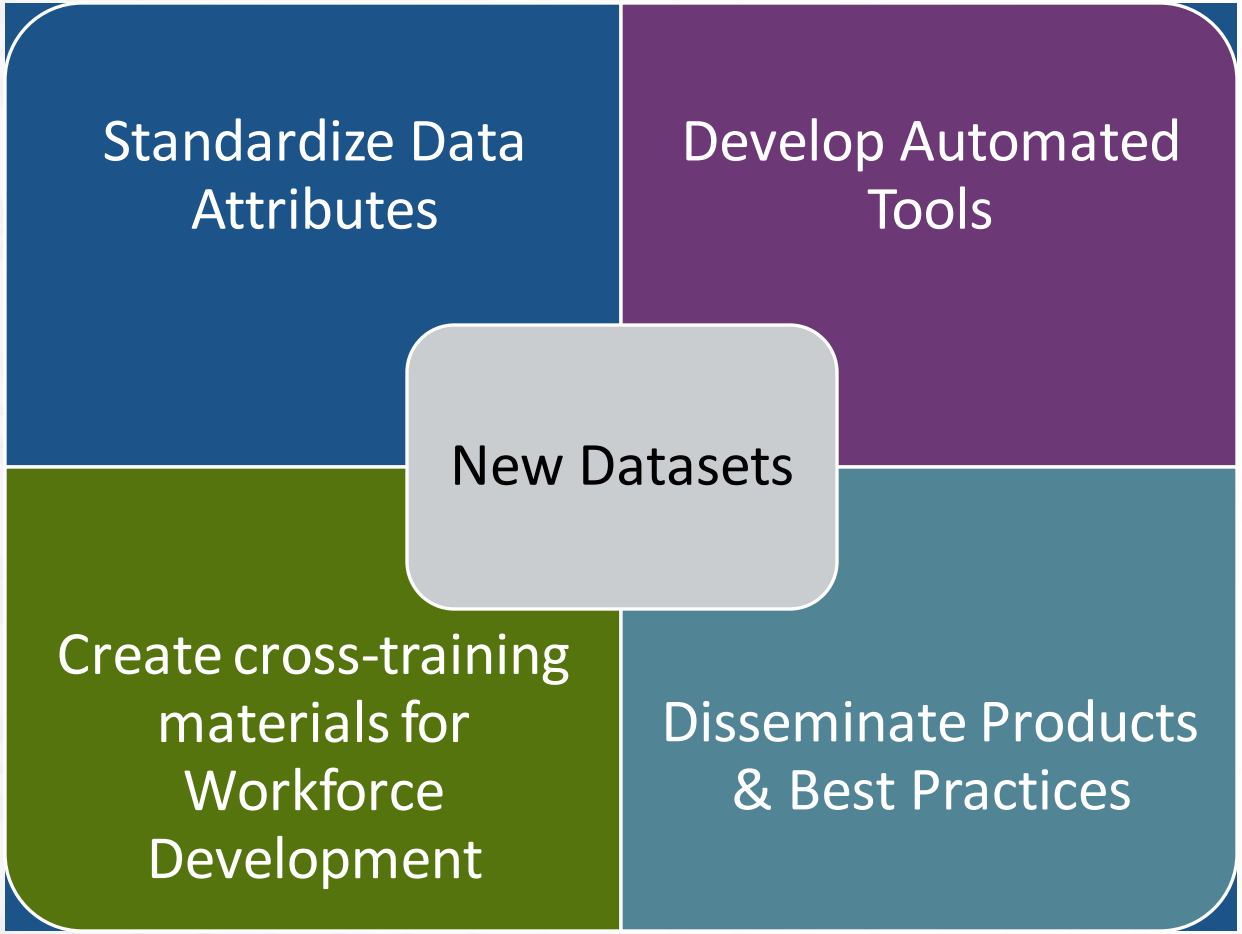
Recommendations from 2019 ACD AI Working Group



Bridge2AI Program Goals

Determining how to:

- Use biomedical and behavioral research grand challenges to generate **flagship data sets**
- **Prepare** AI/ML-friendly data
- Emphasize **ethical** best practices
- Promote **diverse teams**



Bridge2AI Milestones

The program established a public portal (https://bridge2ai.org/) for disseminating information regarding program activities and products.

