



Tomorrow's Doctors, Tomorrow's Cures®

Leveraging AI for Research and Innovation

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August 27, 2024



Association of
American Medical Colleges



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DISCLOSURES:

Advisory Board for GigXR, Inc.
Advisory Board for WideAwake VR, Inc.

Advances in AI are currently being used all areas of business, education, and research, and the medical field is a major opportunity!

Unique challenges we face in Medicine with AI:

Health Data Protection

Bad Models/Incomplete Data/Predictions → Poorer Outcomes

Defining the right use-cases for AI tools for:

Education/Training/Research/Innovation

How do we as a medical community help lead this charge instead of having it be given to us and then try to find a purpose?

How does AI address bias in the literature?

How is adoption made scalable?



Will AI Soon Replace Physicians and Other Health Care Workers?



No, but what we are seeing is that physicians and health workers who know how to use AI tools effectively are starting to surpass those who do not.

What are some things medical schools and deans are thinking about when it comes to AI?

What are the *RIGHT* AI Tools to embrace now?

How do we use these tools to better prepare the next generation of physicians?

How will these AI tools be integrated into areas like admissions, research, innovation, curriculum, clinical environment for training of skills and evaluation of performance?

How do we prepare faculty to use these new AI tools in education, research, and in the clinic?

How will our IT infrastructure handle these tools safely?
students/faculty/education/research/clinical enterprise

Some Examples of AI Applications in Research, Innovation, and the Clinic

- **AI tools in Medical Imaging and XR Applications**
- **AI tools in Research Database Investigations:**
 - (1) Data Warehouses**
 - (2) Digital Twin Modeling**
- **Applications in the Clinic :**
 - (1) Documentation**
 - (2) Care Delivery/Risk Assessment Strategies**
 - (3) Precision Interventions/Skills Development**

Expanding Extended Reality With AI Applications

Health-y-Equality

Awareness of one's own bias and strategies to manage it



Mixed-reality virtual character "coach" who guides recognition of implicit bias, reflection, and mindfulness activities

Learning and practicing culturally-centered communication skills



Chatbot-based virtual patient, chatbot with whom learners can practice skills

ILLIXR: Illinois Extended Reality Project



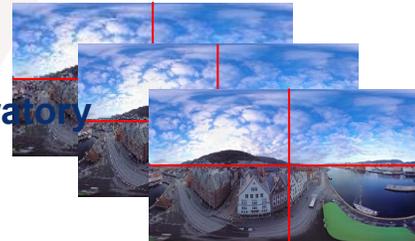
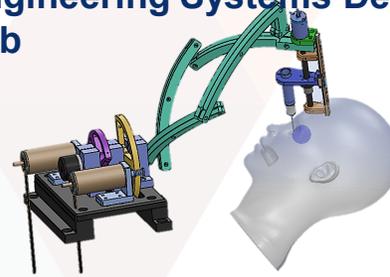
Advanced Imaging and Modeling Lab (AIM) – Jump Simulation

QoE-Aware 360 Video – XR Coordinated Science Laboratory

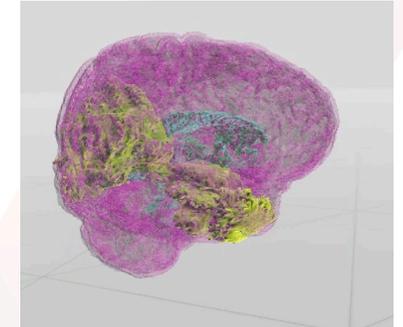
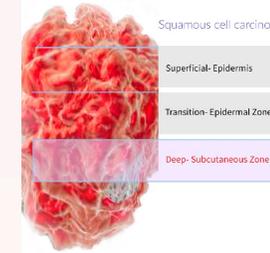
XR in Robotic Medicine



Design Automation / Optimization Engineering Systems Design Lab



Multi-Modal Skin Lesion Identification



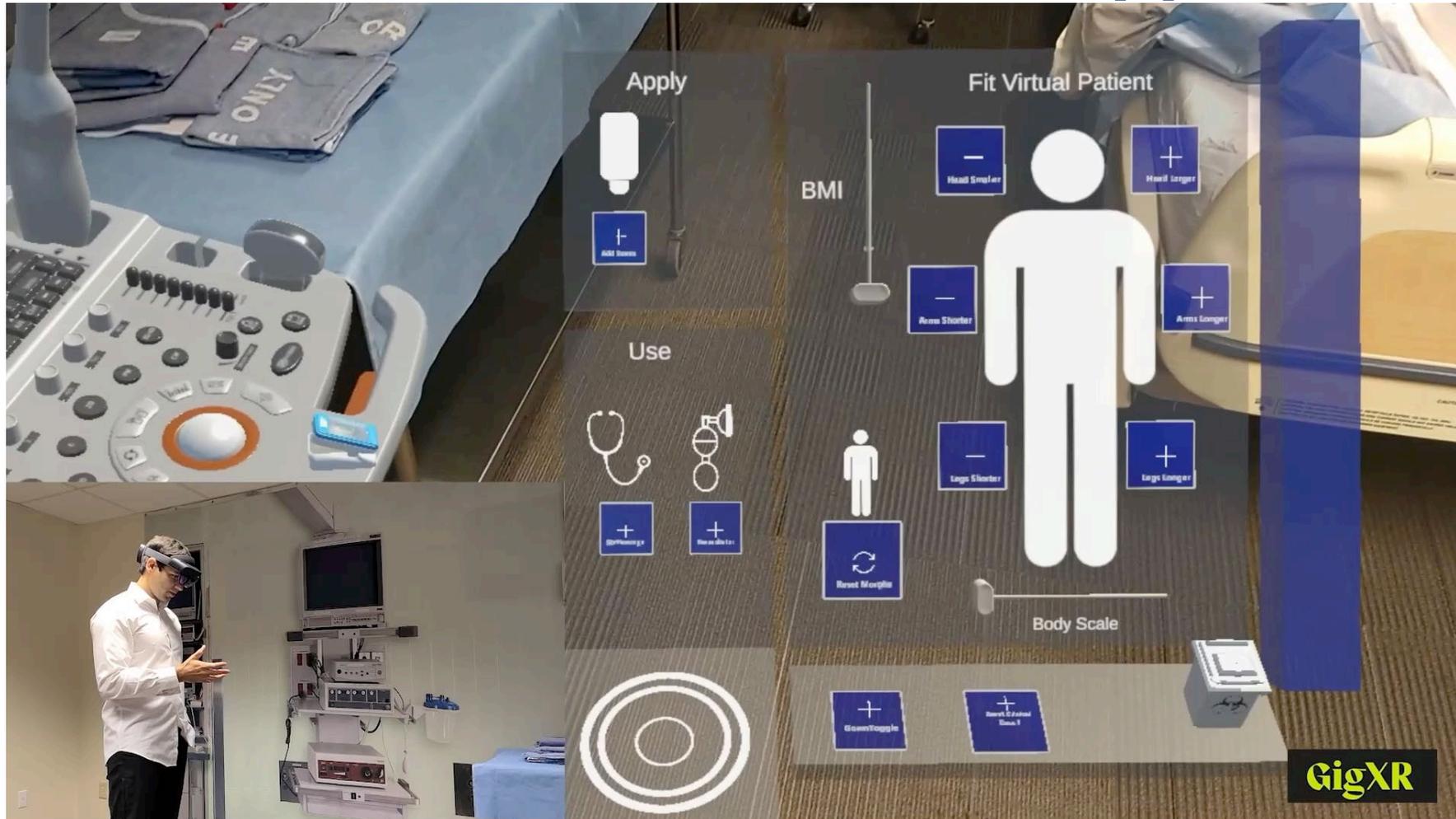
Segmentation from Clinical to VR/XR

AR Medical



XR Visualization, Biomedical, and Clinical Software

RE-Imagining the Future of Medical Simulation and Standardized Pts with AI tools applied to XR



Developing a shared de-identified research data warehouse for AI applications

Define data governance and privacy policies.

Develop infrastructure for data sharing and access control.

Encourage partnering members to contribute data.

Developing a shared de-identified research database

PhysioNet <https://physionet.org/>

Datasets include various types of physiological signals and images.

Different levels of access: open, restricted, credentialed, contributor review.

Software and tools.

Annual challenges (2000-present).

Medical AI Datasets and Data Sharing Platform

The screenshot shows the top navigation bar of the AI Data Sharing platform. On the left is the logo, a stylized 'A' with radiating lines, followed by the text 'AI Data Sharing'. To the right are navigation links: 'Datasets', 'Organizations', 'Groups', 'Docs', and 'News'. A search bar with the text 'Search' and a magnifying glass icon is positioned on the far right. Below the navigation bar is a large dark blue banner. In the center of the banner is the text 'Taiwan Medical AI and Data Portal' in a large, white, sans-serif font. Below this title is the tagline 'FAIR. Safety. Personal Data Protection. Engagement.' in a smaller white font. A white search bar is centered on the banner, containing the placeholder text 'e.g. brain image' and a magnifying glass icon. At the bottom of the banner, the text 'Your feedback is important. Send comments using [contact page](#).' is displayed in white.



Organizations

Taipei Veterans Gen... **14**

National Yang Ming ... **3**

Groups

Medical Image **5**

Brain Image **4**

Tags

brain **3**

brain image **3**

CT **3**

MRI **2**

bipolar disorder **1**

Dementia **1**

depression **1**

Eye **1**

FDG-PET **1**

hemorrhage **1**



17 datasets found

Order by:

Relevance



Taiwan Aging and Mental Illness Cohort

Overview The Taiwan Aging and Mental Illness Cohort (TAMI) presents a detailed and extensive Magnetic Resonance Imaging (MRI) study dataset, spearheaded by Professor Albert C....

PDF **XLSX** **mgz**

Dementia Molecular Imaging Clinical Database

Overview This dataset is at the core of a dementia research project focused on the exploration and diagnosis of dementia using advanced imaging technologies. It integrates data...

PDF **NIFTI**

Brain FDG-PET/MR Image Database

Fluorodeoxyglucose Positron Emission Tomography (FDG-PET) is currently one of the powerful tools for the clinical diagnosis of dementia (AD). Meanwhile, MR imaging, being...

PDF **ZIP**

Brain CT Hemorrhage Public Dataset

Overview This dataset, featured in the RSNA Intracranial Hemorrhage Detection challenge on Kaggle, offers a rich collection of brain CT images. It is meticulously categorized...

CSV **DICOM**



Taiwan Aging and Mental Illness Cohort

Followers

0

Views

236

Dataset Application

Apply

Organization



National Yang Ming Chiao Tung University

National Yang Ming Chiao Tung University (NYCU; Chinese: 國立陽明交通大學) is a public research university in Taipei and Hsinchu, Taiwan. It was created in 2021 through the merger of...

Dataset

Groups

Activity Stream

Taiwan Aging and Mental Illness Cohort

Overview

The Taiwan Aging and Mental Illness Cohort (TAMI) presents a detailed and extensive Magnetic Resonance Imaging (MRI) study dataset, spearheaded by Professor Albert C. Yang. This project, initiated in 2012, is a collaboration between Taipei Veterans General Hospital and National Yang Ming Chiao Tung University, Yang Ming campus. It focuses on providing valuable insights into various mental illnesses and their impact on brain structure and function.

Dataset Composition

Participants: The study includes 1,265 participants, encompassing 587 healthy individuals and 678 patients diagnosed with mental illnesses such as schizophrenia, bipolar disorder, and depression.

Imaging Data: Participants have undergone comprehensive brain imaging scans at the MRI facility located at the Yang Ming campus.

Types of MRI Data:

Structural MRI: Includes data from Structural and Diffusion Tensor Imaging.

Functional MRI: Provides data on brain activity and function.

Dataset Scope and Objectives

To understand the neurological impacts of aging and mental illnesses.

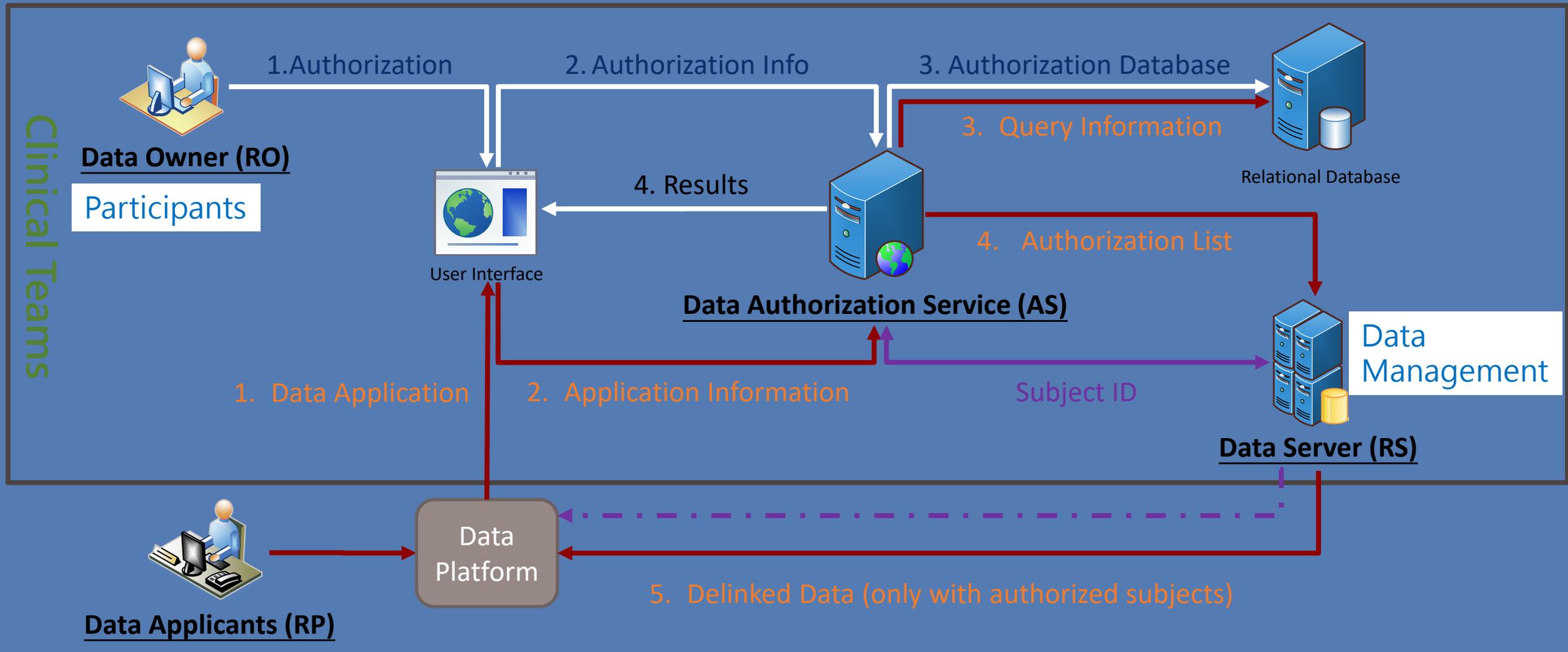
To explore the structural and functional brain changes associated with schizophrenia, bipolar disorder, and depression.

