



Società
Italiana
Intelligenza
Artificiale in
Medicina

Andrea Causio, fondatore e VP





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AGENDA

- Artificial Intelligence
- Big Data
- Machine Learning
- Use cases
- Generative AI
- Società Italiana Intelligenza Artificiale in Medicina (SIIAM)

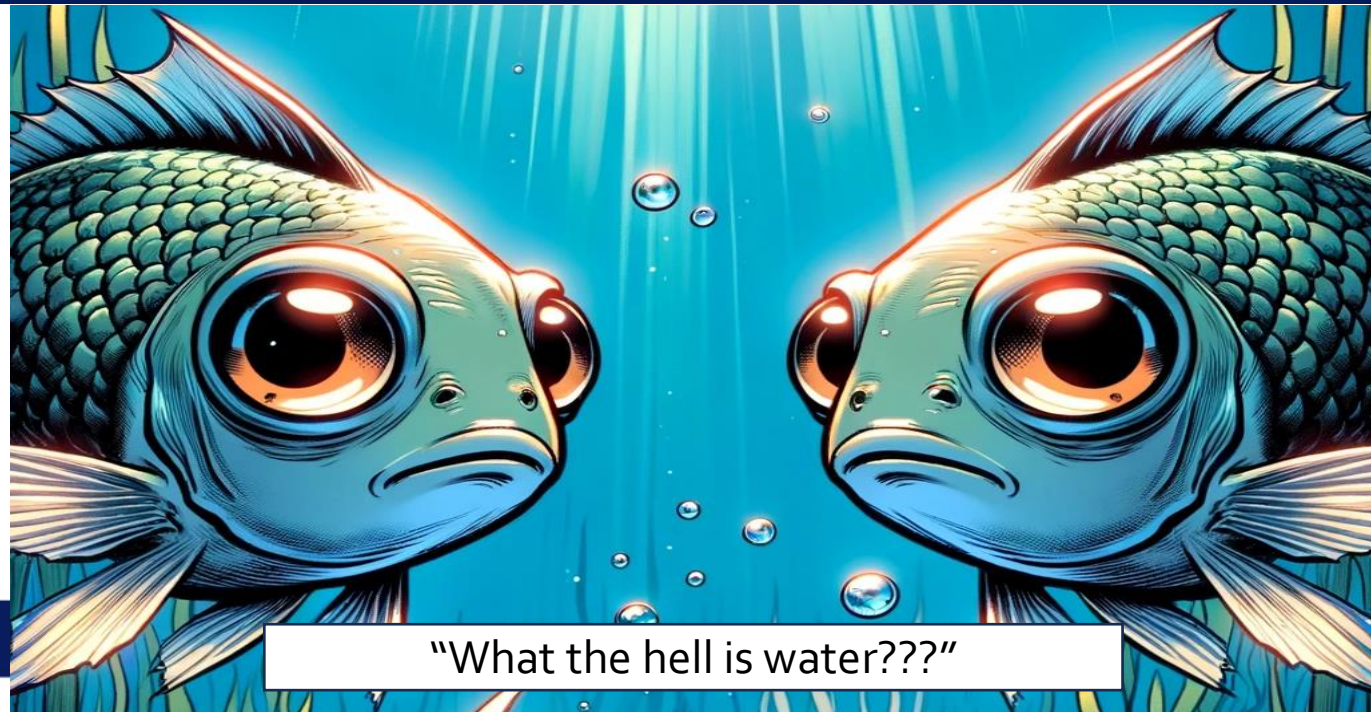




Two fishes, swimming...



"The water today is lovely, isn't it?"



"What the hell is water???"

David Foster Wallace, *This Is Water: Some Thoughts, Delivered on a Significant Occasion, about Living a Compassionate Life.*

Artificial Intelligence (AI)

The theory and development of computer systems able to **perform tasks normally requiring human intelligence**, such as visual perception, speech recognition, decision-making, and translation between languages.