Data

- The four data generation projects (DGPs) have started to release data
- External users worked with data in April 2024

People

- 5 internship programs to train researchers in both AI and biomedical research

Ethics

- Paper submitted (under review) which discusses the ethics considerations as part of data and AI modeling lifecycle

About the Artificial Intelligence/Machine Learning Consortium to Advance Health Equity and Researcher Diversity (AIM-AHEAD)

Goals

Enhance the **participation** and **representation** of researchers and communities currently underrepresented in the development of AI

Address health disparities and inequities using AI/ML

Improve the capabilities of this emerging technology

https://aim-ahead.net/

AIM-AHEAD Impact | Year 1 & 2 Awards

AIM-AHEAD supported over **274 awards** to increase researcher diversity, address data & AI biases, engage underserved communities, and build institutional capacity

Training Programs
- Leadership Fellowship (50)
- Research Fellowship (47)

Community Engagement
- Hub Pilot Projects (35)

AI Health Equity Research
- Pilot Projects (21)
- Consortium Projects (21)

Institutional Capacity Building
- Program for Artificial Intelligence Readiness (15)
- Data and Infrastructure Capacity Building (13)

Joint training to increase researcher diversity in AI/ML by leveraging *All of Us* and N3C datasets, infrastructure, and training components.

All of Us

212 Applications
25 trainees

National COVID Cohort Collaborative

120 Applications
50 trainees

Impact *as of June 5, 2024*

4,418+	Total Members
2,519	Mentees
1,170	Mentors
1,306	Institutions

AIM-AHEAD Named in White House Executive Order

Examples of AIM-AHEAD Supported AI Studies

AIM-AHEAD-supported studies have appeared in high-impact journals, including ***Nature Communication, Scientific Report***, ***Journal of Medical Internet Research AI***, ***PLOS One***, ***Journal of Clinical Oncology, Journal of Systemics, Cybernetics and Informatics, etc.***

Journal of Systemics, Cybernetics and Informatics (2023) 21(2), 13-20
https://doi.org/10.54808/JSCI.21.02.13

Teaching Health Informatics in Middle School: Experience from an NIH AIM-AHEAD pilot

Gregory TARDIEU
Alexandria City Public Schools
Alexandria, VA 22314, USA

Senait TEKLE
Biomedical Informatics Center, The George Washington University
Washington, D.C. 20037, USA

Linda ZANIN
Alexandria City Public Schools
Alexandria, VA 22314, USA

NIH wide AI Collaborative Programs

Ethics, Bias, and Transparency for People and Machines

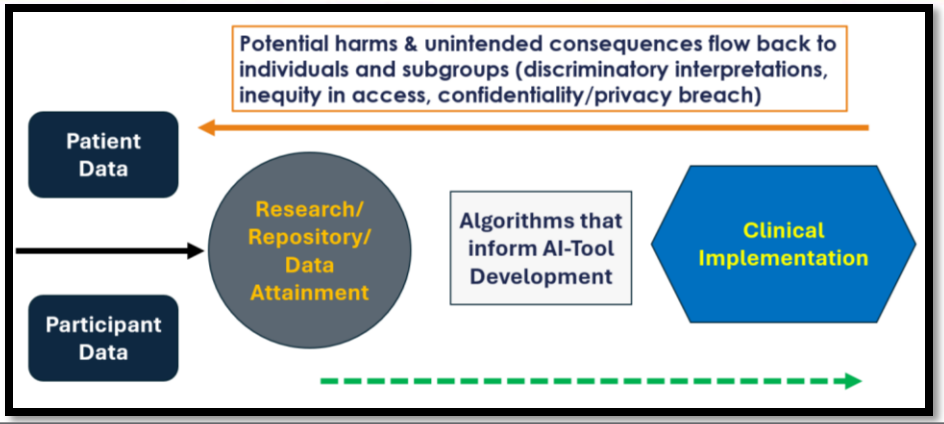
Improving the AI-readiness of Existing, IC-supported Data