Additional Data:

Along with the MRI scans, the dataset also contains:

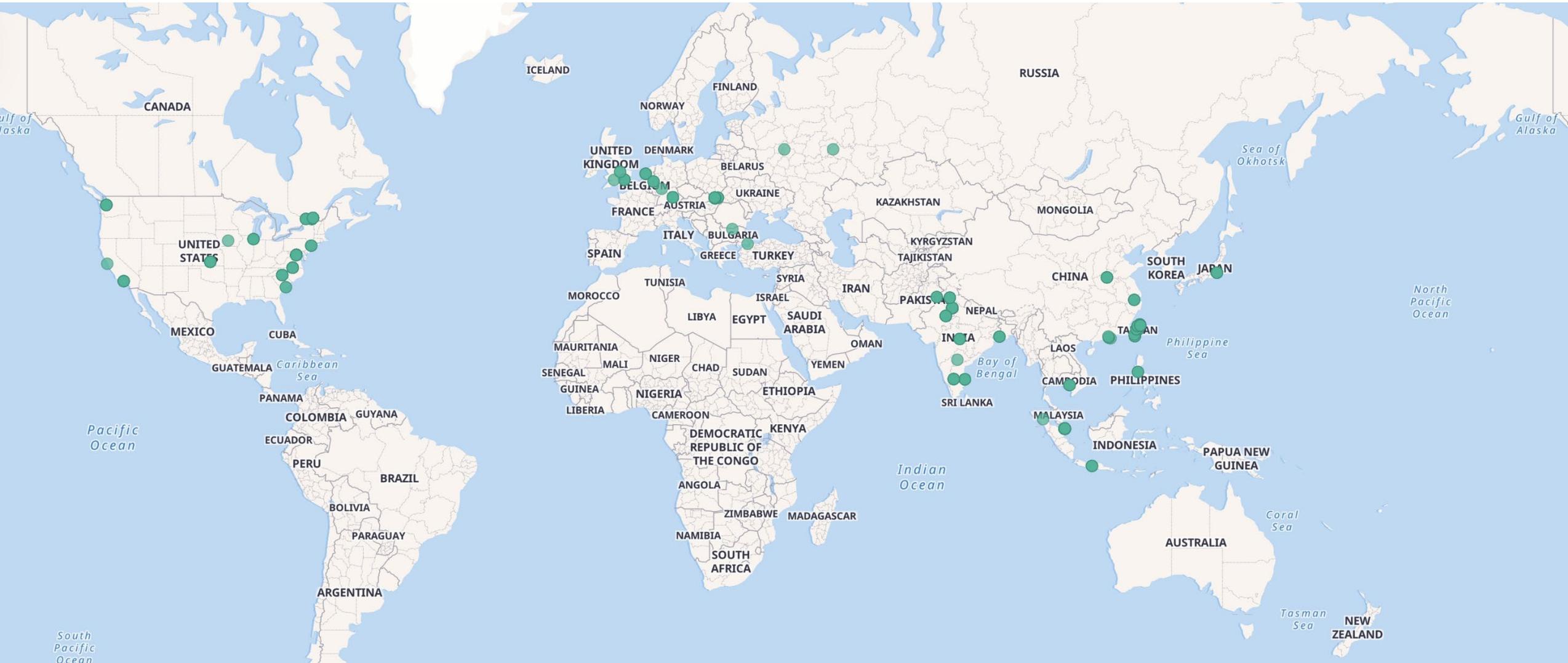
Demographic information of participants. Detailed clinical data for each participant.

Dynamical Consent System



Data User

Worldwide Access



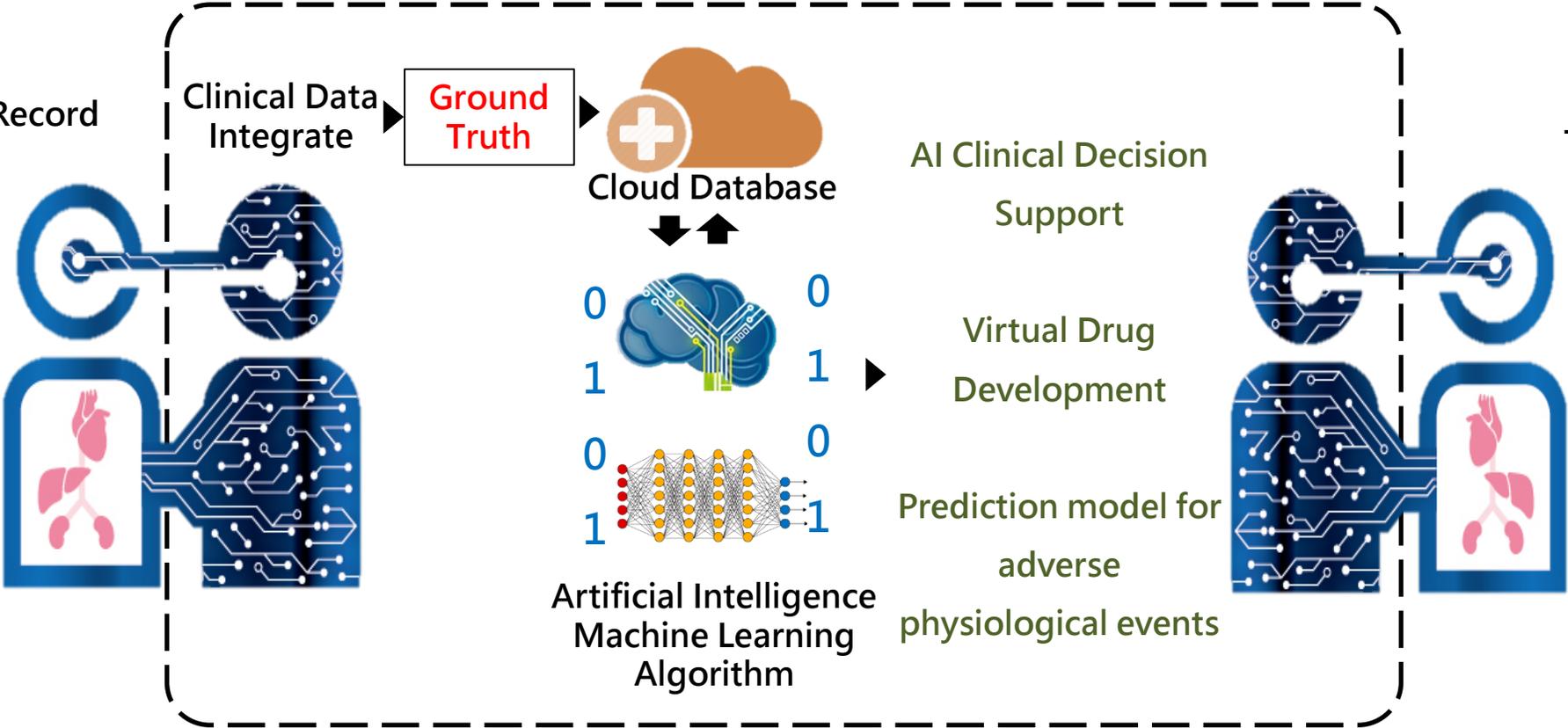
Human Digital Twin as a Research Data Warehouse

Real World

Digital Twin

Real World

Electronic Medical Record
Omics Data
Image Data
Laboratory Data
Sensing/IoT Data



Therapeutic strategy

Validation
for Novel treatment

Alert

Clinical applications of AI tools to improve efficiencies for health care worker documentation

EMRs like EPIC and other vendors now have several AI-tools (over 100 being launched in the next year) that use generative AI to :

- (1) Help physicians revise message responses, letters and instructions into plain language that patients can understand.
- (2) Use AI to automatically queue up orders for prescriptions and labs
- (3) Summarize verbal conversations between a health care provider and patient into an encounter note with associated billing codes
- (4) Eliminate time consuming tasks like drafting insurance denial appeal letters and reviewing prior authorization requirements

Clinical applications of AI tools to improve efficiencies for health care worker documentation

Additional generative AI tools for medical documentation/diagnosis:

- (5) AI will be able to pull in the results, medications and other details that a practitioner might need when responding to a patient's message
- (6) AI is able to calculate wound measurements from photo images
- (7) Research data-mining AI tools for the Cosmos Database
- (8) Prometheus generative AI tool (Microsoft)



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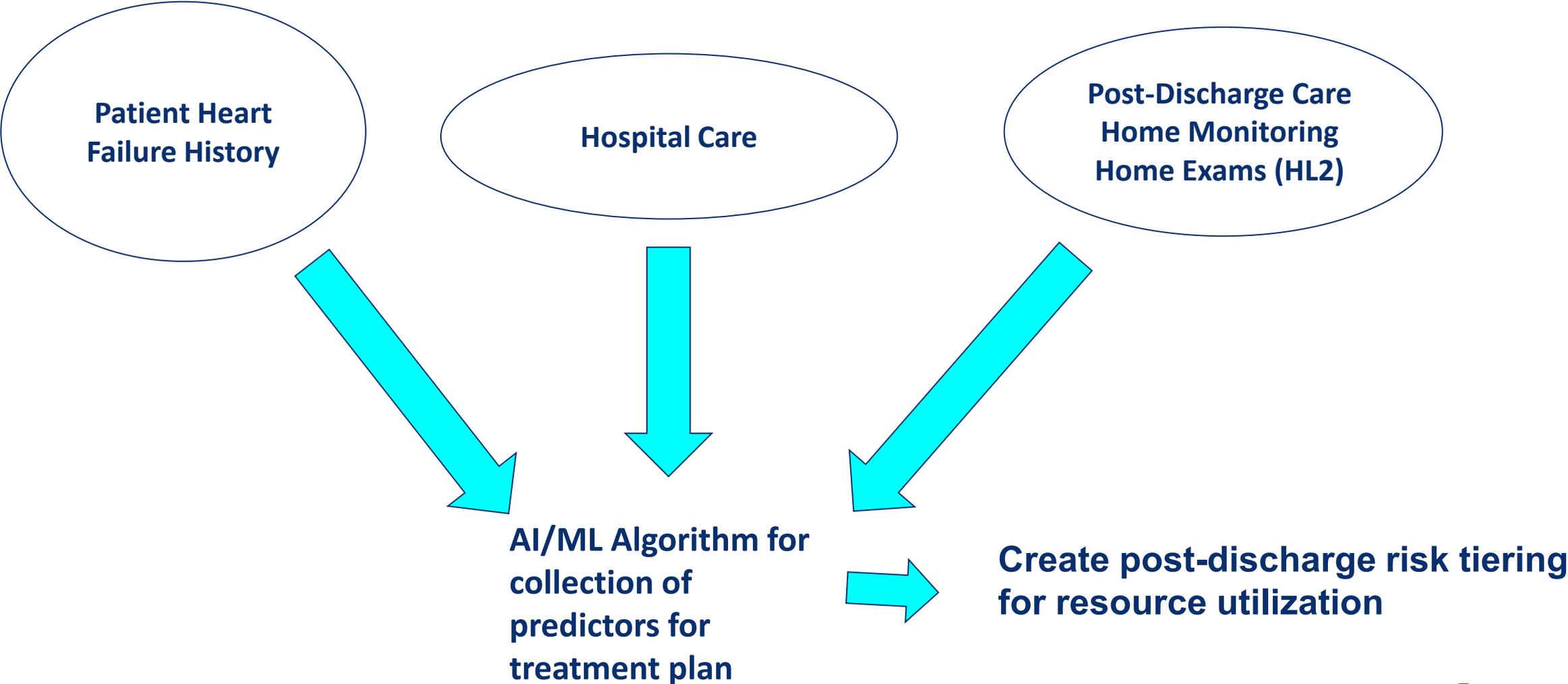
Lead

Using Cloud-Based Data and AI to Advance Medical Decision-Making in Rural Underserved Populations



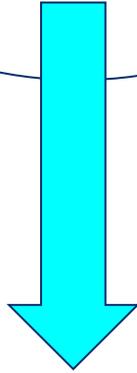
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Data Collection



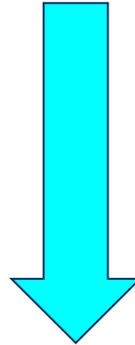
Implementation Post-Discharge Resources by Risk stratification

High risk for Re-admission



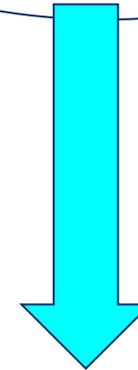
**TID data acquisition with wearables
Phone Bluetooth, HH visit 2x/week
With mixed reality visit with CHF
Specialist weekly or 2x/week**

Moderate risk for Re-admission



**Daily data acquisition with wearables
phone Bluetooth, HH visit weekly with mixed
reality visit with CHF specialist**

Low risk for Re-admission



**3x/wk data acquisition with wearables
Phone Bluetooth, HH biweekly**



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AI Tools for Procedural Applications and Precisional Skills



Association of
American Medical Colleges



New Approaches to AR Imaging Using 3D Holographic Image Reconstruction with Automated Segmentation



Courtesy of ApoQlar

Carle Illinois College of Medicine makes history with FDA-cleared hologram tech for patient treatment



New Partnership with Mediview XR:
First in the World Education,
Research,
and Clinical partner



Carle Illinois College of Medicine makes history with FDA-cleared hologram tech for patient treatment

The Carle Illinois College of Medicine at the University of Illinois Urbana-Champaign is the first in the world to use hologram technology to treat patients. It's called MediView XR and it was just cleared by the Food and Drug Administration.