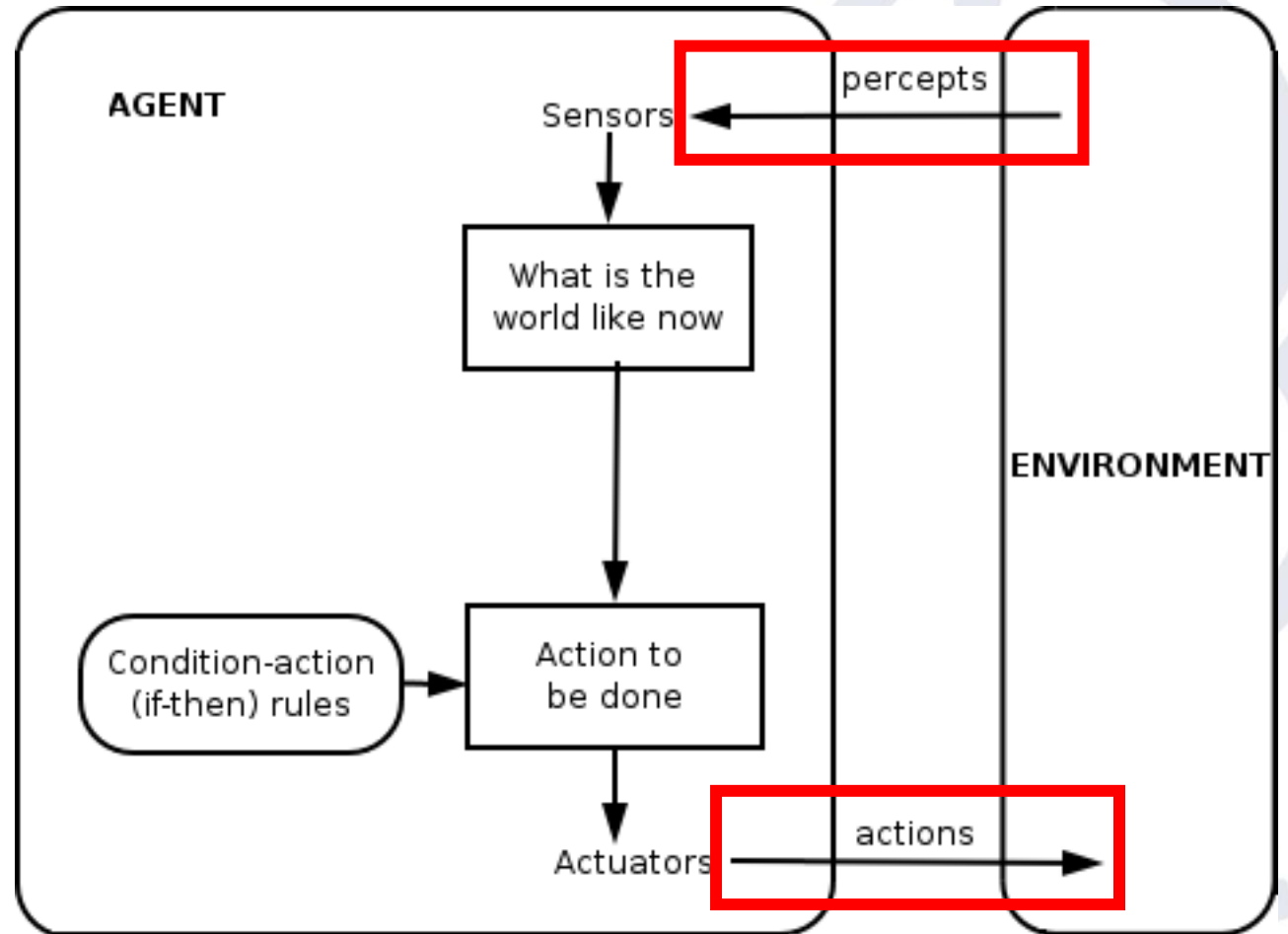
OxfordLanguages





INTELLIGENT AGENT

An agent acting in an intelligent manner; It **perceives its environment**, **takes actions autonomously** to achieve goals, and may improve its performance with learning or acquiring knowledge.





