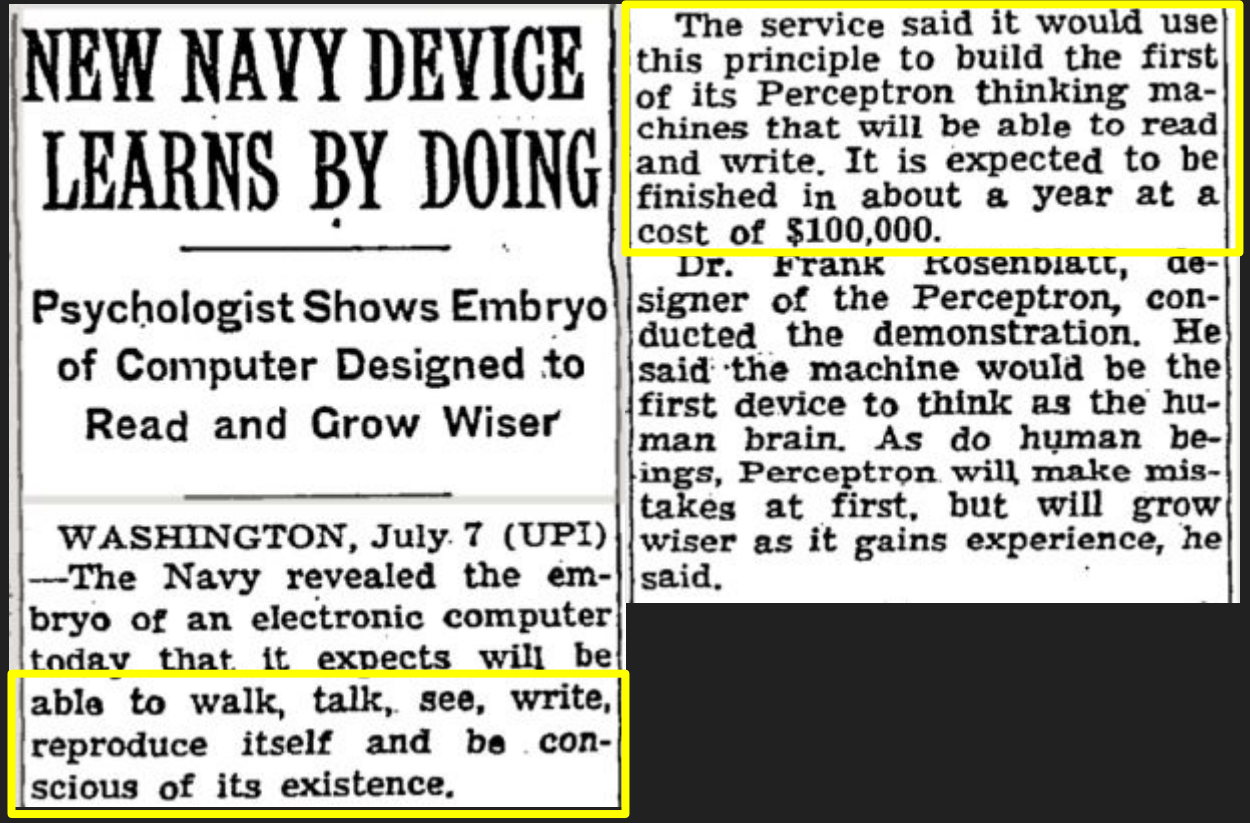
AI in Healthcare

Gavin Taylor, PhD
Professor of Computer Science
US Naval Academy

Marc Rabner, MD, MPH
Chief Medical Officer
CRISP Shared Services

“AI is going to change everything”



NEW NAVY DEVICE LEARNS BY DOING

Psychologist Shows Embryo of Computer Designed to Read and Grow Wiser

WASHINGTON, July 7 (UPI) —The Navy revealed the embryo of an electronic computer today that it expects will be able to walk, talk, see, write, reproduce itself and be conscious of its existence.

The service said it would use this principle to build the first of its Perceptron thinking machines that will be able to read and write. It is expected to be finished in about a year at a cost of $100,000.

Dr. Frank Rosenblatt, designer of the Perceptron, conducted the demonstration. He said the machine would be the first device to think as the human brain. As do human beings, Perceptron will make mistakes at first, but will grow wiser as it gains experience, he said.

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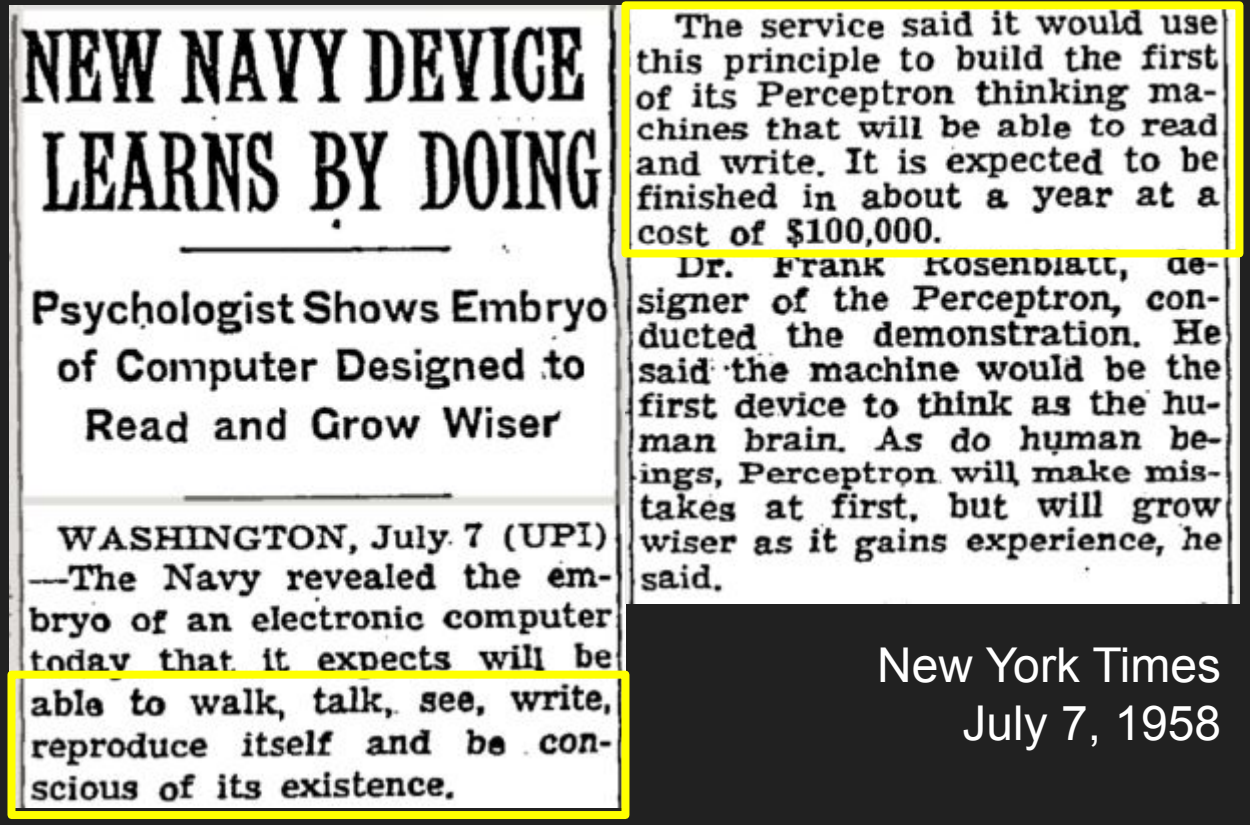