Addressing the Workforce Gap in Data Governance for AI in Biomedicine

Impact 2021-2023

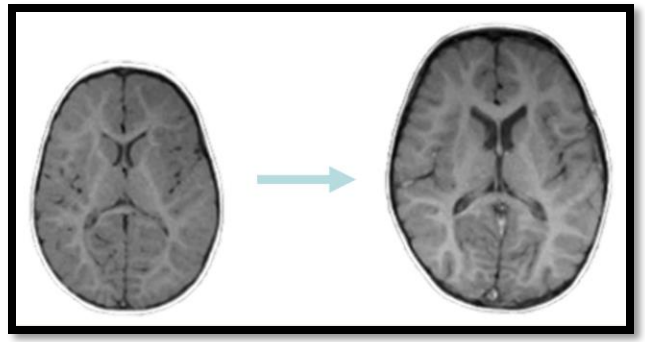
$54M	In funds to investigators
152	Investigators
14	Idea State Insitutions
4	Workshops, Labs, PI meetings

NIH wide AI Collaborative Impacts



PI: Alex Federman, Icahn School of Medicine at Mount Sinai
TITLE (IC):Natural Language Processing and Automated Speech Recognition to Identify Older Adults with Cognitive Impairment Supplement (NIA)
HIGHLIGHTS: Qualitative Examination of Patients' and Clinicians' perspectives on AI-driven Automated Screening for Cognitive Impairment

PI: GILMORE, JOHN HORACE, UNIVERSITY OF NORTH CAROLINA AT CHAPEL HILL
TITLE (IC): Rescuing Missed Longitudinal MRI Scans in the UNC Early Brain Development Study (EBDS)
HIGHLIGHTS: Developed AI methods to fill in missing brain images in cohort studies of early brain development, thereby making a complete AI-ready dataset for further analyses.
RESEARCH PRODUCTS: *Code and documentation:* *https://github.com/yoonmihong/DeepImputation*



PI: Ana Patricia Ortiz, University of Puerto Rico Comprehensive Cancer Center
TITLE (IC): Preparing a workforce to apply AI/ML techniques to datasets derived from Hispanic populations to advance cancer prevention and control research (NCI)
HIGHLIGHTS: Training focuses on techniques to manipulate/pre-process cancer datasets from Hispanic populations and make them FAIR & AI-Ready and methods to create predictive models for cancer diagnosis with focus on datasets from Hispanic populations.

Multimodal AI

Embed in context of ethical, trustworthy AI practices and assessment

Expected outputs:

- New systems-level biomedical research using multimodal AI technologies
- Elucidation of the unique opportunities, risks, and challenges for applying multi-modal AI methods
- Identification of considerations for the appropriate use of multimodal AI, relative to other methodologies

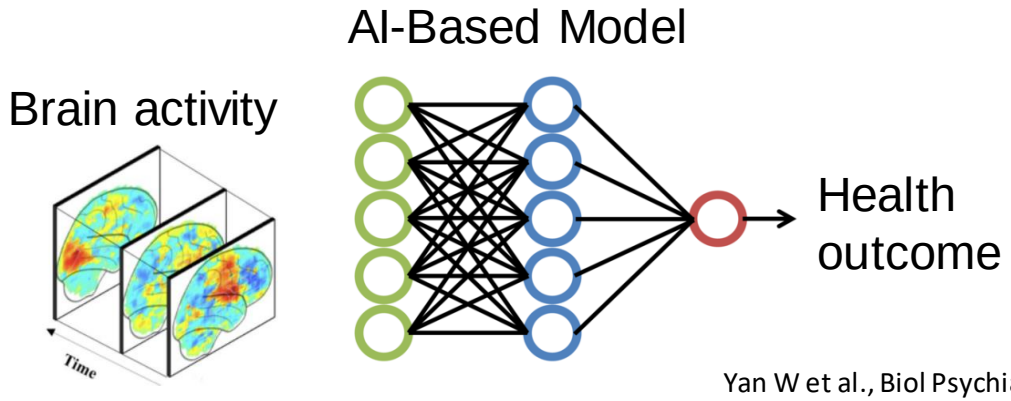
Example of NIDA-sponsored AI studies in human neuroscience

- AI can be used to predict health-related variables based on brain activity patterns