NARROW ARTIFICIAL INTELLIGENCE

- Focused on one single task
- Mimicking how humans perform basic actions such as remembering things, perceiving things, and solving simple problems





A. M. Turing (1950) *Computing Machinery and Intelligence*. *Mind* 49: 433-460.

COMPUTING MACHINERY AND INTELLIGENCE

By A. M. Turing

1. The Imitation Game

I propose to consider the question, "Can machines think?" This should begin with definitions of the meaning of the terms "machine" and "think." The definitions might be framed so as to reflect so far as possible the normal use of the words, but this attitude is dangerous, If the meaning of the words "machine" and "think" are to be found by examining how they are commonly used it is difficult to escape the conclusion that the meaning and the answer to the question, "Can machines think?" is to be sought in a statistical survey such as a Gallup poll. But this is absurd. Instead of attempting such a definition I shall replace the question by another, which is closely related to it and is expressed in relatively unambiguous words.

<https://redirect.cs.umbc.edu/courses/471/papers/turing.pdf>

A Proposal for the Dartmouth Summer Research Project on Artificial Intelligence

August 31, 1955

*John McCarthy, Marvin L. Minsky,
Nathaniel Rochester,
and Claude E. Shannon*

<https://ojs.aaai.org/aimagazine/index.php/aimagazine/article/view/1904>



Big Data

Extremely large data sets that may be analysed computationally to reveal **patterns, trends, and associations**, especially relating to human behaviour and interactions.