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New York Times
July 7, 1958

Outline

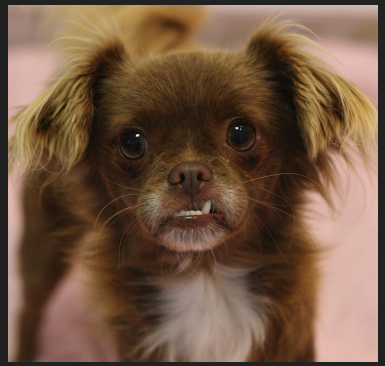
What is meant by AI and “learning”

How AI can be used in complex decision making

What opportunities and dangers users of AI need to be aware of

Easy, but hard

Easy, but hard



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*some images generated by Google Gemini




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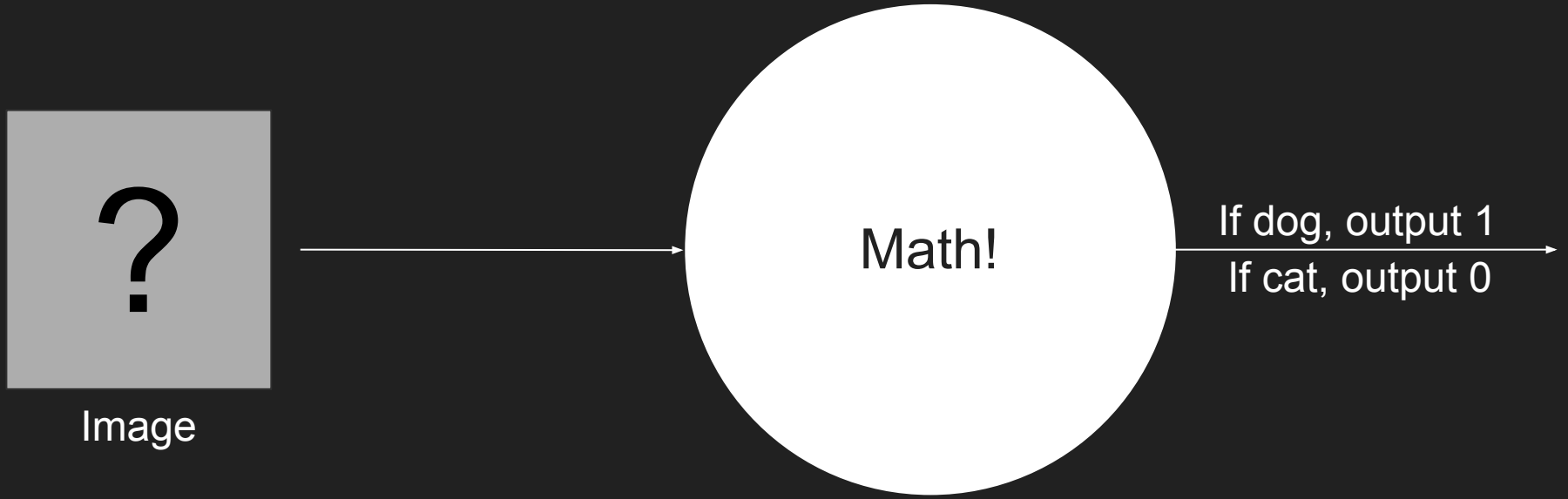
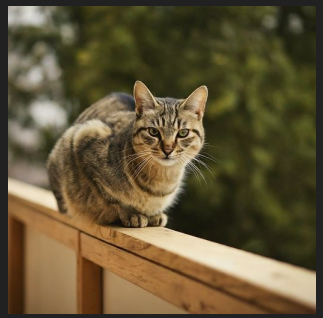

?
Image
Math!
If dog, output 1
If cat, output 0



Math!

If dog, output 1

If cat, output 0

More interestingly…

- Does this brain scan indicate a tumor?
- Given this person's location data, what issues likely determine how they vote?
- Given this recording, what words were said?
- Given an incomplete block of text, what word likely appears next?
- What documents include text most related to a given question?

More interestingly…

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AI integration can heavily disrupt workplace dynamics in a way that needs human care.

Case Study: Sepsis Watch

- Tool built at Duke University from 32 million datapoints to predict development of sepsis.
- If a patient was predicted to be at high risk, the patient was flagged on a dashboard visible to nurses, who would alert the attending.
- Frequent friction was observed when a doctor was “accused of missing something” by a nurse they did not know, about a patient the nurse had not seen, by a tool that was not explainable.
- Significant emotional labor and workflow design was necessary to make the tool workable.

Elish and Watkins. Repairing Innovation: A study of integrating AI in clinical care

Sendak et al. Real-World Integration of a Sepsis Deep Learning Technology Into Routine Clinical Care

In what ways can AI do harm?

AI can be wrong in convincing and authoritative ways

AI can be biased against individuals or groups

AI can be wrong in convincing and authoritative ways

AI can be wrong in convincing and authoritative ways

Prompt: Explain why Gavin Taylor was fired from the US Naval Academy

Stable Diffusion (which, to be clear, is wrong):

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Stable Diffusion (which, to be clear, is wrong): Gavin Taylor, an

AI can be wrong in convincing and authoritative ways

Prompt: Explain why Gavin Taylor was fired from the US Naval Academy

Stable Diffusion (which, to be clear, is wrong): Gavin Taylor, an alumni of the United States Naval Academy (USNA), was dismissed from the academy on March 10, 1996, following allegations of sexual misconduct.