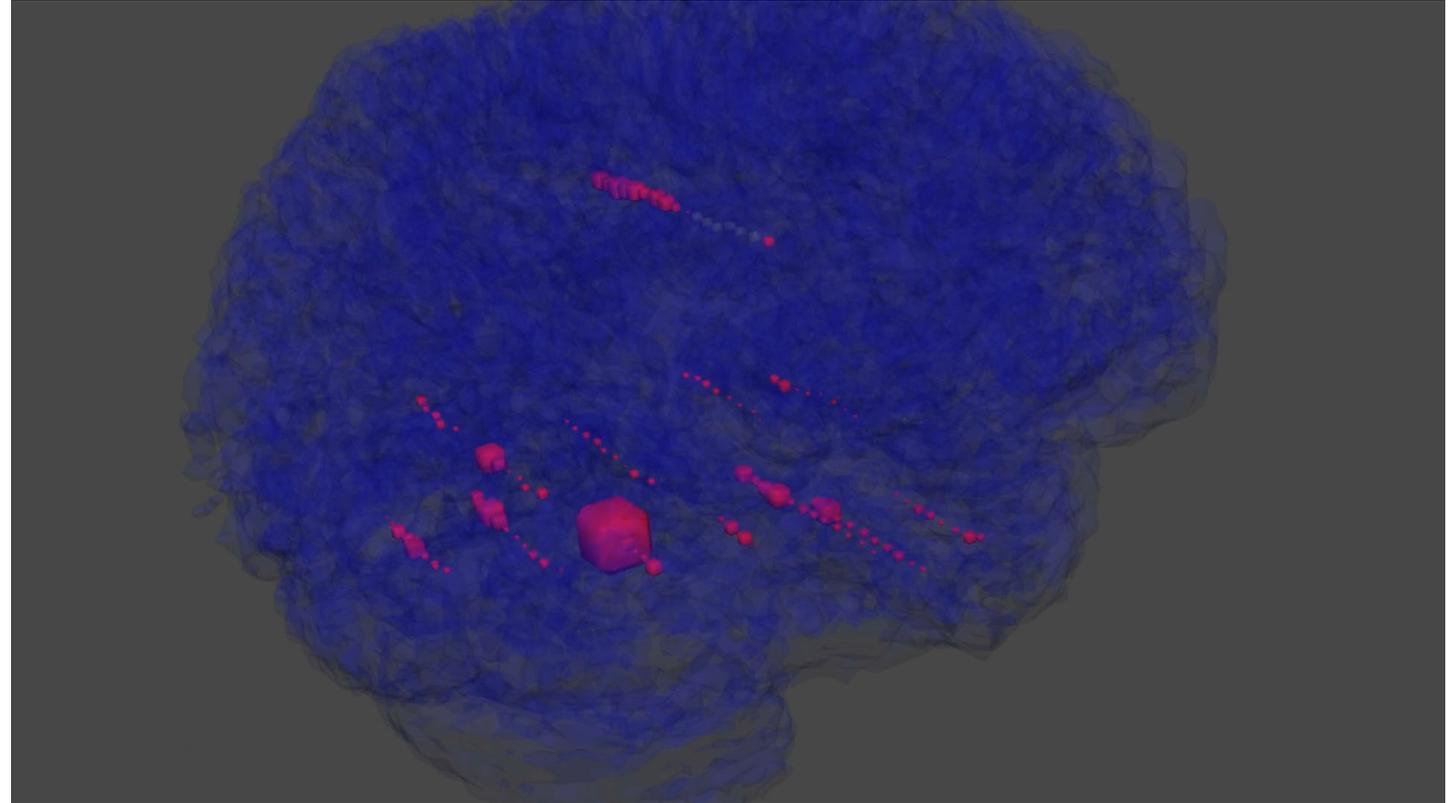
MediView
XR90

Time Sequential 3D visualization of Seizure

Problem : National shortage of epileptologists (~10 years of training). They must review the multi-modal data separately and convey the location within the brain to the neurosurgeon for excision. This process takes a minimum of 1-2 hours.

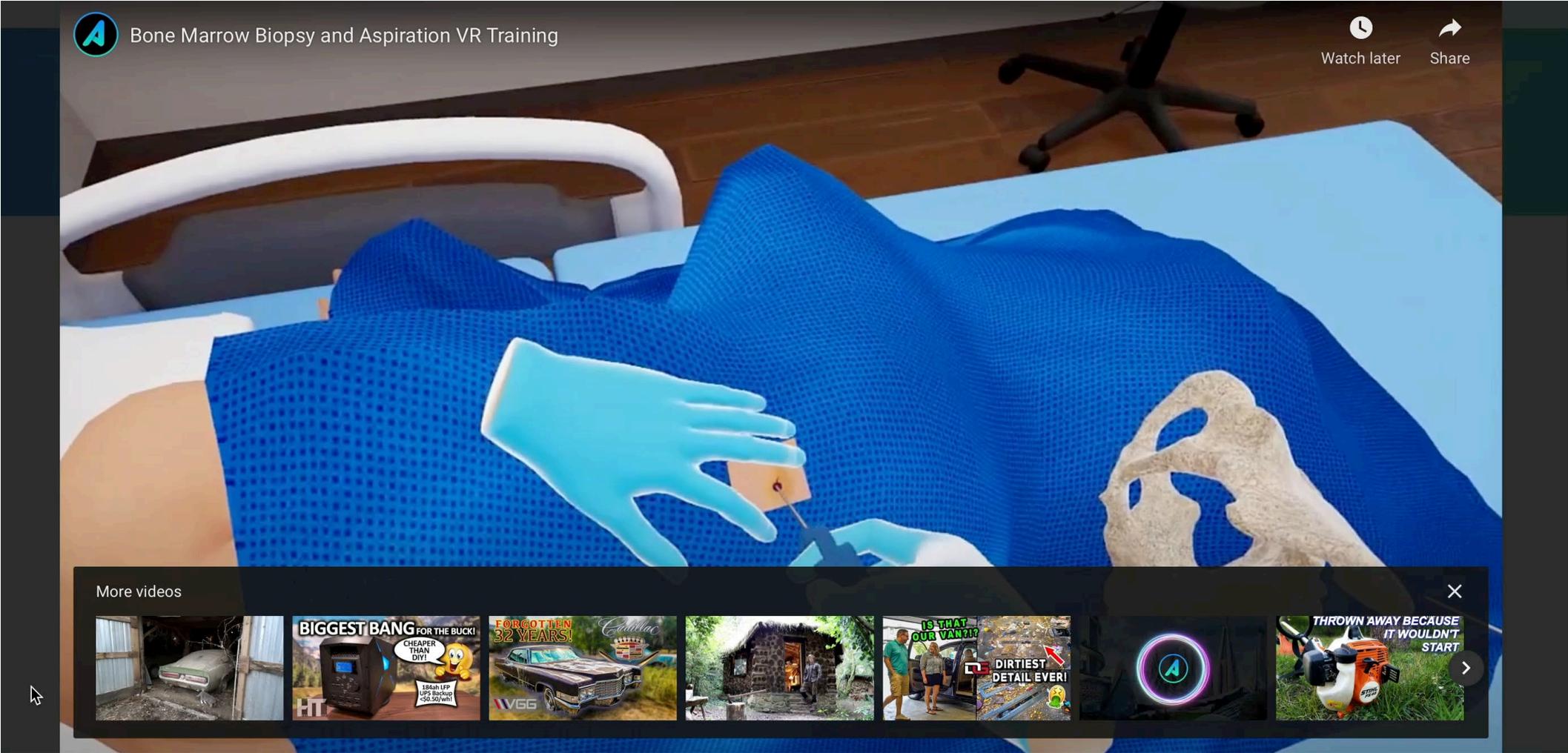
Innovation: Nearly fully automated conversion of multi-modal clinical data (MRI, CT with electrodes, and SEEG waveforms) into an animated 4D model viewable in VR with AI identifying foci of seizure activity for surgical resection.

Impact: Early results are confirming location within minutes of review in VR. This technology can increase access to more patients and improve spatial seizure loci communication between epileptologist and surgeon.



Details of media: this is a 20 second video, a seizure begins at 10 seconds and propagates through the brain as detected by adjacent electrodes (courtesy of Dr. Matthew Bramlet, UIUC).

AI Applications in Dx & Procedural Skills Simulation



AI Applications in Procedural Skills Competency Assessment



Take-home points on AI applications in medical schools and the healthcare environment

What are the *RIGHT* AI Tools to embrace now?

How do we use these tools to better prepare the next generation of physicians?

How will these AI tools be integrated into areas like admissions, research, innovation, curriculum, clinical environment for training of skills and evaluation of performance?

How do we prepare faculty to use these new AI tools in education, research, and in the clinic?

How will our IT infrastructure handle these tools safely?
students/faculty/education/research/clinical enterprise

The best way to predict the future is to innovate it together!

THANK YOU !

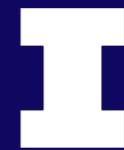
X: @MarkCohenFACS

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Carle Illinois
COLLEGE OF MEDICINE



UNIVERSITY OF
ILLINOIS
URBANA-CHAMPAIGN



ASSOCIATION OF AMERICAN MEDICAL COLLEGES (AAMC)
Session: Leveraging AI for Research & Innovation

Pixels to Practice: Imaging's Role in Medical AI

Florence (Flo) X. Doo, MD MA (she/hers)
 Director of Innovation, University of Maryland Medical Intelligent Imaging (UM2ii) Center
 Assistant Professor, Dept of Diagnostic Radiology & Nuclear Medicine, University of Maryland Baltimore
 Faculty, University of Maryland-Institute for Health Computing (UM-IHC)

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1

Disclosures

- **University of Maryland Medical Intelligent Imaging Center (UM2ii)**
 Cloud credits from Amazon Web Services, Google Cloud, and Microsoft Azure/OpenAI.
- **Association of Academic Radiology Clinical Effectiveness in Radiology Research Academic Fund (AAR CERRAF)**
- **The Johns Hopkins Mid-Atlantic Center for Cardiometabolic Health Equity (MACCHE), supported by the National Institute On Minority Health And Health Disparities of the National Institutes of Health (NIH NMHHD) under Award Number #P50MD017348. The content is solely the responsibility of the authors and does not necessarily represent the official views of MACCHE or the National Institutes of Health.**
- **UMMC Innovation Fund**
- **Previously: AAMC Organization of Student Representatives (OSR) American College of Radiology (ACR) Informatics Fellow**

I'm a physician.
 I can't predict the future.
 This is (probably) already outdated by the time I give this talk.

***All discussed items are for educational purposes only, no specific product is endorsed.**

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2



Question for audience:

→ Is **imaging** part of your medical AI research / strategy?

image credit: Dr. Glaucomflecken (@DGlaucmflecken), "Faculty Meeting – Radiology Orders"
<https://www.youtube.com/watch?v=cMyV6PsVsxQ>

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3

Faculty UNIVERSITY OF MARYLAND SCHOOL OF MEDICINE umii UNIVERSITY OF MARYLAND Medical Intelligent Imaging (UM2ii) Center INSTITUTE FOR HEALTH COMPUTING MPOWERING THE STATE

ABOUT ME

- **Dual Fellowships:** (Body Imaging) Stanford University, Palo Alto, CA (Informatics) American College of Radiology Mt. Sinai West, Manhattan, New York City, NY
- **Radiology Residency:** Mt. Sinai West, Manhattan, New York City, NY
- **Prelim-Medicine:** Yale-Waterbury Hospital, Waterbury, CT
- **Medical School (MD):** Oakland University William Beaumont SOM, Rochester, MI ***OSR :**
- **Graduate (MA):** Boston University, Boston, MA
- **Undergraduate (BA):** Wellesley College, Wellesley, MA
- **High School:** Huntington Beach High School, Huntington Beach, CA