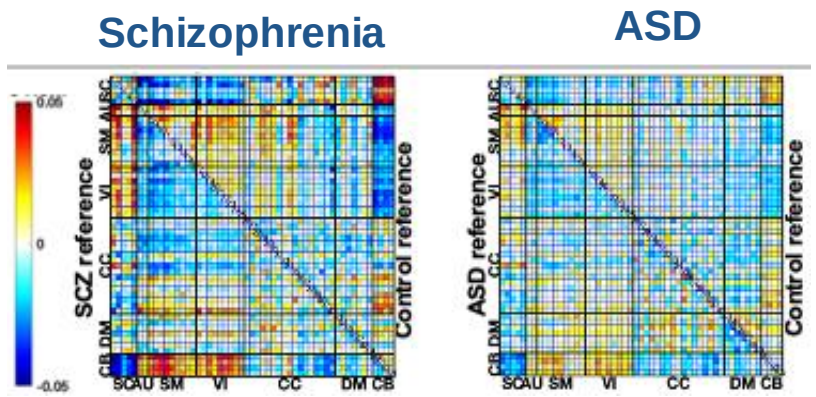
- To generate reproducible markers, extremely large samples may be needed

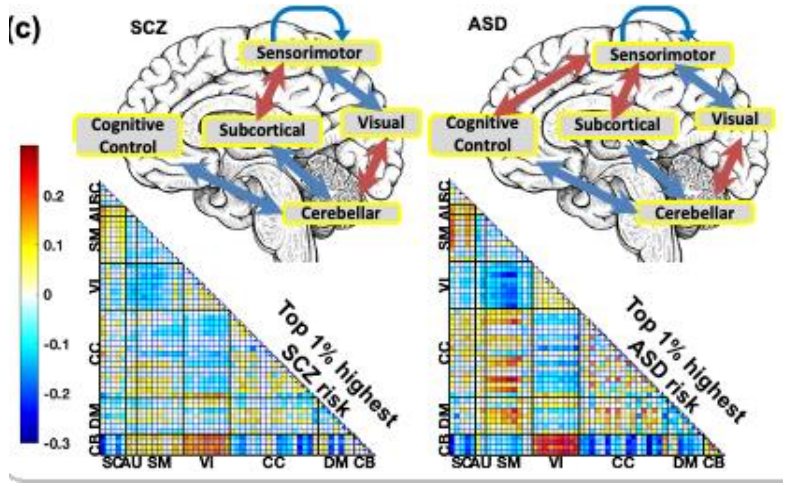
- We can use cutting-edge methods from AI, to translate AI-based models from big datasets to independent smaller datasets

(He et al, 2022)