AI can be biased against individuals or groups

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?

AI can be biased against individuals or groups

Facial recognition is typically trained on people for whom we have lots of pictures (celebrities)

Voice recognition datasets rarely reflect all accents or speech disabilities

Datasets which are based on human decisions will reflect human bias

Medical datasets represent people who regularly receive treatment and are willing to share their data

Conclusions

AI is developing quickly, and can work extremely well

AI can help a person consider more data and more information when making difficult decisions

Successfully integrating AI into a decision making process requires human skills

It is easy to accidentally cause harm due to data bias

CRISP
Shared Services

CRISP's Vision

To advance health and wellness by deploying health information technology solutions adopted through cooperation and collaboration.

CRISP
Shared Services

Quintuple Aim

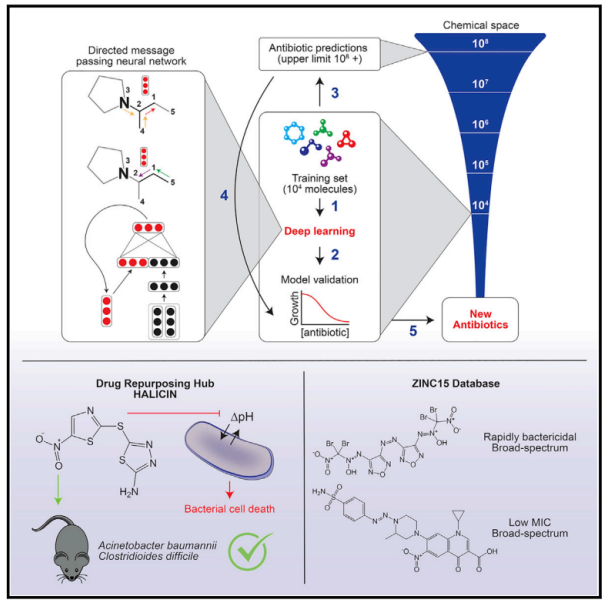
Improving Clinical Outcomes

Article

Cell

A Deep Learning Approach to Antibiotic Discovery

Graphical Abstract



Authors

Jonathan M. Stokes, Kevin Yang, Kyle Swanson, ..., Tommi S. Jaakkola, Regina Barzilay, James J. Collins

Correspondence

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In Brief

A trained deep neural network predicts antibiotic activity in molecules that are structurally different from known antibiotics, among which Halicin exhibits efficacy against broad-spectrum bacterial infections in mice.

Natural language processing of admission notes to predict severe maternal morbidity during the delivery encounter

Mark A. Clapp MD, MPH, Ellen Kim MD, MPH, Kaitlyn E. James PhD, MPH, Roy H. Perlis MD, MSc, Anjali J. Kaimal MD, MAS and Thomas H. McCoy MD

American Journal of Obstetrics and Gynecology, 2022-09-01, Volume 227, Issue 3, Pages 511.e1-511.e8, Copyright © 2022 Elsevier Inc.

eClinicalMedicine

Part of THE LANCET *Discovery Science*

ARTICLES | VOLUME 65, 102259, NOVEMBER 2023

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Identification and risk stratification of coronary disease by artificial intelligence-enabled ECG

Samir Awasthi • Nikhil Sachdeva • Yash Gupta • Ausath G. Anto • Shahir Asfahan • Ruben Abbou • et al.

Show all authors

Open Access • Published: October 19, 2023 • DOI: https://doi.org/10.1016/j.eclinm.2023.102259 •

Check for updates

Enhancing the Patient Experience

40

USING ARTIFICIAL INTELLIGENCE TO IMPROVE PATIENT AND FAMILY EXPERIENCE

Suzanne Collin. *Great Ormond Street Hospital for Children NHS Foundation Trust, UK*

10.1136/bmjpo-2023-GOSH.44

Within Great Ormond Street Hospital for Children, (GOSH), valuable patient feedback is collected via the Friends and Family Test (FFT). GOSH receives 2,000 comments per month from inpatient and outpatient areas a
contains unstructured free text.

The GOSH Patient Experience Te
feedback, manually applying sentime
qualitative comment. Trends and th
reported on from all wards and dep
extremely time consuming, resulting
shared in the Trust retrospectively.

CLINICAL RESEARCH

Can Artificial Intelligence Improve the Readability of Patient Education Materials?

Kirchner, Gregory J. MD, MPH[1]; Kim, Raymond Y. MD[1]; Weddle, John B. MD[1]; Bible, Jesse E. MD[1]

Author Information

Clinical Orthopaedics and Related Research 481(11):p 2260-2267, November 2023. | **DOI:** 10.1097/CORR.0000000000002668