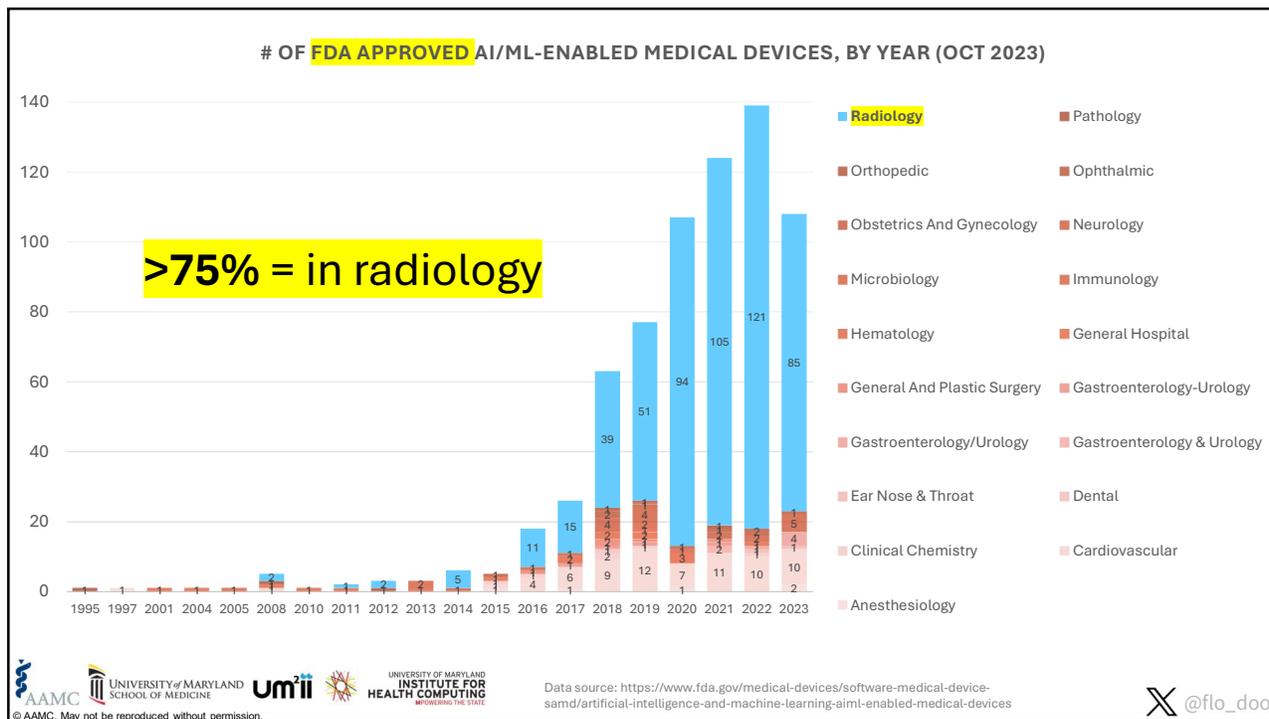
“digital native” generation



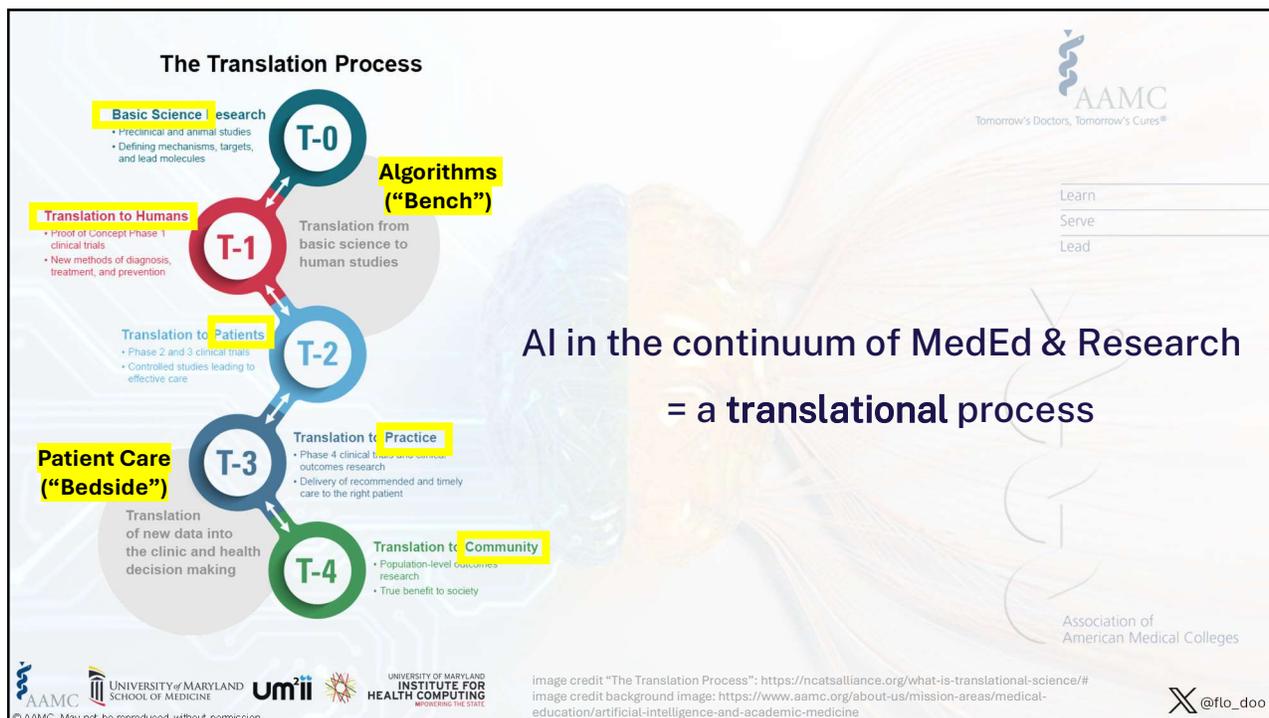
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4



5

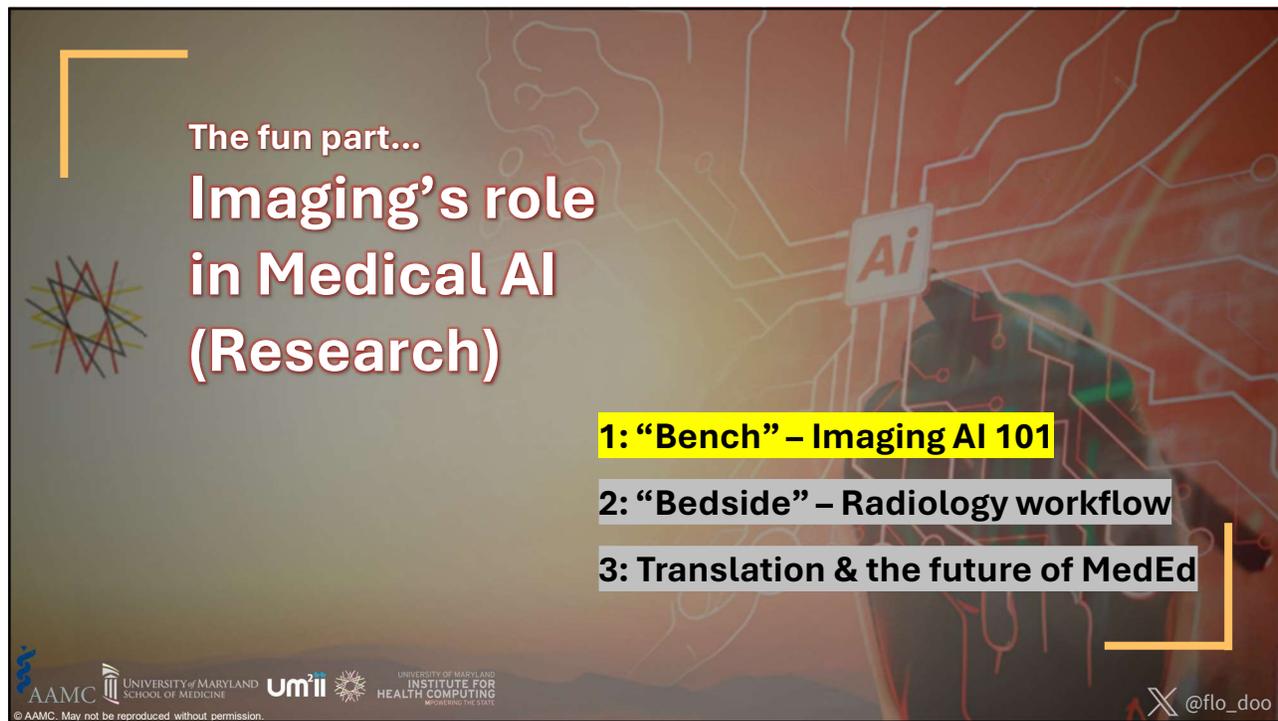


6

The fun part...

Imaging's role in Medical AI (Research)

- 1: "Bench" – Imaging AI 101
- 2: "Bedside" – Radiology workflow
- 3: Translation & the future of MedEd

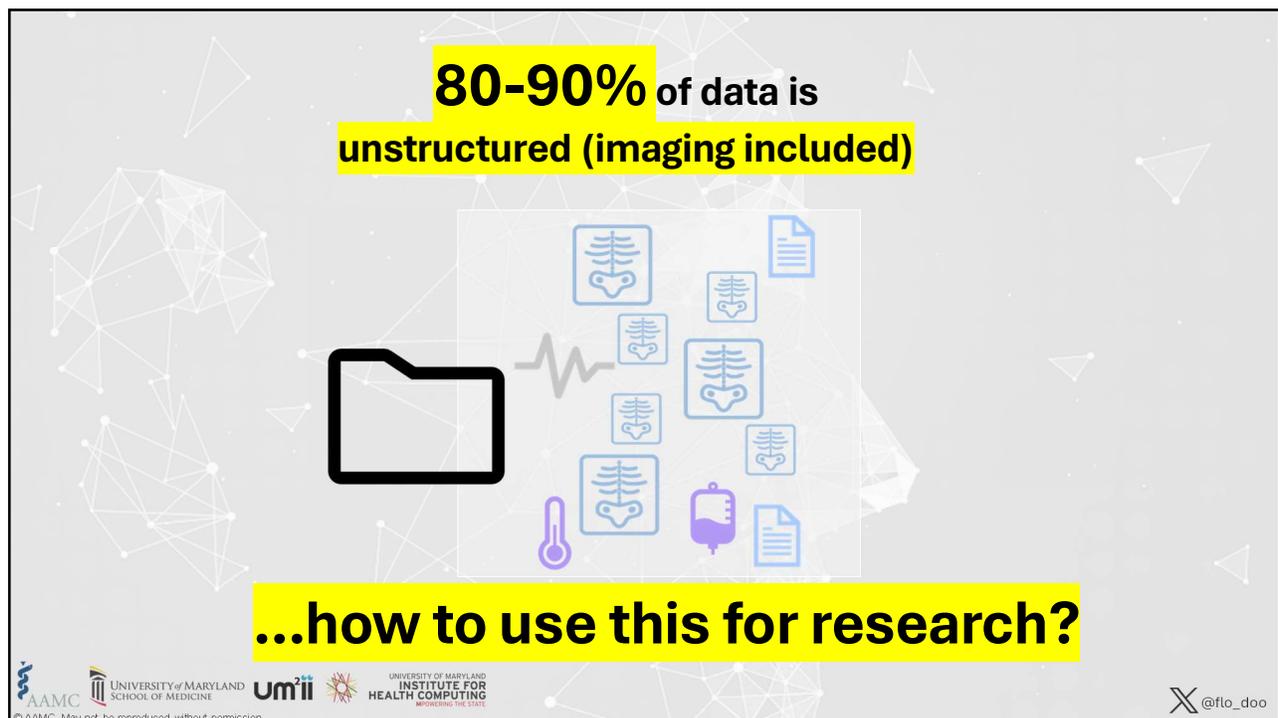


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7

80-90% of data is unstructured (imaging included)



...how to use this for research?

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8

AI 101: Image data

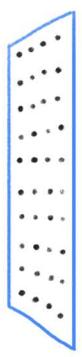
CAT



(Labeled
PHOTOS)

DOG








OUTPUT






<https://raihanmj.medium.com/deep-learning-simple-image-classification-using-convolutional-neural-network-dog-and-cat-8c99aef29e8>

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9

AI 101: Image data



	COMPUTED TOMOGRAPHY	MAGNETIC RESONANCE	POSITRON EMISSION	RADIOGRAPHY	ANGIOGRAPHY	ULTRASOUND	FLUOROSCOPY	
ABDOMINAL IMAGING								FINDINGS
BREAST IMAGING								FINDINGS
CARDIAC IMAGING								FINDINGS
EMERGENCY IMAGING								FINDINGS
MUSCULOSKELETAL								FINDINGS
NEURORADIOLOGY								FINDINGS
NUCLEAR MEDICINE								FINDINGS
PEDIATRIC IMAGING								FINDINGS
THORACIC IMAGING								FINDINGS
INTERVENTIONAL								FINDINGS
	ANATOMY	ANATOMY	ANATOMY	ANATOMY	ANATOMY	ANATOMY	ANATOMY	






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10



CURRENT

Human (needs programming skills)

Language = Code: Programming applications & AI

Real-life deployment/action

a Clinical radiology workflow

Acquisition → Preprocessing → Images → Image-based tasks → Reporting → Integrated diagnostics

b Image-based tasks

- Detection:** Detecting potential abnormalities within images on the basis of changes in intensities or the appearance of unusual patterns, with an emphasis on reducing false positives.
- Characterization:**
 - Segmentation:** Defining the boundary extent of an abnormality for subsequent diagnosis and treatment planning.
 - Diagnosis:** Evaluating and classifying abnormalities such as benign vs malignant.
 - Staging:** Classifying abnormalities into multiple predefined categories such as the TNM classification of malignant tumours.
- Monitoring:**
 - Change analysis:** Tracking object characteristics across multiple temporal scans for diagnosis as well as evaluating treatment response.

Output: Single "tasks" (i.e. classification)

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(left) Doo FX, Cook TS, Siegel EL, Joshi A, Parekh V, Elahi A, Yi PH. Exploring the Clinical Translation of Generative Models Like ChatGPT: Promise and Pitfalls in Radiology, From Patients to Population Health. *J Am Coll Radiol*. 2023 Sep;20(9):877-885. doi: 10.1016/j.jacr.2023.07.007. Epub 2023 Jul 17. PMID: 37467871.
 (right) Hosny, A., Parmar, C., Quackenbush, J. et al. Artificial intelligence in radiology. *Nat Rev Cancer* 18, 500–510 (2018). <https://doi.org/10.1038/s41568-018-0016-5>

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11

Please tell me what is it in each cell in a tabular format aligned with this picture grid.

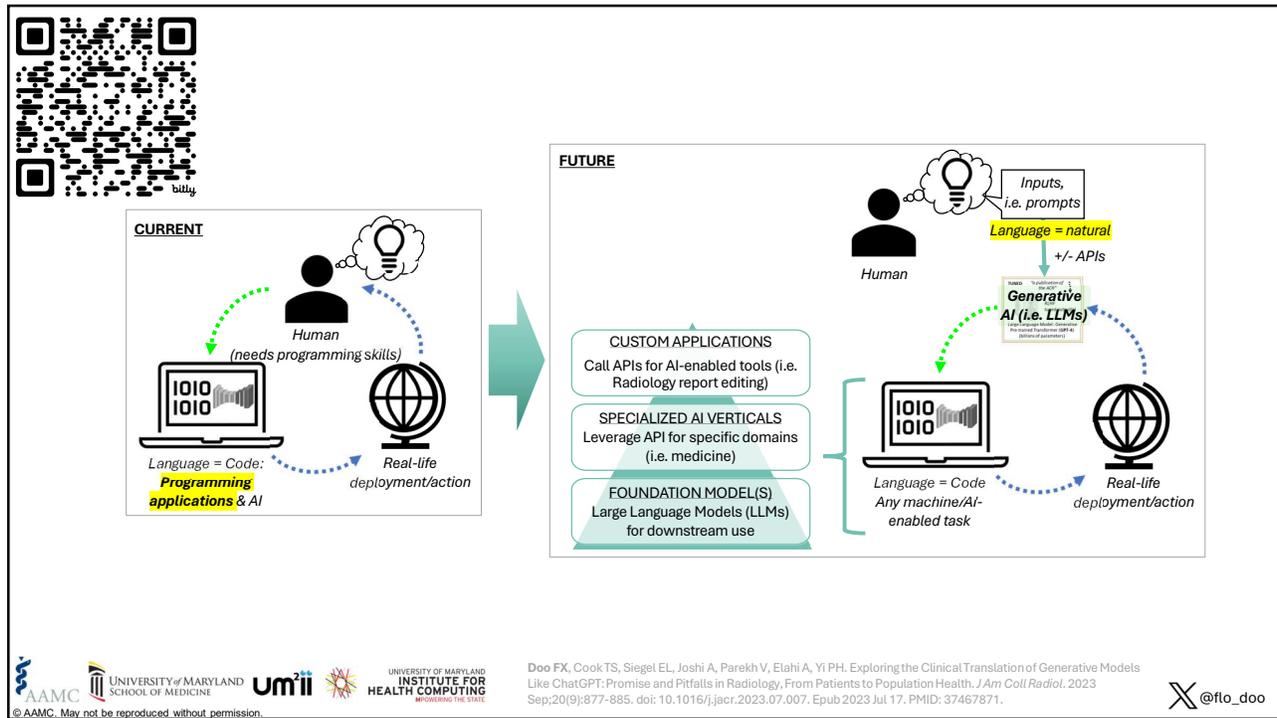
Certainly! Here's a breakdown of the content of each cell in the format of a table:

Row	Column 1	Column 2	Column 3	Column 4
1	Muffin with blueberries	Chihuahua (side profile)	Blueberry Muffin	Chihuahua (profile looking up)
2	Chihuahua (frontal face)	Cookie with chocolate chips	Chihuahua (face close-up)	Blueberry Muffin with sugar on top
3	Blueberry Muffin with a smiley face	Chihuahua (frontal face close-up)	Blueberry Muffin with blueberries on top	Chihuahua (slightly showing teeth)
4	Chihuahua (puppy face close-up)	Group of Cookies with chocolate chips	Group of Chihuahua puppies	Muffin with blueberries

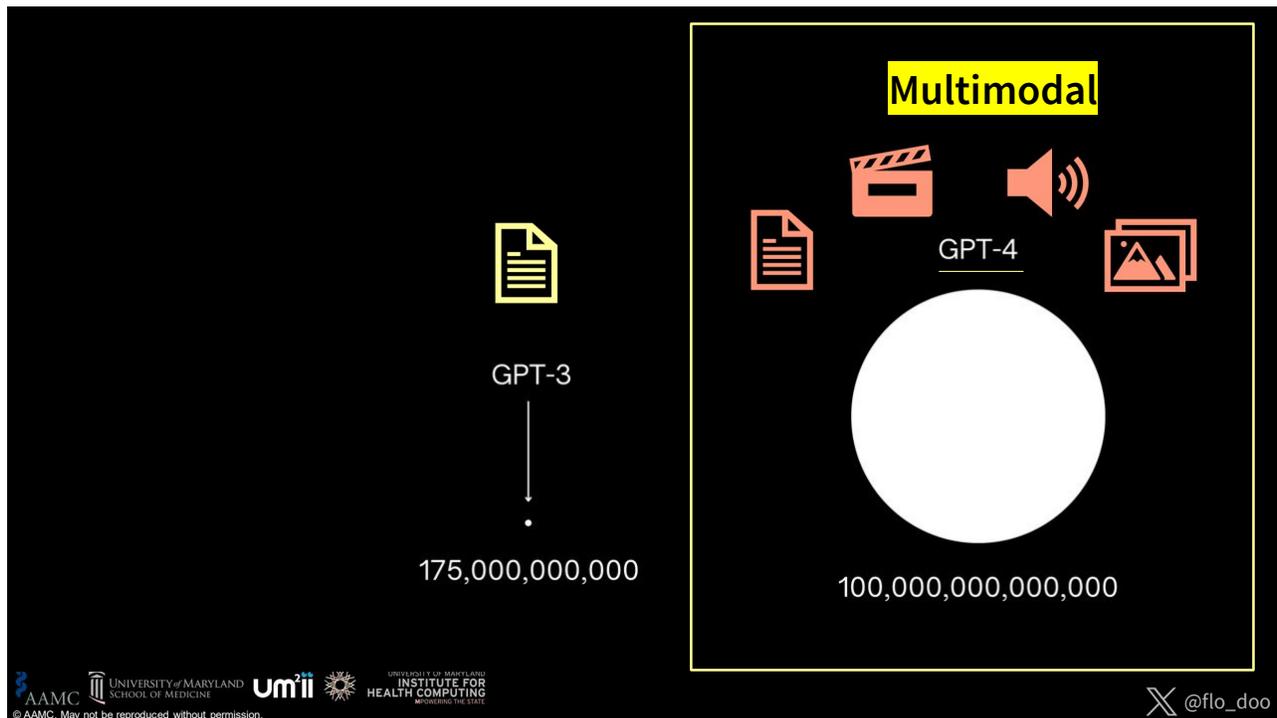
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12



13



14

Science Current Issue First release papers Archive About ▾ Submit manu

HOME > SCIENCE > VOL. 381, NO. 6663 > AS ARTIFICIAL INTELLIGENCE GOES MULTIMODAL, MEDICAL APPLICATIONS MULTIPLY

🔒 | EXPERT VOICES f t in r s e

As artificial intelligence goes multimodal, medical applications multiply

ERIC J. TOPOL [Authors Info & Affiliations](#)

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15

The future is multimodal

imaging is integral!

Data modalities **Opportunities**

- Omics
- Metabolites, immune status, biomarkers
- Microbiome
- EHR/scans
- Wearable biosensors
- Ambient sensors
- Environment
- Precision health **refine dx & tx**
- Digital clinical trials **"in silico"/virtual**
- Hospital-at-home **monitoring**
- Pandemic surveillance **early detection**
- Digital twins **individual care models**
- Virtual health coach **personal 24/7 assistance**

Acosta JN, Falcone GJ, Rajpurkar P, Topol EJ. Multimodal biomedical AI. Nat Med. 2022 Sep;28(9):1773-1784. doi: 10.1038/s41591-022-01981-2. Epub 2022 Sep 15. PMID: 36109635.

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16

The fun part...

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- 1: "Bench" – Imaging AI 101
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17

Radiologists

#MYRADGIRLFRIEND

NURSE CAN YOU JUST GET THE DOCTOR?

I AM YOUR DOCTOR. I'M A RADIOLOGIST.

NO, THE REAL DOCTOR.

What my family thinks I do

What other depts think I do

What I thought I'd do (in R1)

What I actually do

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18

Radiologists: Medicine's earliest (and best known) data scientists

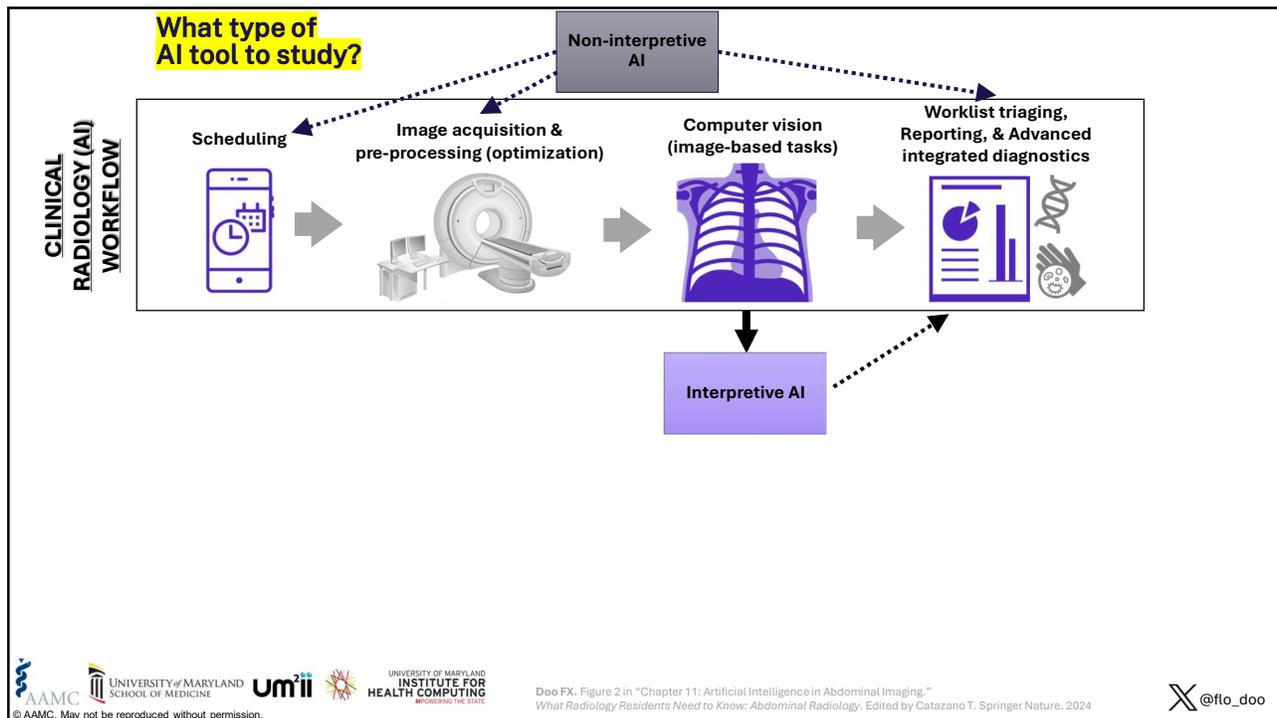
- X-Ray
- Contrast Agents
- Ultrasound
- Nuclear Medicine
- Computed Tomography (CT)
- Magnetic Resonance Imaging (MRI)
- Interventional Radiology (IR)
- Evidence-Based Clinical Guidelines
- Picture Archiving and Communications Systems (PACS)
- Computerized Voice Recognition and Transcription
- Electronic Health Records
- Value-Based Medicine
- **Artificial Intelligence & Data Science**

Improving care for 100+ years by embracing new technologies and approaches to medicine.

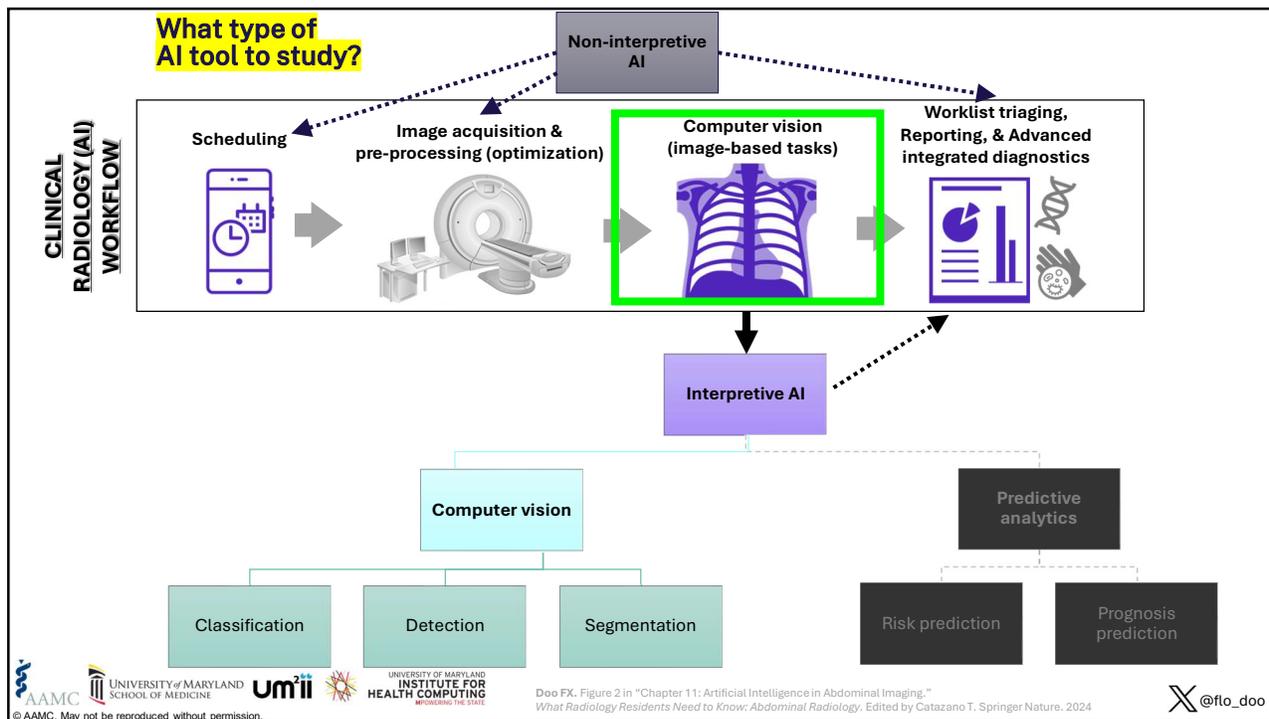
Since 1895, to name just a few innovations we've adopted...