Yan W et al., Biol Psychiatry. 2023





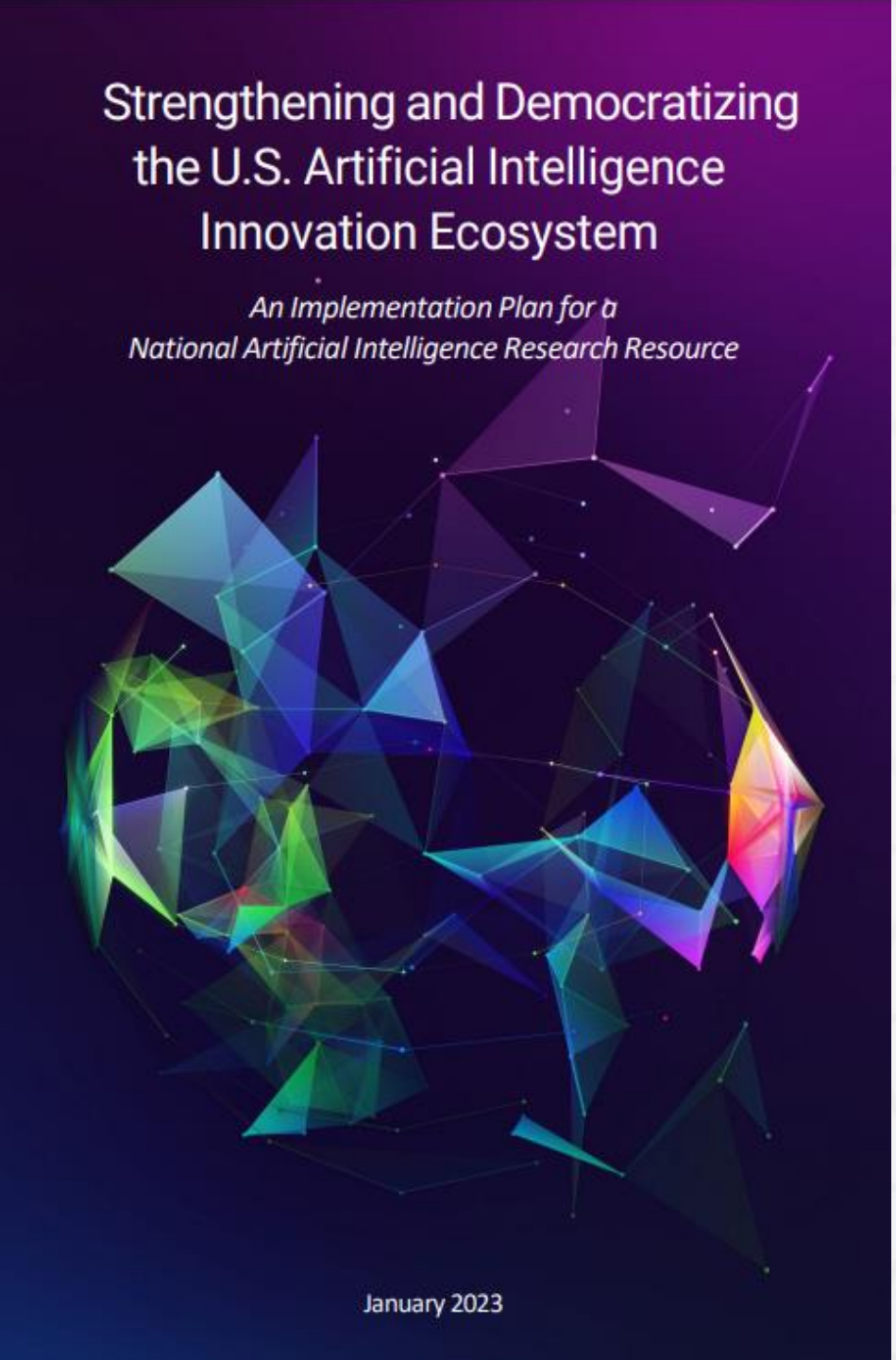
Agency Collaborations

- **Machine Learning and Artificial Intelligence NSTC Subcommittee**
- **National AI Research Resource (NAIRR)**
- **Health and Human Services AI Task Force**
- **NCI-DOE Collaboration for Advanced AI to end Cancer**

Impacts of NCI-DOE collaboration:

- **30 AI/ML publicly-available resources**
- **134 publications** since 2016
- **50+ public and private organizations** participating in innovation challenges

DBliss/NIH



Agency Collaborations: National AI Research Resource (NAIRR)

National AI Research Resource: a shared research infrastructure facilitating access to compute, software, datasets, models, training and user support for researchers and students

Objective: To strengthen and democratize the U.S. AI Innovation ecosystem in a way that protects privacy, civil rights, and civil liberties

Goals:

- Spur **innovation**
- Increase the **diversity** of talent in AI
- Improve U.S. **capacity** for AI R&D
- Advance **trustworthy AI**

NSF | NIH | DOE | NASA | NOAA

NIH Contributions to the NAIRR Pilot

DATA: NIH contributes large amounts of curated, interoperable, **AI-Ready Data**

SECURITY: NIH brings different data together in secure, privacy-preserving ways to **protect patient safety in AI**

TRUSTWORTHY AND ETHICAL AI: NIH adopts ethical practices and addresses bias, diversity, and transparency to **build trustworthy AI**

BROADENING PARTICIPATION: NIH cloud-based platforms and programs **lower the barriers to data science and grow capacity** in under-served and -resourced communities

NIH Contributions to NAIRR Pilot

Governance	• Experience developing and overseeing federated interoperability
NAIRR Open	• Integration of *ImmPort* datasets into the NAIRR • Integration of Health Equity Action Network (HEAN) datasets and ScHARE analysis tools into the NAIRR
NAIRR Secure*	• Integration of the Medical Imaging and Data Resource Center (MIDRC) and National COVID Cohort Collaborative (N3C) into NAIRR Secure
Software Stack	• Coordinate with NSF and DOE a NAIRR software stack community workshop
Classroom	• NIH Cloudlab and other platform tools leveraged in NAIRR
Outreach	• Leverage NIH networks to attract diverse users and data