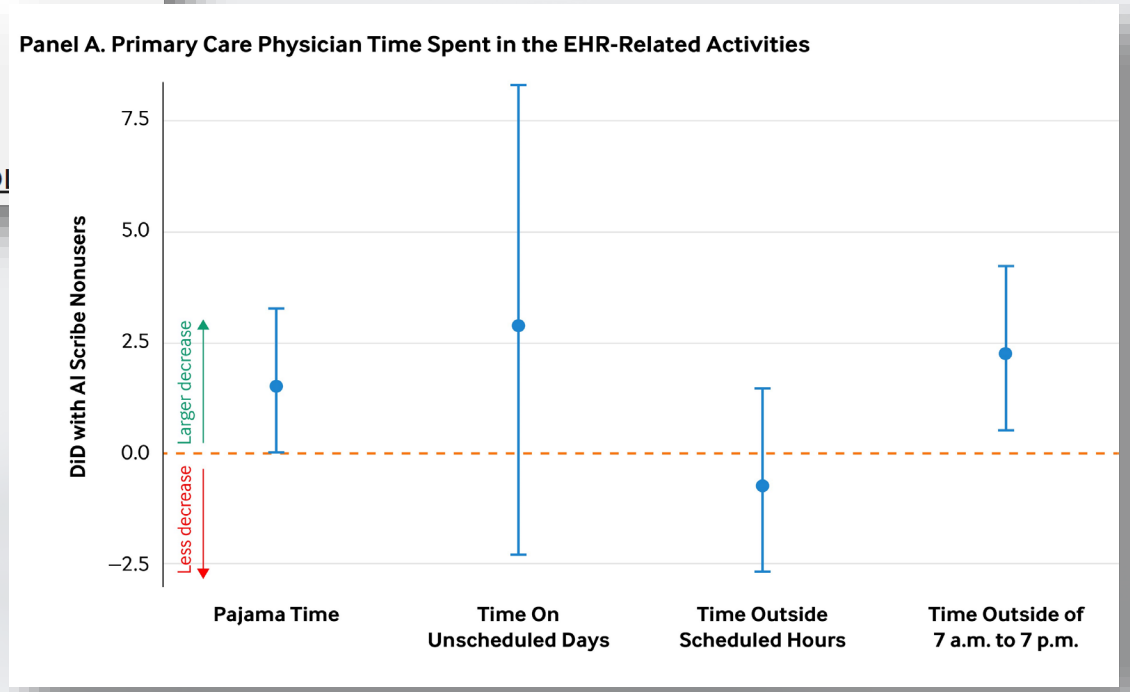
Addressing Provider Satisfaction

Ambient Artificial Intelligence Scribes to Alleviate the Burden of Clinical Documentation

Early results with generative artificial intelligence deployed in The Permanente Medical Group yield some promising results and key observations, although the long-term development and wider deployment will require a rigorous evaluation framework that tracks engagement, effectiveness, quality, and safety.

Authors: Aaron A. Tierney, PhD, Gregg Gayre, MD, Brian Hoberman, MD, MBA, Britt Mattern, MBA, Manuel MD, Patricia Kipnis, PhD, Vincent Liu, MD, MS, and Kristine Lee, MD Author Info & Affiliations

Published February 21, 2024 | NEJM Catal Innov Care Deliv 2024;5(3) | DOI: 10.1056/CAT.23.0404 | VOI



Achieving Financial Sustainability

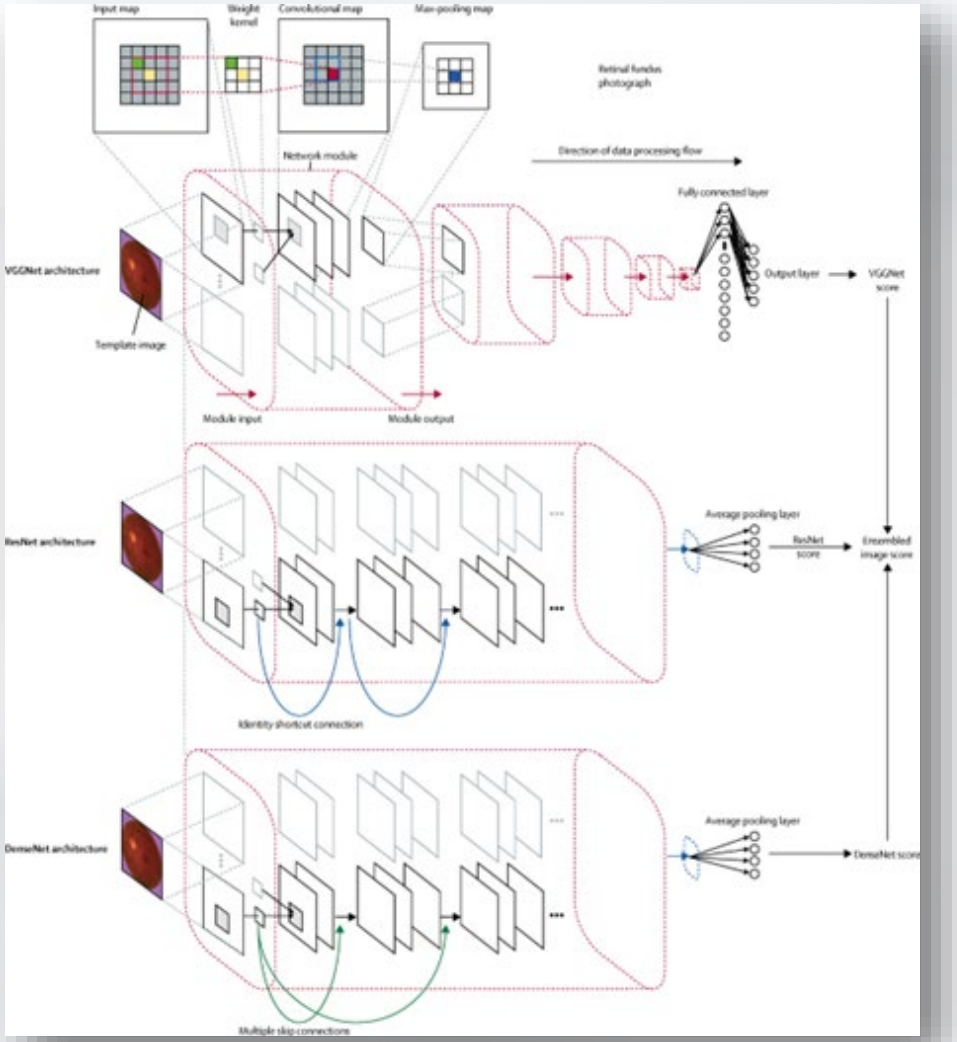
THE LANCET
Digital Health

ARTICLES | VOLUME 2, ISSUE 5, E240-E249, MAY 2020 Download Full Issue

Artificial intelligence for teleophthalmology-based diabetic retinopathy screening in a national programme: an economic analysis modelling study

Yuchen Xie, MScPH * • Quang D Nguyen, BEng * • Haslina Hamzah, BSc * • Gilbert Lim, PhD • Valentina Bellemo, MSc • Dinesh V Gunasekeran, MBBS • et al. Show all authors • Show footnotes

Open Access • Published: April 23, 2020 • DOI: https://doi.org/10.1016/S2589-7500(20)30060-1 •