Slide credit: Dr. Geraldine McGinty, Imaging Informatics Summit 2022

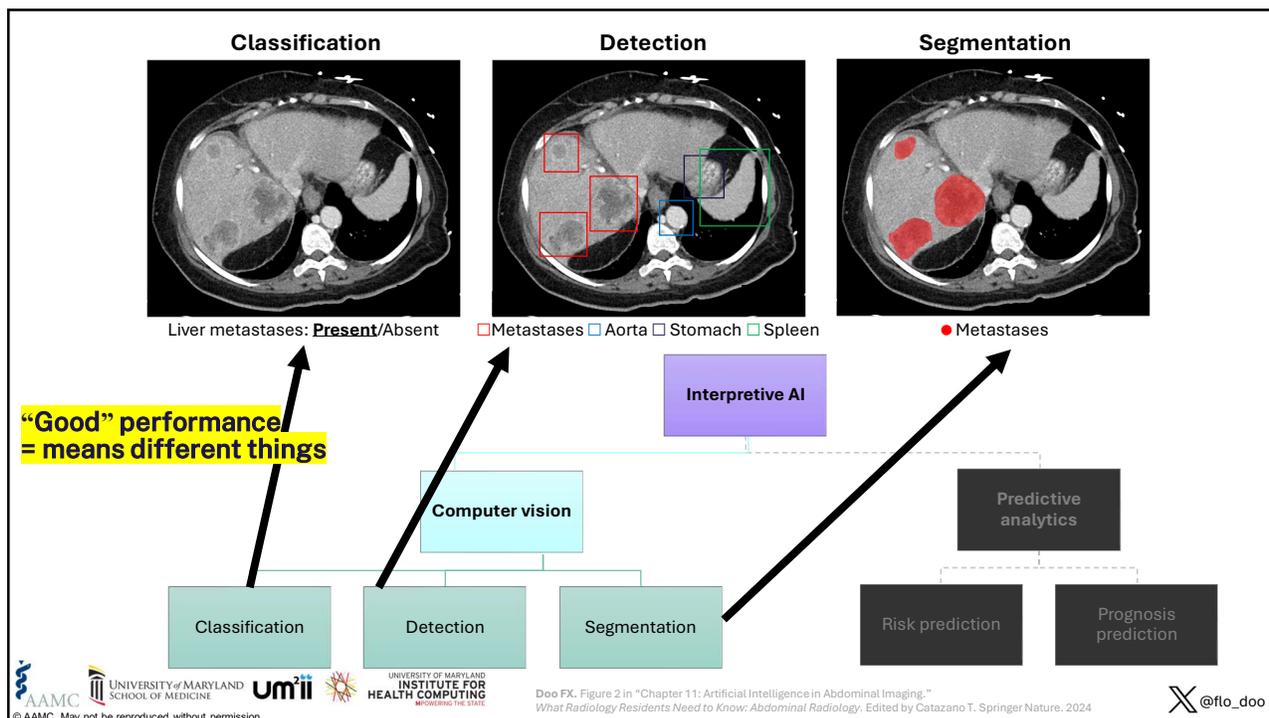
19



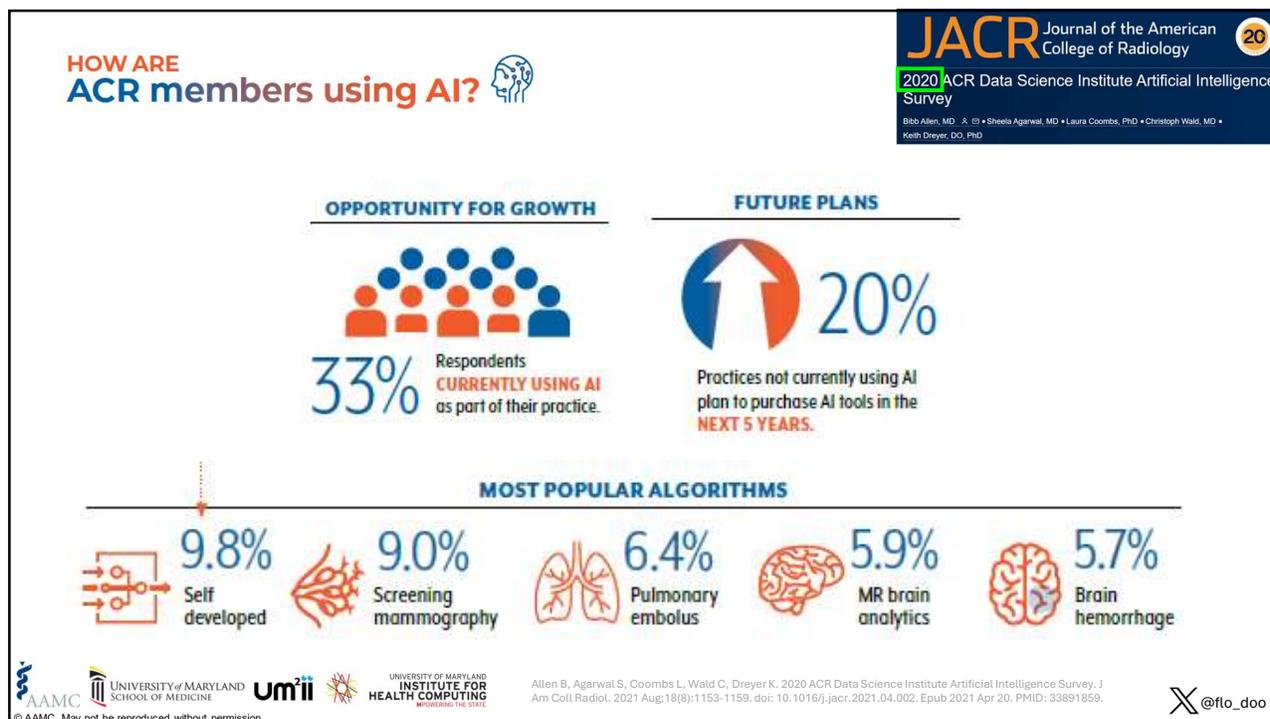
20



21



22



23

#MedEd: What AI results are important for... Clinical care? Research?

2021 - INITIAL PILOT

1934 consecutive CTPA studies over 3-month period before go live

Variable	phase			p-value
	Overall, N = 245 ¹	1, N = 116 ¹	2, N = 129 ¹	
Positive cases missed by radiologists	20 (8.2%)	14 (12%)	6 (4.7%)	0.034 ²

PHASE 1
JUL - SEP 2021
No AI assisted reads

PHASE 2
JAN - MAR 2022
Reads with AI assistance

¹Frequency (%) for Sex and Status
²Pearson's Chi-squared test

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 © AAMC. May not be reproduced without permission. credit to University of Maryland's Dr. Jean Jeudy for this slide & data @flo_doo

24

AI during residency training

human-AI interfaces as part of learning

FINDINGS:

CARDIOVASCULAR, MEDIASTINUM, THYROID:
Visualized thyroid gland: [Normal]

Vasculature:

- Diagnostic quality: [Adequate]
- Pulmonary arteries: [No pulmonary embolus]
- Artificial intelligence: [Normal]
- Pulmonary artery caliber: [Normal]

Thoracic aorta: [Normal in caliber and course] [No atherosclerosis]

Heart and pericardium: [Normal heart size] [No pericardial effusion]

Esophagus: [Normally decompressed]

Pick List Choices:
AI positive. Concordant.
AI positive. Discordant due to...
AI negative. Concordant.
AI negative. Discordant due to...
AI unavailable.

No PE findings detected

How (or if) to record when AI was used?

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Oncologic Provider Report
1040 Pancreatic Cancer Metastatic Demo, Unknown DOB

Response: Partial Response (PR)
Criteria: Metastatic Disease

Study Date	Target Lesion Size (cm)	% Change from Baseline	% Change from Lowest	% Change from Prior
1/6/18	19.4	-	-	-
3/7/18	15.8	-18.6%	-	-
6/27/18	13.5	-30.4%	-	-14.6%

Target Lesions:

- Liver Left Lobe: 2.8 x 2.6 cm
- LN Periportal: 2.0 x 0.8 cm
- Liver Right Lobe: 4.1 x 3.5 cm
- Pancreas Body: 4.6 x 3.6 cm
- LN Periportal: 3.6 x 1.3 cm

Non-Target Lesions: Liver Multiple Present

Other Findings: No Other Findings

Tumor Burden:
Current Sum: 13.5 cm
% Change from Baseline: -30.4%
% Change from Lowest: N/A
% Change from Prior: -14.6%

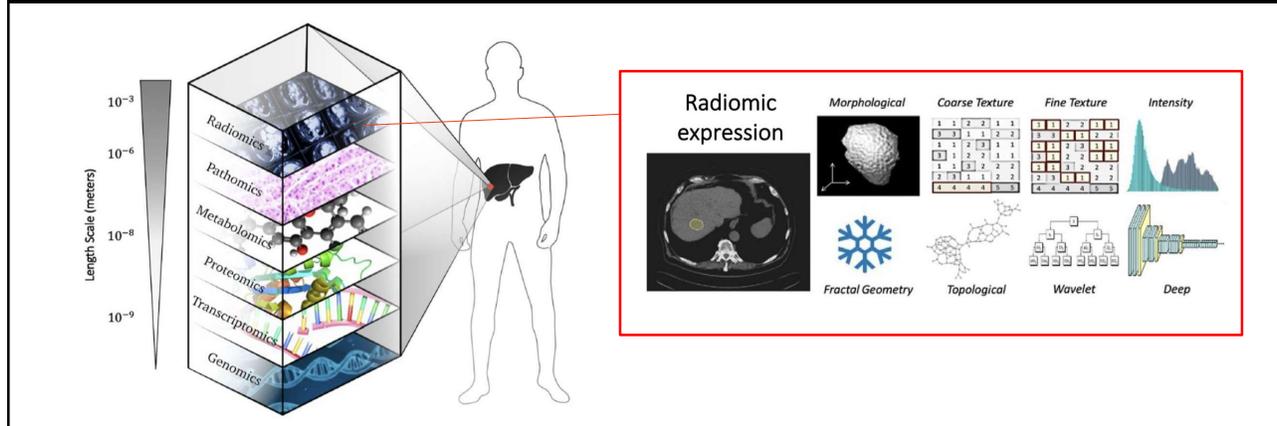
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Gandhi D, Garg T, Patel L, Eikassem AA, Bansal V, Smith A. Artificial intelligence in gastrointestinal and hepatic imaging: past, present and future scopes. Clin Imaging. 2022 Jul;87:43-53. doi: 10.1016/j.clinimag.2022.04.007. Epub 2022 Apr 20. PMID: 35487161.

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think of imaging → One pillar of integrated diagnostics
(quantitative) imaging-based biomarkers
“omics”

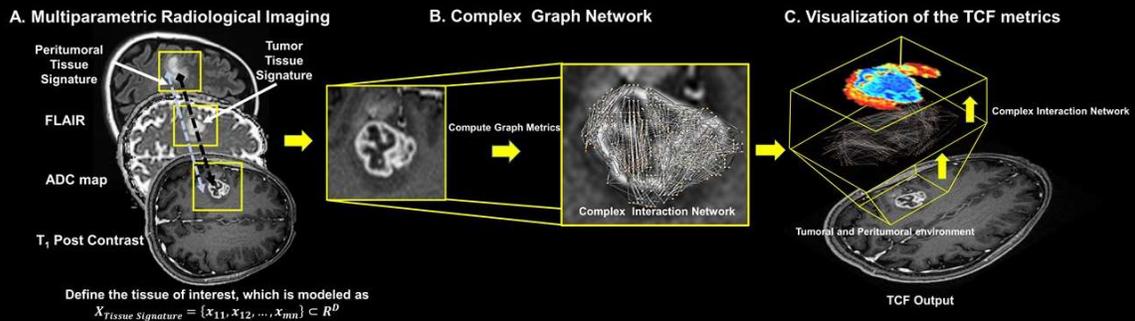


AAMC UNIVERSITY OF MARYLAND SCHOOL OF MEDICINE umii UNIVERSITY OF MARYLAND INSTITUTE FOR HEALTH COMPUTING MPOWERING THE STATE Laifata KJ, Wang Y, Konkel B, Yin FF, Bashir MR. Radiomics: a primer on high-throughput image phenotyping. *Abdom Radiol (NY)*. 2022 Sep;47(9):2986-3002. doi: 10.1007/s00261-021-03254-x. Epub 2021 Aug 25. PMID: 34435228. Link: rdcu.be/cv60f X @flo_doo

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think of imaging → One pillar of integrated diagnostics
(quantitative) imaging-based biomarkers
“omics”

Tumor Connectomics Framework



AAMC UNIVERSITY OF MARYLAND SCHOOL OF MEDICINE umii UNIVERSITY OF MARYLAND INSTITUTE FOR HEALTH COMPUTING MPOWERING THE STATE Parekh VS, Pillai JJ, Macura KJ, LaViolette PS, Jacobs MA. Tumor Connectomics: Mapping the Intra-Tumoral Complex Interaction Network Using Machine Learning. *Cancers (Basel)*. 2022 Mar 14;14(6):1481. doi: 10.3390/cancers14061481. PMID: 35326634; PMCID: PMC8946165. X @flo_doo

28

The fun part...

Imaging's role in Medical AI (Research)

- 1: "Bench" – Imaging AI 101
- 2: "Bedside" – Radiology workflow
- 3: Translation & the future of MedEd

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The Translation Process

T-0 Basic Science research
 • Preclinical and animal studies
 • Defining mechanisms, targets, and lead molecules

T-1 Translation to Humans
 • Proof of Concept Phase 1 clinical trials
 • New methods of diagnosis, treatment, and prevention

T-2 Translation to Patients
 • Phase 2 and 3 clinical trials
 • Controlled studies leading to effective care

T-3 Patient Care ("Bedside")
 Translation of new data into the clinic and health decision making

T-4 Translation to Community
 • Population-level outcomes research
 • True benefit to society

Algorithms ("Bench")
 Translation from basic science to human studies

Practice
 • Phase 4 clinical trials
 • Outcomes research
 • Delivery of recommended and timely care to the right patient

Community

AI in the continuum of MedEd & Research = a translational process

think: leadership, faculty, & trainee roles?

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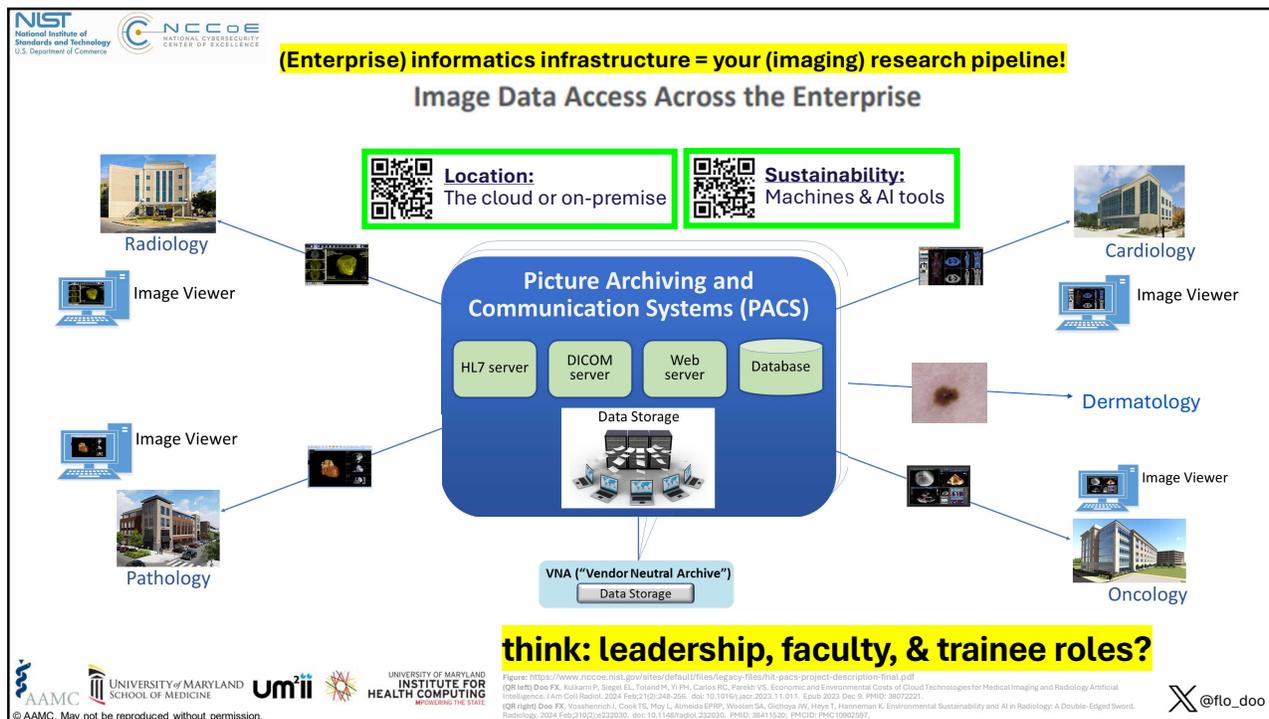
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image credit "The Translation Process": <https://ncatsalliance.org/what-is-translational-science/#>
 image credit background image: <https://www.aamc.org/about-us/mission-areas/medical-education/artificial-intelligence-and-academic-medicine>

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31

For #MedEd & AI research: Be AI (imaging) literate – understand limitations

Hype Reality

No, you cannot generate a "radiology report" using a single image of an MRI exam.