** NIH and DOE jointly lead NAIRR Secure*

NIH Data and Computational Infrastructure Ecosystem

NIH STRIDES Initiative

STRIDES / CloudLab

ImmPort Private Data

Your site for managing ImmPort data uploads

ScHARe

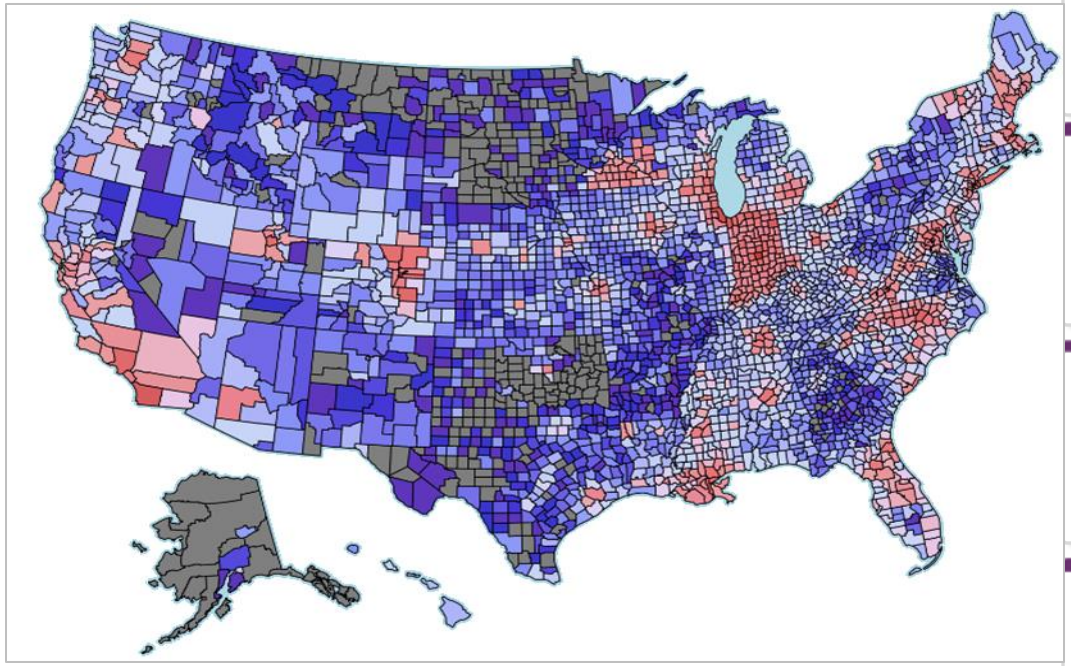
N3C: Translating Health Data Into Health Solutions

MIDRC

MEDICAL IMAGING AND DATA RESOURCE CENTER.

AI Ready Datasets for COVID and Clinical Modeling
National COVID Cohort Collaborative (N3C)

Data Diversity, Representation, and Harmonization are foundations for robust, trustworthy AI



Geographics: 50/50 States >92% of all US Counties in USA
Representative of US population
Source: Community, Academic, FQHCs
Patient Mix: Inpatient ~20%, Outpatient ED ~80%
Longitudinal Data: 1/1/2018 to Present

https://covid.cd2h.org/

COVID+ CASES 8.9m	Patients 22.5m
Rows of Data 32.7b	Contributors Health Systems 84
Institutions Using Data 391	Active Investigators >3900
Research Studies 553	Citations & H-Index. 3890/29