CRISP Shared Services

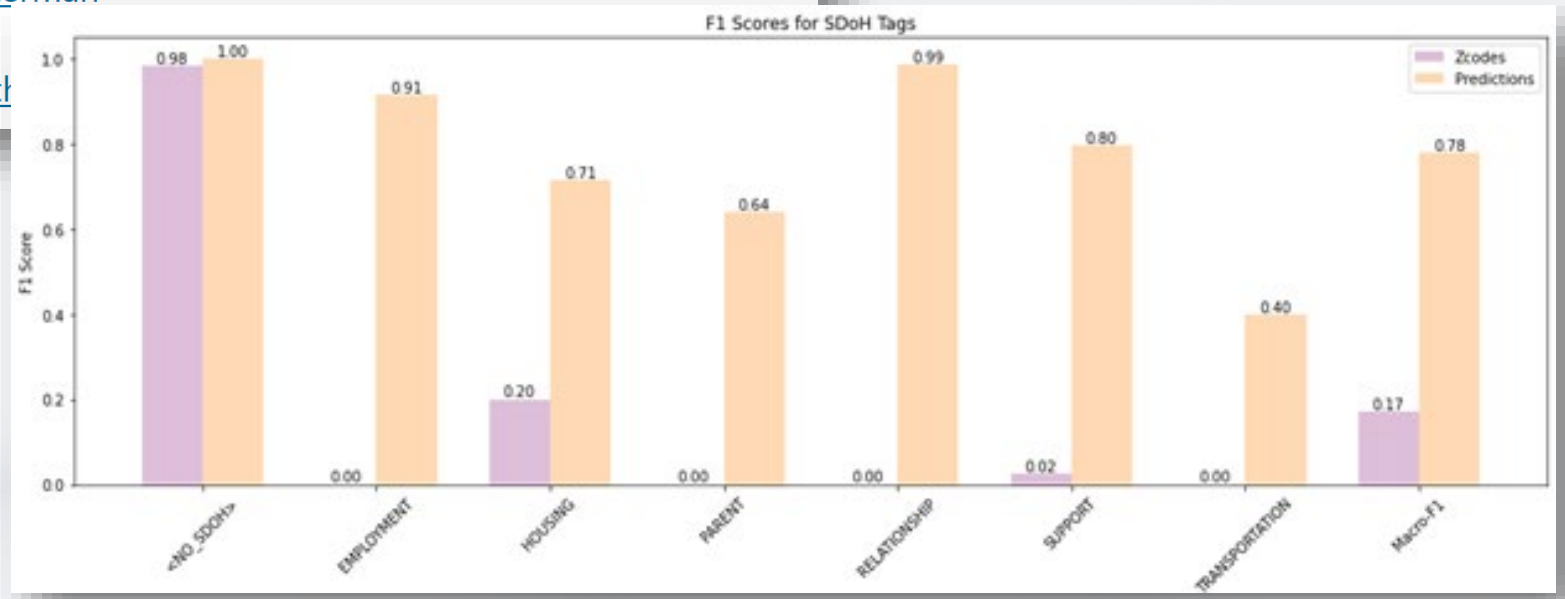
Advancing Health Equity

Article | Open access | Published: 11 January 2024

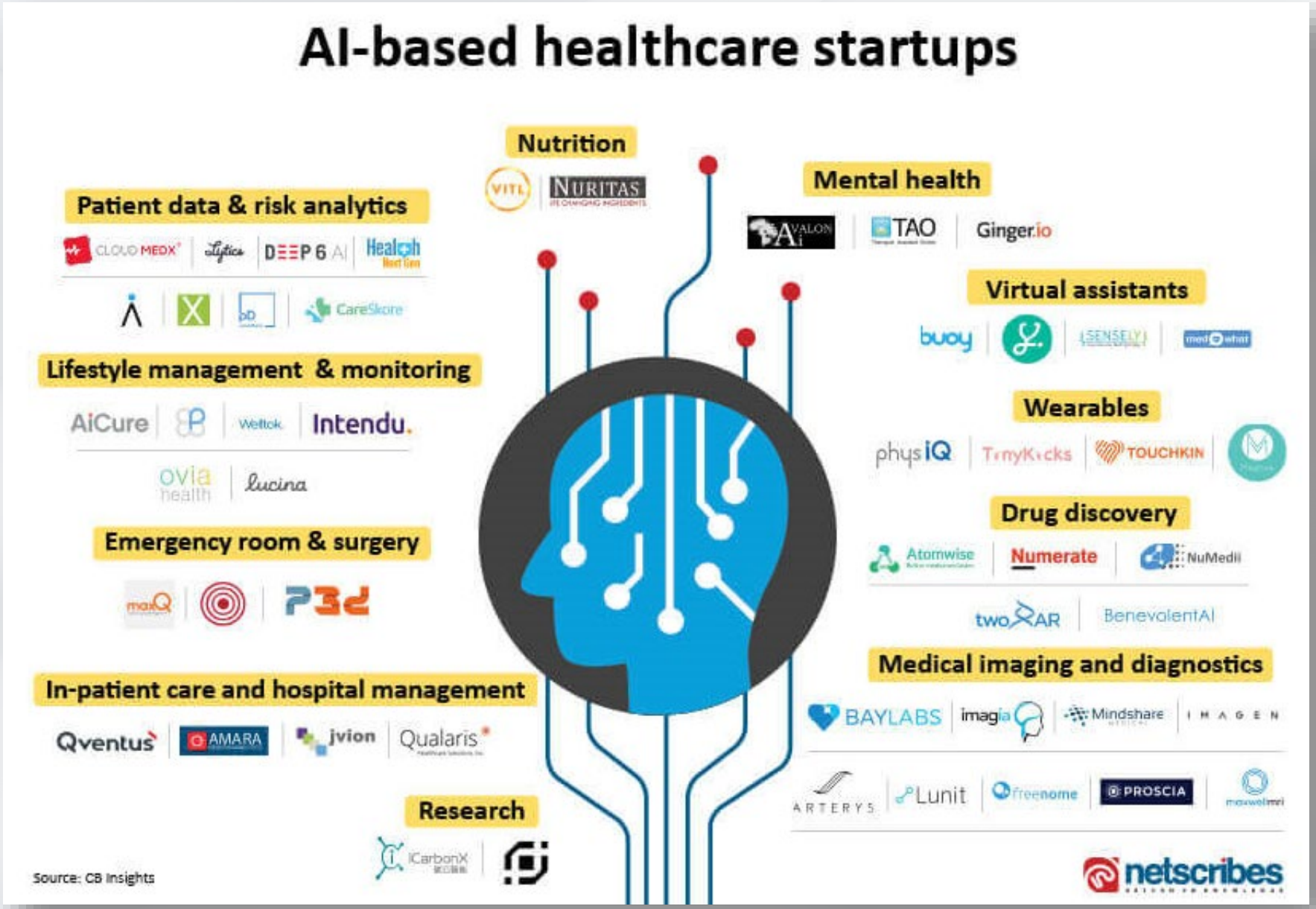
Large language models to identify social determinants of health in electronic health records