"expert" radiologist as opposed to...??? Or do you mean "MSK radiologist"?

No, you cannot assess joint effusion on this image, as even a small joint effusion can give this appearance here.

No, you can't come to this conclusion based on a single image.

No, an "expert radiologist" would describe the type of meniscal tear AND its location. You also can't conclude this using a single image, as there may be additional tears.

No, these structures are NOT visible in this image.

Where did this "right" side come from???

Prompt: Write a radiology report as an expert radiologist for the following case.

GPT-4V:

Report: MRI of the right knee demonstrates a large joint effusion, which is most pronounced in the suprapatellar region. There is also evidence of a tear in the medial meniscus, as well as mild degenerative changes in the articular cartilage. The anterior cruciate ligament and posterior cruciate ligament are intact. The extensor mechanism is also intact. No other significant abnormalities are seen. Impression: Large joint effusion and medial meniscal tear in the right knee, with mild degenerative changes in the articular cartilage.

Evaluation from Professionals: Correct study identification, correct diagnosis (effusion and meniscal tear).

Were they radiologists? No radiologist I know would have accepted this output as is. Clinical domain expertise is crucial. Details matter.

If you had just asked for a description of this image or an image caption, this would have been OK (minus the "large" and "right").

credit: Woojin Kim MD, <https://twitter.com/woojinrad>

32

For #MedEd & AI research: Be AI (imaging) literate – bias

Automation Bias

“autopilot” = Trust AI result, more than yourself

WE LOVE IT MORE IF WE MADE IT

The IKEA effect

Anchoring bias

The Google (AI) effect
(trainees?)

think: leadership, faculty, & trainee roles?

<https://www.datasciencecentral.com/23-types-of-bias-in-data-for-machinelearning-and-deeplearning/>
<https://openclassrooms.com/en/courses/7035961-make-effective-decisions/7121041-deal-with-your-cognitive-biases>

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For #MedEd & AI research: Be AI (imaging) literate – physician involvement in AI research

Standard of Care Historical Workflow Nov 2016 - Nov 2018 (n=86)

Stroke: Vascular and Interventional Neurology
An official publication of the AHA and the SVIN

Sept 2022

Who is missing from new workflow?

ai Synchronized Care Workflow Dec 2018 - May 2020 (n=102)

86.7 min

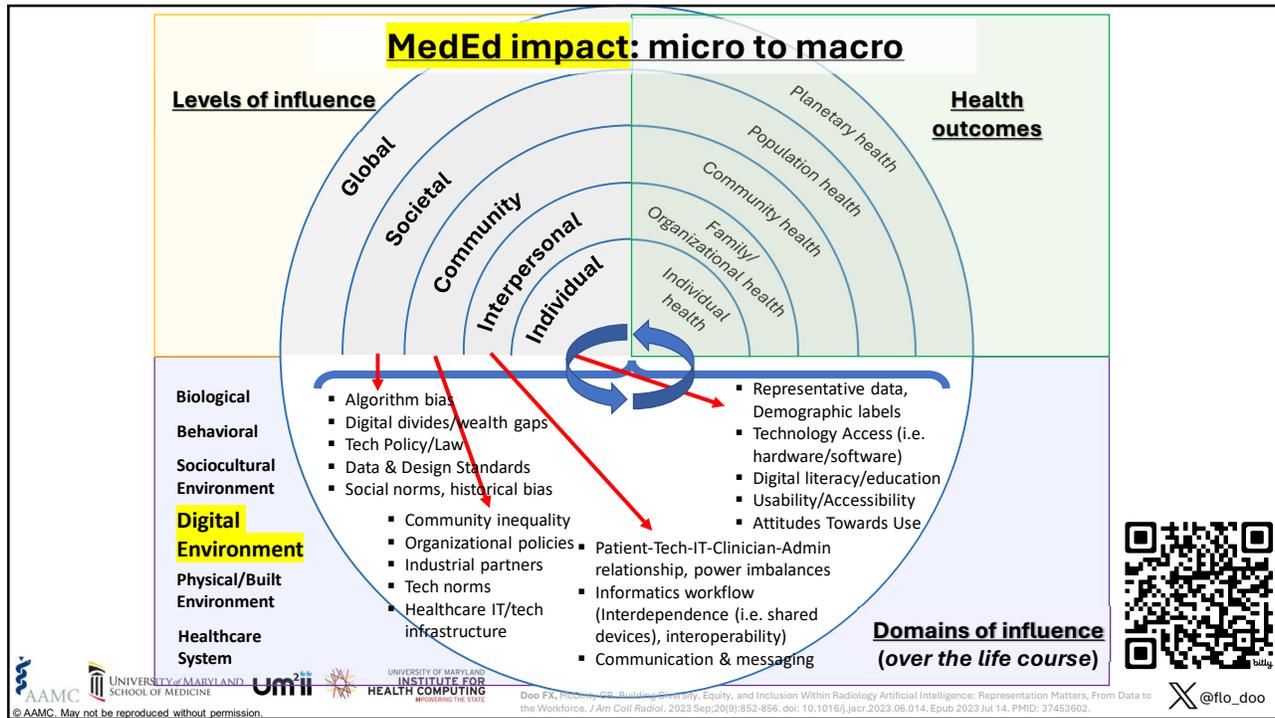
Saved in Workflow

(P<0.0001)

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Hassan AE, Ringheanu VM, Preston L, Tekle WG. Artificial Intelligence–Parallel Stroke Workflow Tool Improves Reperfusion Rates and Door-In to Puncture Interval. *Stroke: Vascular and Interventional Neurology*. 2022 Sept 15;37(2):304. doi: 10.1161/svin.121.000224

34



37

Translation of AI = Healthcare delivery (research)

What are current needs and solutions related to the safety, effectiveness, reliability, and transparency of AI used in clinical radiology practices?

AI-enabled tools have potential to improve patient outcomes and overall population health, but only a few have demonstrated **sustained clinical impact.**

ACR and Radiological Society of North America (RSNA) organized in-person workshop

Discussed current radiology AI landscape, such as experiences and problems, as well as the stakeholder needs and solutions

FOUND MAJOR THEMES IN 2 CATEGORIES:

AI Product Development:

- Definition of clinical task
- Data discovery and curation
- Model development and performance validation
- Regulatory clearance and expected standards

AI Implementation:

- Institutional governance
- Evaluation and validation
- Integration into clinical workflow
- Institutional and external performance monitoring
- Aligning incentives through reimbursement and certification

Establishing mechanisms that advance the safety, effectiveness, reliability, and transparency of AI will be key to facilitating full adoption in radiology.

Logos: AAMC, UNIVERSITY OF MARYLAND SCHOOL OF MEDICINE, umii, UNIVERSITY OF MARYLAND INSTITUTE FOR HEALTH COMPUTING

QR Code: @flo_doo

© AAMC. May not be reproduced without permission. Larson DB, Doo FX, Allen B Jr, Mongan J, Flanders AE, Wald C. Proceedings From the 2022 ACR-RSNA Workshop on Safety, Effectiveness, Reliability, and Transparency in AI. J Am Coll Radiol. 2024 Jul;21(7):1119-1129. doi: 10.1016/j.jacr.2024.01.024. PMID: 38354844.

38

Needed: More #MedEd research & application

Board exams

2022
Noninterpretive
Skills

Study Guide

ABR | AMERICAN BOARD OF RADIOLOGY

This study guide is to be used in preparation for all Diagnostic Radiology Core and Certifying exams administered through calendar year 2022.

Fellowships

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- **Being BIR Certified:** The Fellow will receive support for certification in the field of informatics, including the use of technology in the practice of radiology.
- **Being BIR Certified:** The Fellow will receive support for certification in the field of informatics, including the use of technology in the practice of radiology.

ABR is an Equal Opportunity Employer. Minorities and women are encouraged to apply. The Fellow will receive support for research in the field of informatics, including the use of technology in the practice of radiology.

Informatics Fellows

2022

Florence Doo, MD
Stanford University, California

2023

Alvika Ferni Abdurrahman, MD
University of North Carolina, Chapel Hill

2024

Dan Cohen Abidin, MD
Dartmouth Health Sciences University, Brooklyn, NY

Society CME, for those already in practice

DATA SCIENCE INSTITUTE*
AMERICAN COLLEGE OF RADIOLOGY

ity | **Get Involved** | Resources

Resources

- Glossary of Terms
- Informatics e-Learning Hub
- Short Course on AI for the Practicing Radiologist

We will all use AI someday.
How will we make sure **all of us** use it safely, and ethically?

research = continuum of bench to bedside

39

The Translation Process

T-0 Basic Science research

- Preclinical and animal studies
- Defining mechanisms, targets, and lead molecules

T-1 Translation to Humans

- Proof of Concept Phase 1 clinical trials
- New methods of diagnosis, treatment, and prevention

T-2 Translation to Patients

- Phase 2 and 3 clinical trials
- Controlled studies leading to effective care

T-3 Patient Care ("Bedside")

- Phase 4 clinical trials
- Outcomes research
- Delivery of recommended and timely care to the right patient

T-4 Translation to Community

- Population-level outcomes research
- True benefit to society

Algorithms ("Bench")

AI in the continuum of MedEd & Research = a translational process

think: innovation!

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image credit "The Translation Process": <https://ncatsalliance.org/what-is-translational-science/#>

40

Tasks that humans can do

Human tasks that could be automated

New tasks that humans can do with the help of machines

(Generative) AI?

Source:
Human Development Report Office based on Brynjolfsson (2022).
UNDP (United Nations Development Programme). 2022. Human Development Report 2021-22: Uncertain Times, Unsettled Lives: Shaping our Future in a Transforming World. New York.

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New AI-enabled tools: Dynamic Digital Radiography (DDR)

Expiration Inspiration Expiration Inspiration Expiration Inspiration

All patients with normal physiology All patients with COPD All patients with restrictive physiology

Flow (cm³/s)

Lung Area (cm²)

11.44
9.29
7.15
5.01

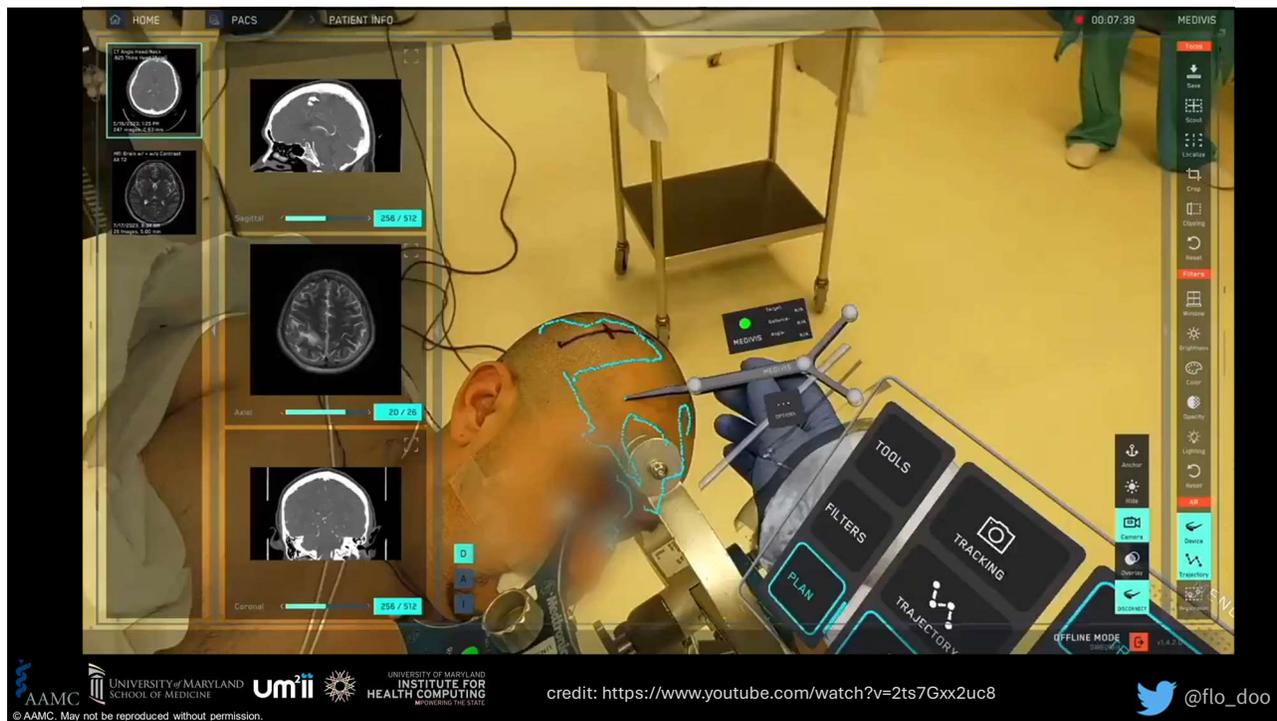
Frame No.

45 90 135 180 225

Santibanez V, Pisano TJ, Doo FX, Salvatore M, Padilla M, Braun N, Concepcion J, O'Sullivan MM. Dynamic Digital Radiography Pulmonary Function Testing: A Machine Learning Lung Study Alternative. *CHEST Pulmonary*. Epub 29 March 2024. DOI: <https://doi.org/10.1016/j.chpulm.2024.100052>

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42



43

Be part of the innovation. What applications can you imagine?