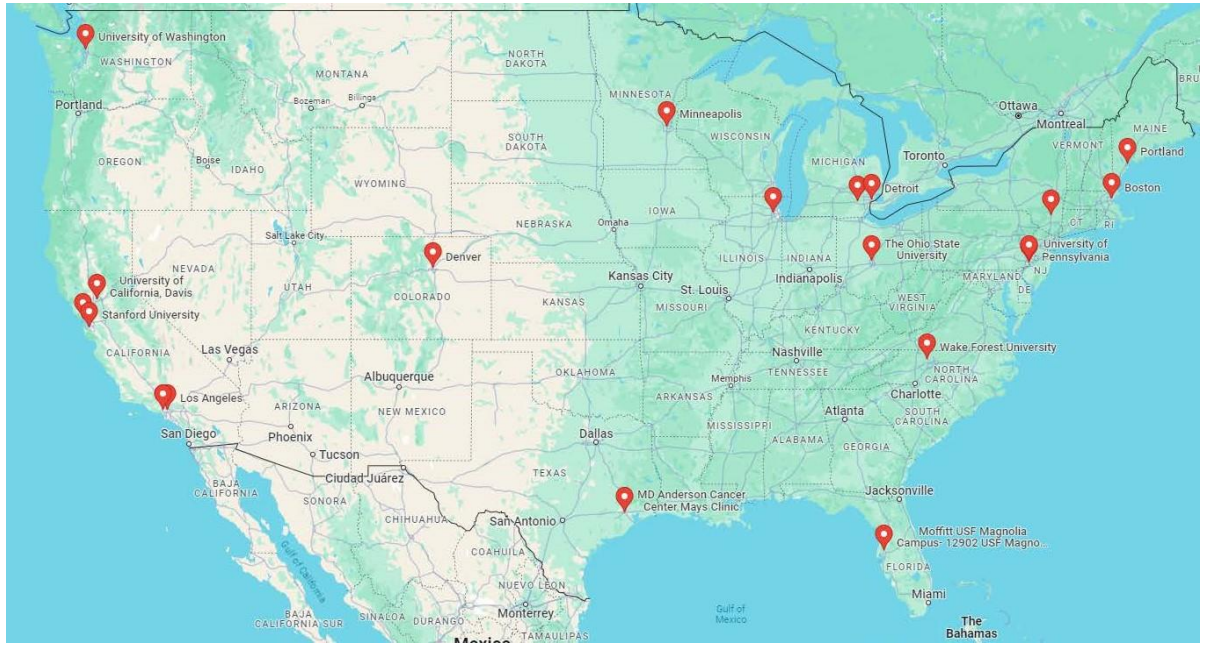
National COVID Cohort Collaborative

NIH National Center for Advancing Translational Sciences

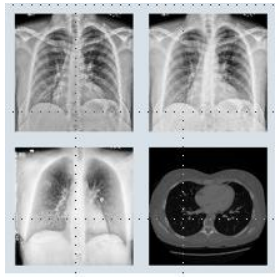
AI Ready Datasets for Medical Imaging AI Applications

Medical Imaging and Data Resource Center (MIDRC)

Information dense medical imaging data has many applications in AI algorithm development



* Map of MIDRC Investigators
A collaboration of ~20 institutions &
> 100 investigators from academia, community practices, FDA, and others



MIDRC BY THE NUMBERS

309,270 Imaging Studies Ingested	**176,961** Imaging Studies released to the Public	**132,309** Imaging Studies undergoing quality & harmonization
254 Total Data Downloads this month	**73,695** Cases	**14.39TB** Total size Published
58 Publications	**140+** Presentations	**31** Algorithms
847 Registered Users	**100+** Investigators	**632** Collaborating Institutions

https://www.midrc.org/

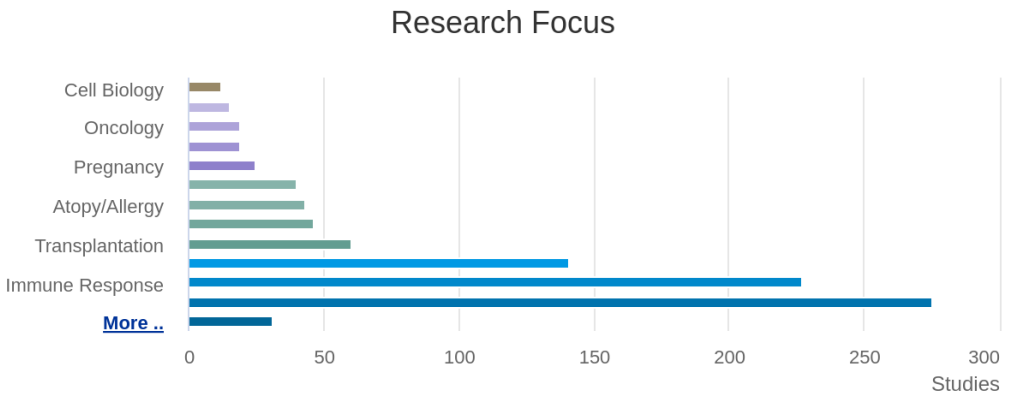
MIDRC MEDICAL IMAGING AND DATA RESOURCE CENTER | NIH National Institute of Biomedical Imaging and Bioengineering