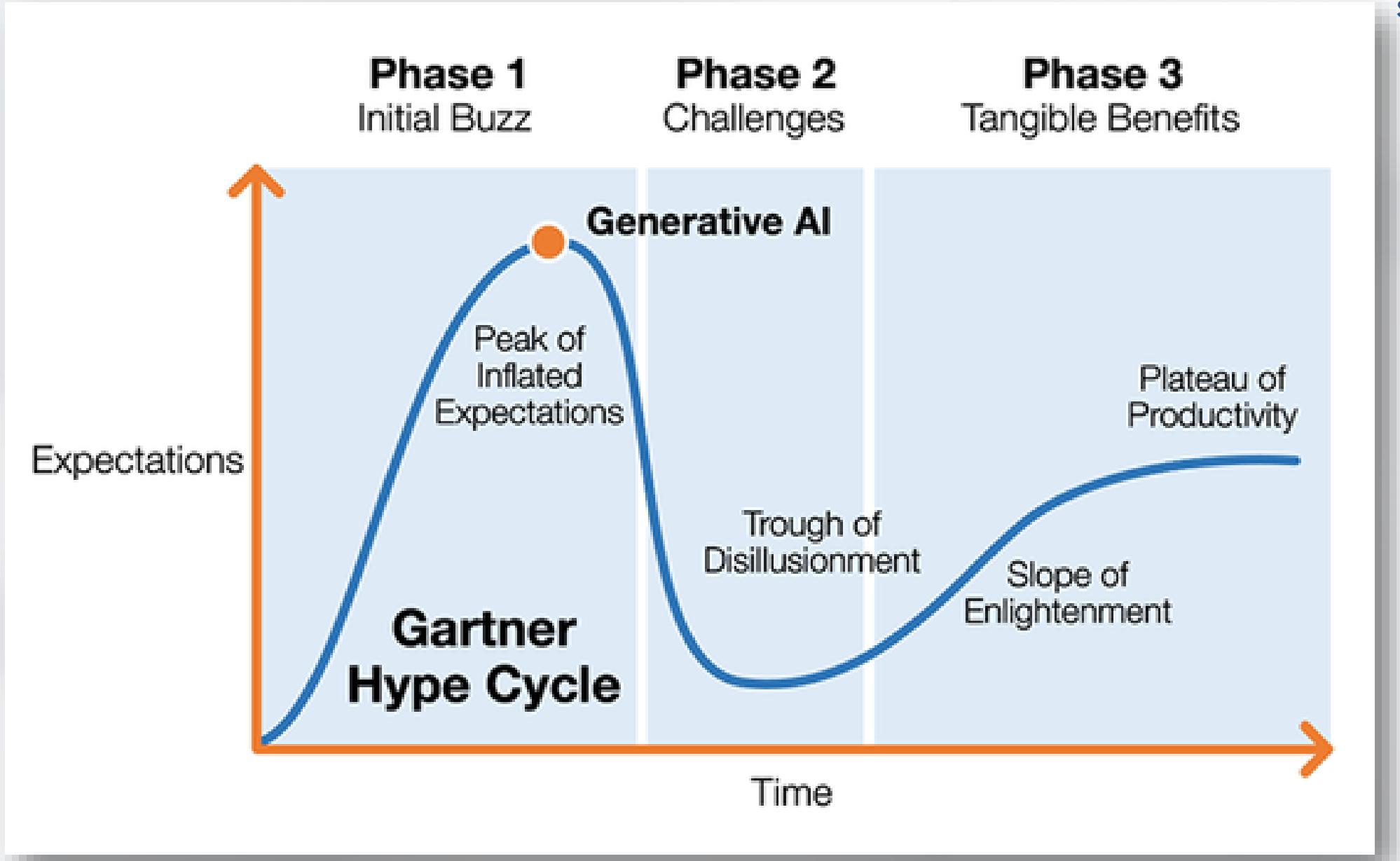
Marco Guevara, Shan Chen, Spencer Thomas, Tafadzwa L. Chaunzwa, Idalid Franco, Benjamin H. Kann, Shalini Moningi, Jack M. Qian, Madeleine Goldstein, Susan Harper, Hugo J. W. L. Aerts, Paul J. Catalano, Guergana K. Savova, Raymond H. Mak & Danielle S. Bitterman

npj Digital Medicine **7**, Article number: 6 (2024) | Cite th



AI-based healthcare startups





Source: https://www.forbes.com/sites/brentdykes/2023/08/30/generative-ai-three-key-factors-that-will-elevate-it-beyond-the-hype/