JAMA. doi:10.1001/jama.2023.14217
Published online August 7, 2023.

JAMA | Special Communication | AI IN MEDICINE
Creation and Adoption of Large Language Models in Medicine
 Nigam H. Shah, MBBS, PhD; David Entwistle, BS, MHSA; Michael A. Pfeffer, MD

“ The medical profession has made a mistake in not shaping the creation, design, and adoption of most information technology systems in health care... the same mistake cannot be repeated. ”

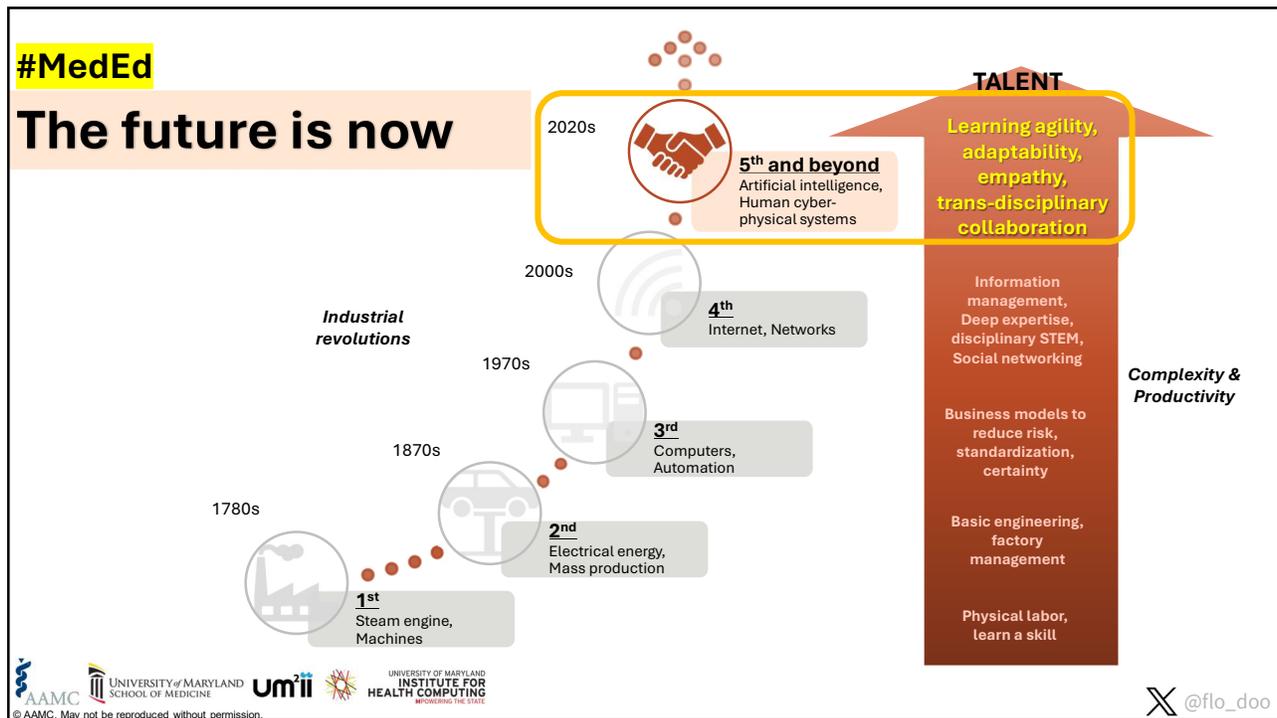
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44



45



46



What do you think of the **role of imaging** in **medical AI** now?

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image credit: Dr. Glaucomflecken (@DGlaucomflecken), "Faculty Meeting – Radiology Orders"
<https://www.youtube.com/watch?v=cMyV6PsVsxQ>

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47



Thank you for listening!



For any questions or comments, please contact:
Florence (Flo) X. Doo, MD MA (she/hers)
(fdoo@som.umaryland.edu)

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48



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Leveraging AI for Research & Innovation

Common pitfalls in project design

Gustavo A. Patino, MD PhD
Associate Dean for UME, Western Michigan
University Homer Stryker M.D. School of
Medicine

August 27, 2024

Learn

Serve

Lead



Association of
American Medical Colleges

Disclosures

Assistant editor for *Academic Medicine*

Technical reviewer and LiveProject mentor for Manning Publications

All opinions are my own and do not represent those of any of my affiliated organizations

What do we mean when we say AI?

Limit this discussion to:

Machine learning (ML)

Generative AI, especially large language models (LLMs)

Common pitfalls using AI in research

AI is the focus of the project and not a tool to answer a question

Not sharing enough details to allow replicability and assessing external validity

Focusing exclusively on AI performance, failing to engage with the model

Endowing the AI models with human qualities

Is AI the right tool for the research question?

ML and LLM aim to make predictions

Is there something to be gained from AI predictions:

Are they better than those done by humans?

Are they more cost effective than those done by humans?

Use AI methods only if predictions with those conditions are needed

Use the same standards as for other experimental approaches

Need to allow for replicability and assessment of external validity

Provide thorough description of the dataset, including the split between training and testing subsets and any processing

It is not enough to mention the programming language and libraries used

Consider sharing the scripts

Use same evaluation standards as for human users

Engage with the AI model

Performance is important, but is not the only important aspect

Report performance using applied measures (e.g. sensitivity) instead of loss functions (e.g. log-likelihood)

What independent variables proved important to make the predictions?

Do the misclassified samples have something in common?

Is there any evidence of bias?

AI is just a tool

The fact that these are mathematical techniques doesn't mean the results are infallible

- Can be biased

- Still need quality data for data development

Results are heavily dependent on the human user

- Importance of prompt quality for LLM output

The model can find correlations between variables, but doesn't care what those variables are

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Thank you!

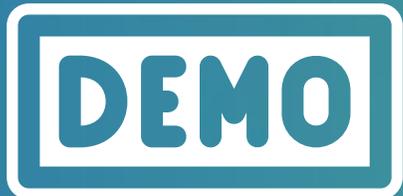
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Registration will open in November

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- Accreditation
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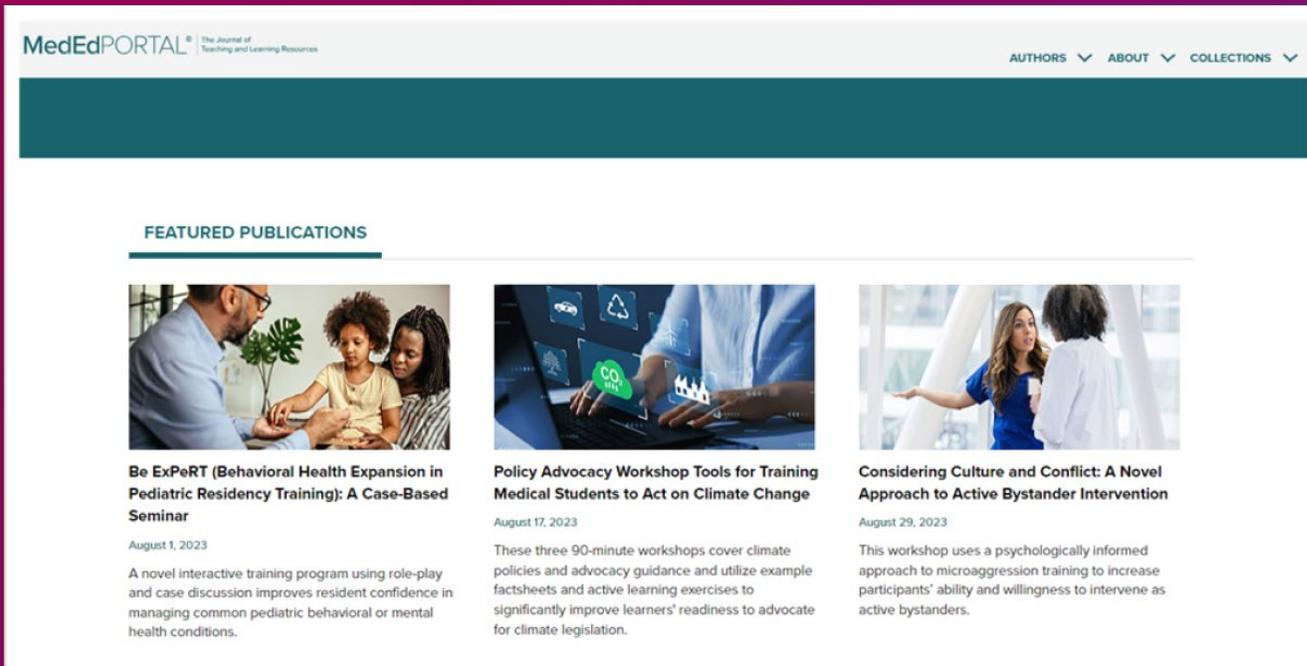
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The screenshot shows the MedEdPORTAL website homepage. At the top left is the logo "MedEdPORTAL® The Journal of Teaching and Learning Resources". To the right are navigation links: "AUTHORS", "ABOUT", and "COLLECTIONS". Below the navigation is a dark teal horizontal bar. Underneath is a section titled "FEATURED PUBLICATIONS" with three articles:

- Be ExPeRT (Behavioral Health Expansion in Pediatric Residency Training): A Case-Based Seminar**
August 1, 2023
A novel interactive training program using role-play and case discussion improves resident confidence in managing common pediatric behavioral or mental health conditions.
- Policy Advocacy Workshop Tools for Training Medical Students to Act on Climate Change**
August 17, 2023
These three 90-minute workshops cover climate policies and advocacy guidance and utilize example factsheets and active learning exercises to significantly improve learners' readiness to advocate for climate legislation.
- Considering Culture and Conflict: A Novel Approach to Active Bystander Intervention**
August 29, 2023
This workshop uses a psychologically informed approach to microaggression training to increase participants' ability and willingness to intervene as active bystanders.

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Artificial Intelligence

Learn from Experts & Engage with Colleagues

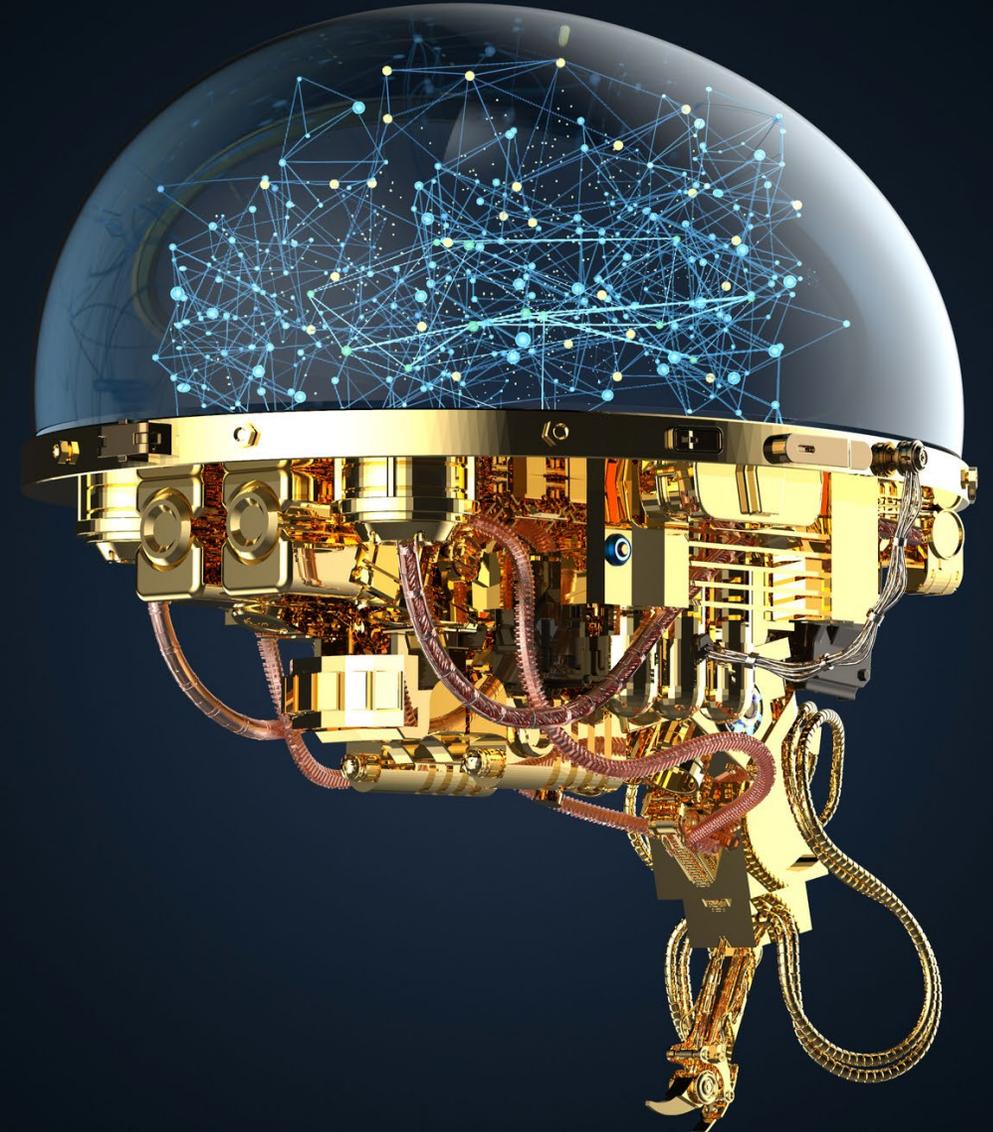
Check out our ...

- Webinar series
- Key resources collection
- Discussion threads



Check out our ...

- AI and Academic Medicine webpage



Upcoming AAMC AI Webinars

The Use of Artificial Intelligence (AI) Tools in the Scholarly Publishing Process: Considerations and Practical Suggestions for Scholars – Sept. 10, 2024

Building AI Partnerships Across Medicine, Industry & Government – Sept. 24, 2024

Past AAMC AI Webinars

Artificial Intelligence and Medical School Admissions and Selection - July 30, 2024

Leveraging AI to Support Operational Functions - June 25, 2024

- *Video recording*
- *Presentation slides*
- *Q&A section summary*



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