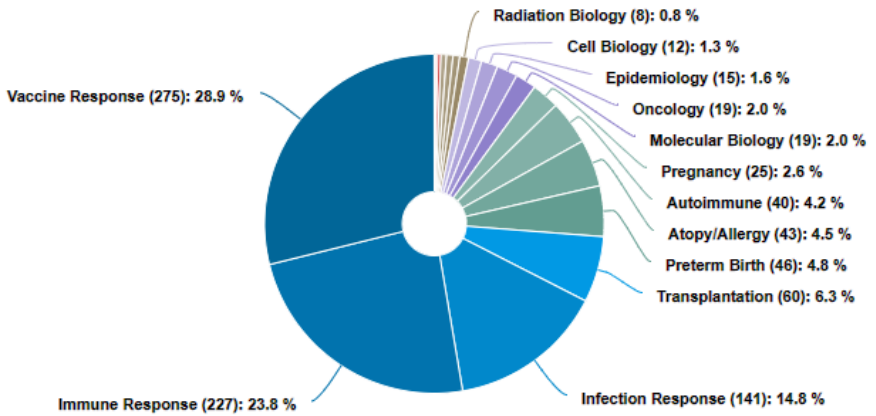
AI Ready Datasets for Immunology Research

ImmPort

Immunology data supports AI development and data reuse in a broad range of applications across test and study types

Studies	Subjects	Diseases
952	101125	160
Experiments	**Total Results**	**Lab Tests**
3669	7037834	1286834





https://immport.org/shared/home

ImmPort Bioinformatics For The Future of Immunology

NIH National Institute of Allergy and Infectious Diseases

AI Ready Datasets for Social Determinants of Health (SDOH)
ScHARe Health Equity Action Network (HEAN)

Social Determinants of Health brings the lived experience to AI algorithms and meets communities where they are

- ScHARe Cloud Platform host over 245 national federated data sets focused on population science, social determinants of health (SDoH), environmental and behavioral data
- ScHARe data repository will be available in Sept 2024 to host NIH funded project's data targeting social science and behavioral research, especially in areas of health disparities, healthcare delivery and health outcomes data
- HEAN (Health Equity Action Network)
  - Focus on chronic disease and relationship of the SDoH - 7 of 29 initial R01-level projects have transferred data to the RCC for a total of 639 records
  - Aligned data with ScHARe CDEs to enhance data integration and interoperability

https://www.nimhd.nih.gov/resources/schare/

NIH National Institute on Minority Health and Health Disparities

AI at NIH

- AI and machine learning methods are not new to NIH
- We lack data resources at a scale necessary to optimally use AI/ML methods to improve health
  - Data relevant to decision making for individual patients, in real time
  - Data to drive innovation in technology development, new therapeutics and prevention methods, and health care delivery
  - Data to eliminate disparities: rural, elderly/adolescents, designated populations with health disparities
- We must respectfully engage people to earn trust
- Diversity is critical to avoid harm to some populations
- Current needs:
  - Dramatic increase in data collection from the clinical care environment, including all populations
  - NIH resource to facilitate optimal and especially ethical use of AI for health

Charge to the AI Working Group

The ACD AI WG is charged with articulating a strategic and integrated vision for biomedical research opportunities that would benefit from developing and application of novel AI methods. In considering this charge, the AI WG's recommendations should address the following:

- Assess progress to date and develop a framework to support strategic priorities and biomedical research opportunities in AI, particularly involving the development and application of novel methodologies (i.e. foundational models, multimodal generative AI, Edge AI, etc) for knowledge discovery and human health. This should include the necessary data and computing resources that will be required for using and scaling AI in biomedicine, allowing for interdisciplinary collaboration across fields.

- With respect to these priorities, define the potential privacy, security, ethical, policy, and cost challenges that NIH should consider in supporting and deploying AI to maximally benefit the biomedical enterprise. Consider potential approaches for mitigating these challenges, including new areas of science that could be developed.

- Recommend strategies for ensuring equitable benefits result from these strategic priorities, including equitable benefits in inclusive algorithmic development, the application of transparent and explainable AI, and collaborative training programs to enable a health learning environment using AI and AI-enabled tools.