HHS Trustworthy AI Framework

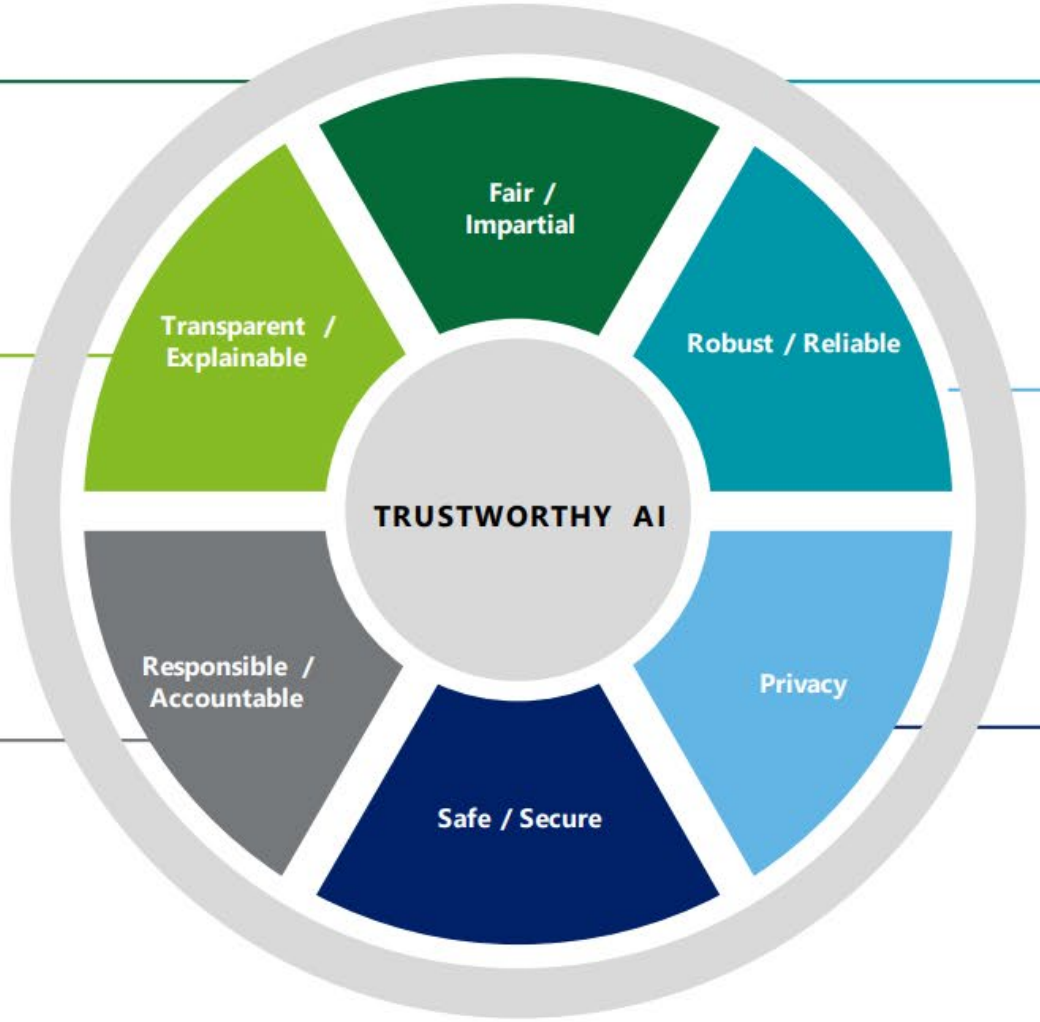
Adapted from Deloitte

CRISP Shared Services

Fair / Impartial
AI applications should include internal and external checks to help ensure equitable application across all participants

Transparent / Explainable
All participants should be able to understand how their data is being used and how AI systems make decisions; algorithms, attributes, and correlations should be open to inspection

Responsible / Accountable
Policies should be in place to determine governance and who is held responsible for the output of AI system decisions



Robust / Reliable
AI systems should have the ability to learn from humans and other systems and produce consistent, accurate, and reliable outputs

Privacy
Consumer privacy should be respected, and customer data should not be used beyond its intended and stated use; consumers should be able to opt in / out of sharing their data

Safe / Secure
AI systems should be protected from risks (including Cyber) that may cause physical and/or digital harm

Transparent / Explainable

A trustworthy AI reality-check: the lack of transparency of artificial intelligence products in healthcare

Jana Fehr[1,2,3], Brian Citro[4], Rohit Malpani[5], Christoph Lippert[1,2,6] and Vince I. Madai[3,7]*

stitute, Potsdam, Germany, [2]Digital Engineering
QUEST Center for Responsible Research, Berlin
erlin, Berlin, Germany, [4]Independent Researcher,
[6]Hasso Plattner Institute for Digital Health at
i, New York, NY, United States, [7]Faculty of
School of Computing and Digital Technology,
dom

Review

September 22, 2021

Lack of Transparency and Potential Bias in Artificial Intelligence Data Sets and Algorithms

A Scoping Review

Roxana Daneshjou, MD, PhD[1,2]; Mary P. Smith, MD[3]; Mary D. Sun, MSCR[4]; et al

» Author Affiliations

JAMA Dermatol. 2021;157(11):1362-1369. doi:10.1001/jamadermatol.2021.3129

Fair / Impartial

Journal of Stroke & Cerebrovascular Diseases

RESEARCH ARTICLE | VOLUME 30, ISSUE 7, 105832, JULY 2021 Download Full Issue

Discrepancies in Stroke Distribution and Dataset Origin in Machine Learning for Stroke

Lohit Velagapudi, BS • Nikolaos Mouchtouris, MD • Michael P. Baldassari, BA • ...
Stavropoula Tjoumakaris, MD • Robert H. Rosenwasser, MD, MBA • Pascal Jabbour, MD •
Show all authors

Published: April 30, 2021 • DOI: https://doi.org/10.1016/j.jstrokecerebrovasdis.2021.105832

FIGURE 2A – Incidence of Stroke in 2018 per 100K, by State

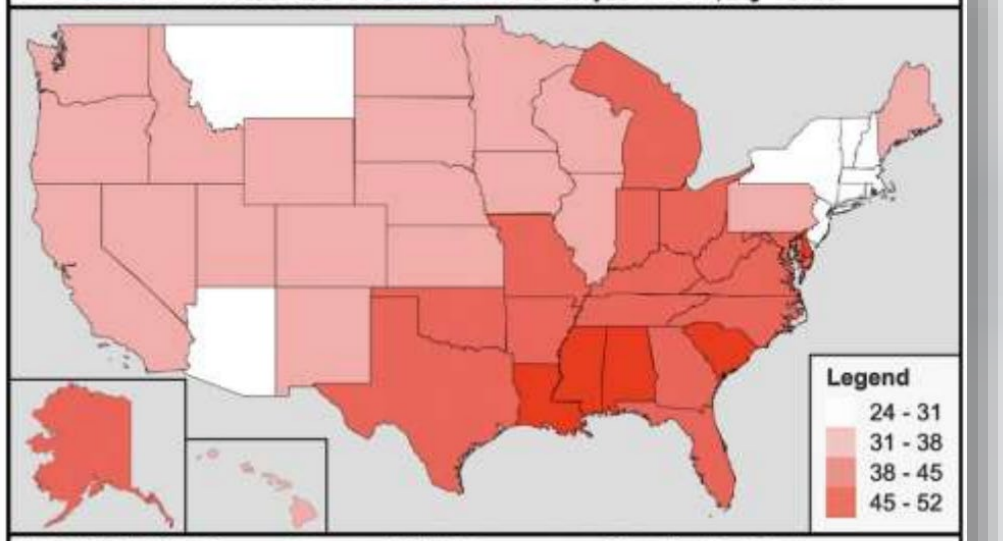
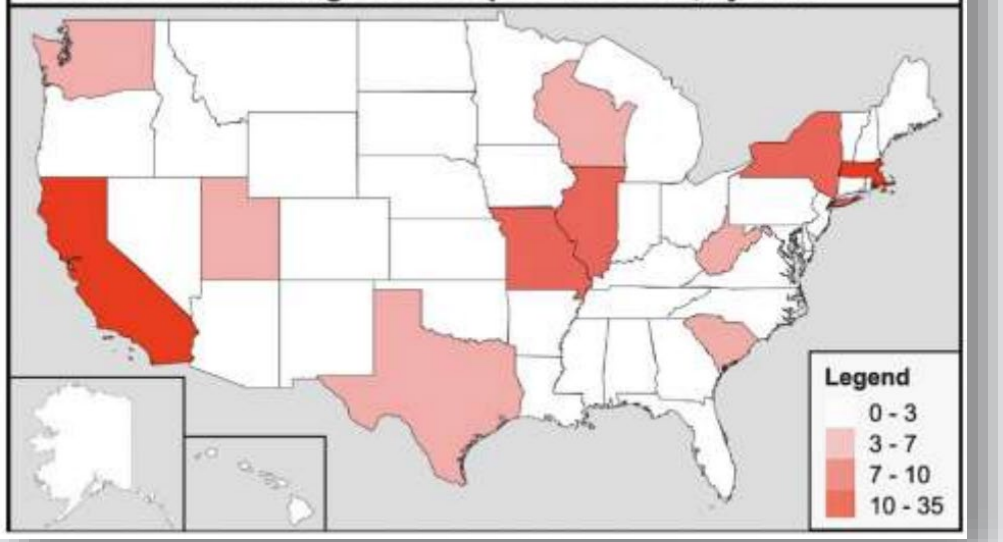
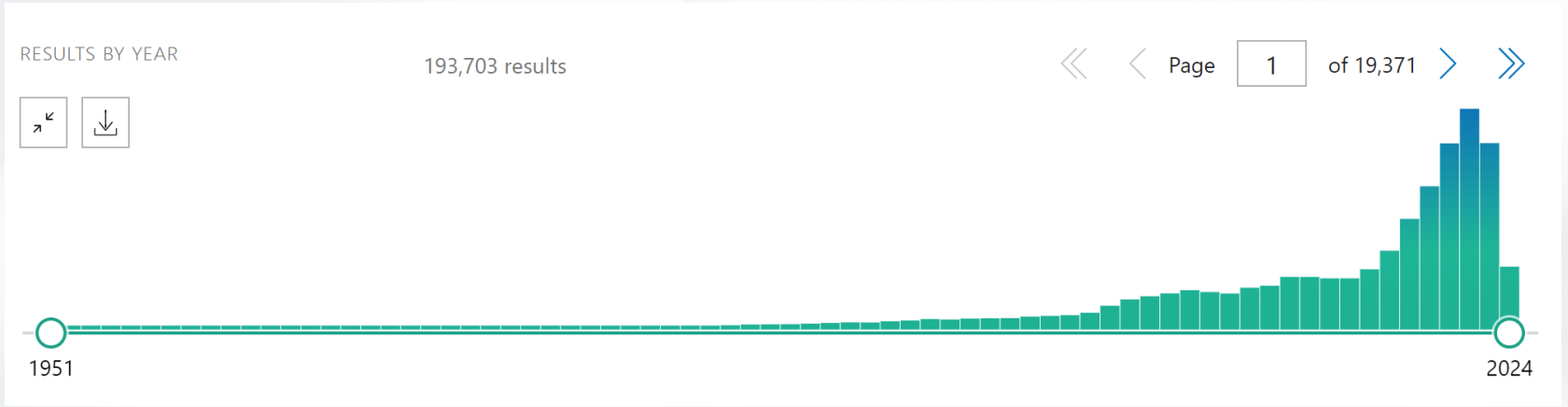


FIGURE 2B - Percentage of ML Papers on Stroke, by State





- **Data quality**
  - Is the training data accurate and representative?
- **Methodology**
  - Was the tool developed appropriately?
- **Model Performance and Monitoring**
  - Is the model performing as expected?
  - Is the model monitored over time to identify continuous performance?
- **Consistency**
  - How do new versions of the AI tool impact output?

CRISP
Shared Services

- **Data Sensitivity**
  - Is there sensitive data that needs to be treated differently?
- **Individual Privacy**
  - Are individuals aware of how their data is being used and given the opportunity to opt out?
- **Legal Requirements**
- **Data Sharing and Use**

CRISP
Shared Services

Safe / Secure

The HIPAA Journal

Michigan's Largest FQHC Suffers Ransomware Attack Affecting 184,000 Patients

Cherry Street Services, Inc., which operates as Cherry Health Services, fell victim to a ransomware attack in December 2023.

The New York Times

Cyberattack Paralyzes the Largest U.S. Health Care Payment System

The hacking shut down the nation's biggest health care payment system, causing financial chaos that affected a broad spectrum ranging from...

CBS News

Lurie Children's Hospital health records, phone lines back up after cyberattack

CHICAGO (CBS) -- Lurie Children's Hospital said late Monday that it was making progress in getting all its systems back online,...

Responsible / Accountable

USA Today

UnitedHealth's artificial intelligence denies claims in error, lawsuit says

For years, vital decisions about who got medical care coverage took place in back offices at health insurance companies.

Nov 19, 2023

- **Roles and Responsibilities**
  - Are there clear roles and responsibilities? Who is responsible for the output?
- **Digital Identity management**
  - Can you keep track of who is using the tool and how?
- **Traceability**
  - Can you retrace how the AI solution arrived at a given solution?
- **Auditability**
  - Could a third-party assesss the appropriateness of the decision making?

AI Governance

Adapted from Deloitte's Trustworthy AI framework

Possible AI Use Cases at CRISP

Internal Operational Efficiency

- **Features and requirements documentation**
- Technical documentation
- Code review support
- Salesforce cleanup
- Locate appropriate policies and procedures

Utilization

- **Targeted outreach to participants**
- Educational materials for specific user groups
- Identify gaps in tool design to drive the most utilization

Workflows and User Experience

- **Role-based display of patient data**
- Identify areas for improved user experience
- Smart universal search

Data Quality

- **Clinical data standardization across sources**
- Improve patient matching
- Identify and remove duplicates
- NLP of free text notes

Clinical Decision Making

- **Summarization of HIE record for care team**
- Combine outside records with internal EHR data for enhanced clinical decision support