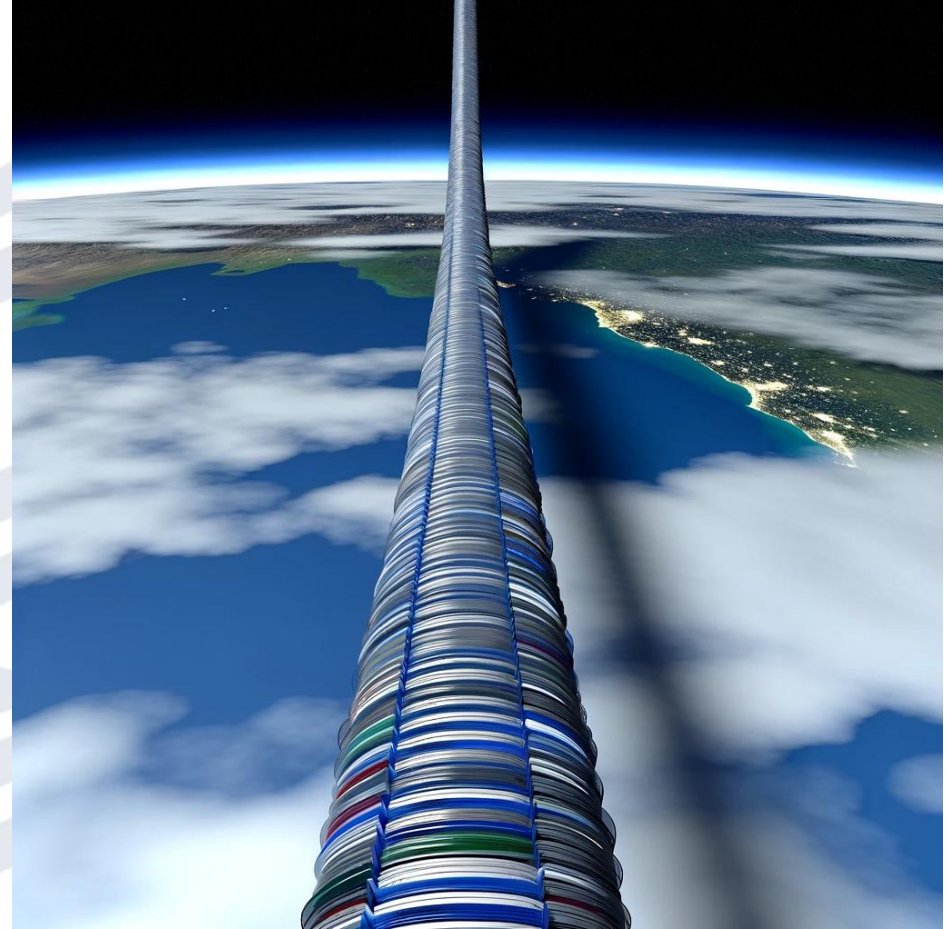
OxfordLanguages



1994 – 700 megabytes

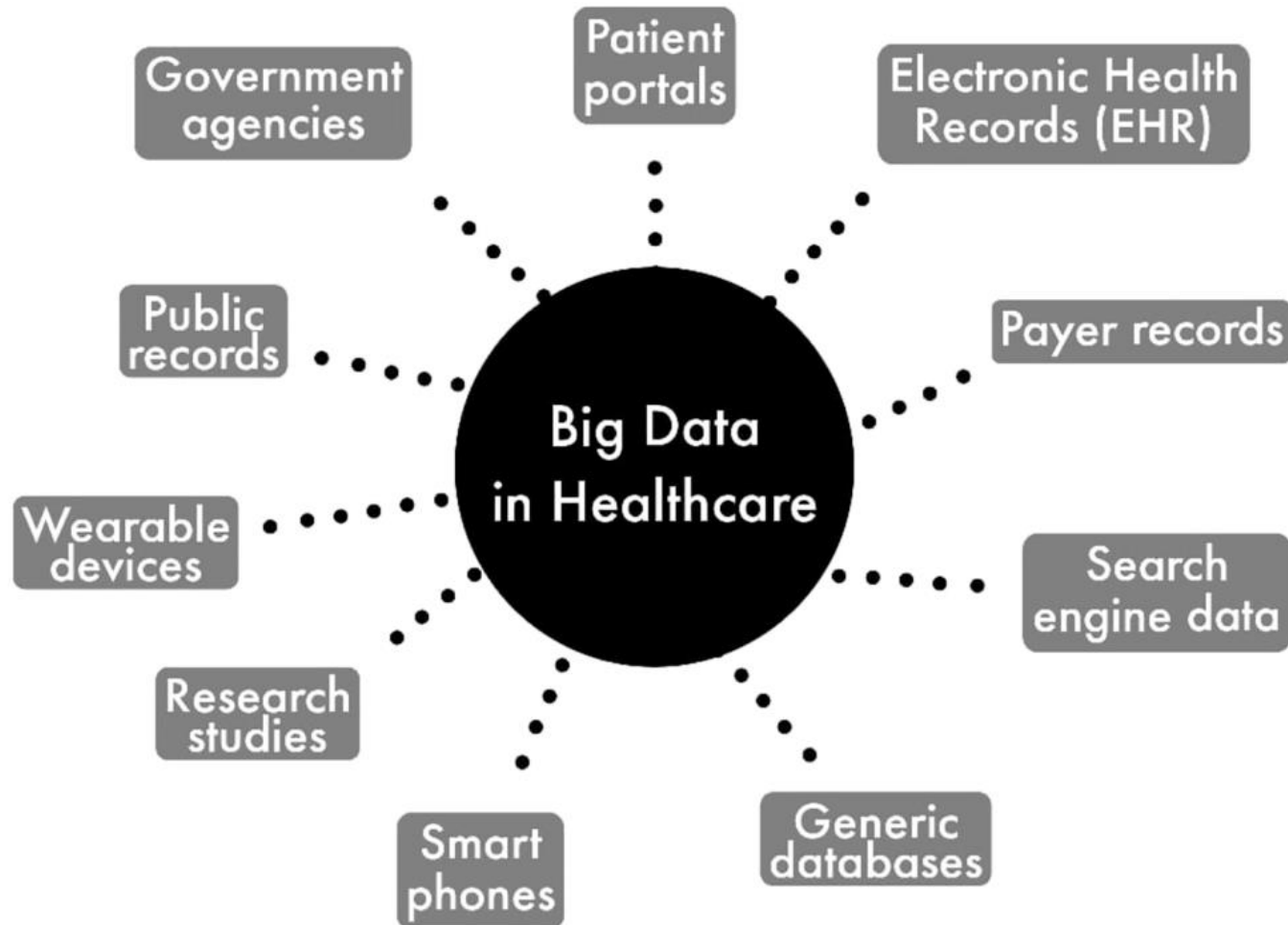


2017 – 2.5 exabytes/day





WHERE IS THE DATA COMING FROM?



Machine Learning

The use and development of computer systems that are able to learn and adapt **without following explicit instructions**, by using algorithms and statistical models to analyse and **draw inferences from patterns in data**.

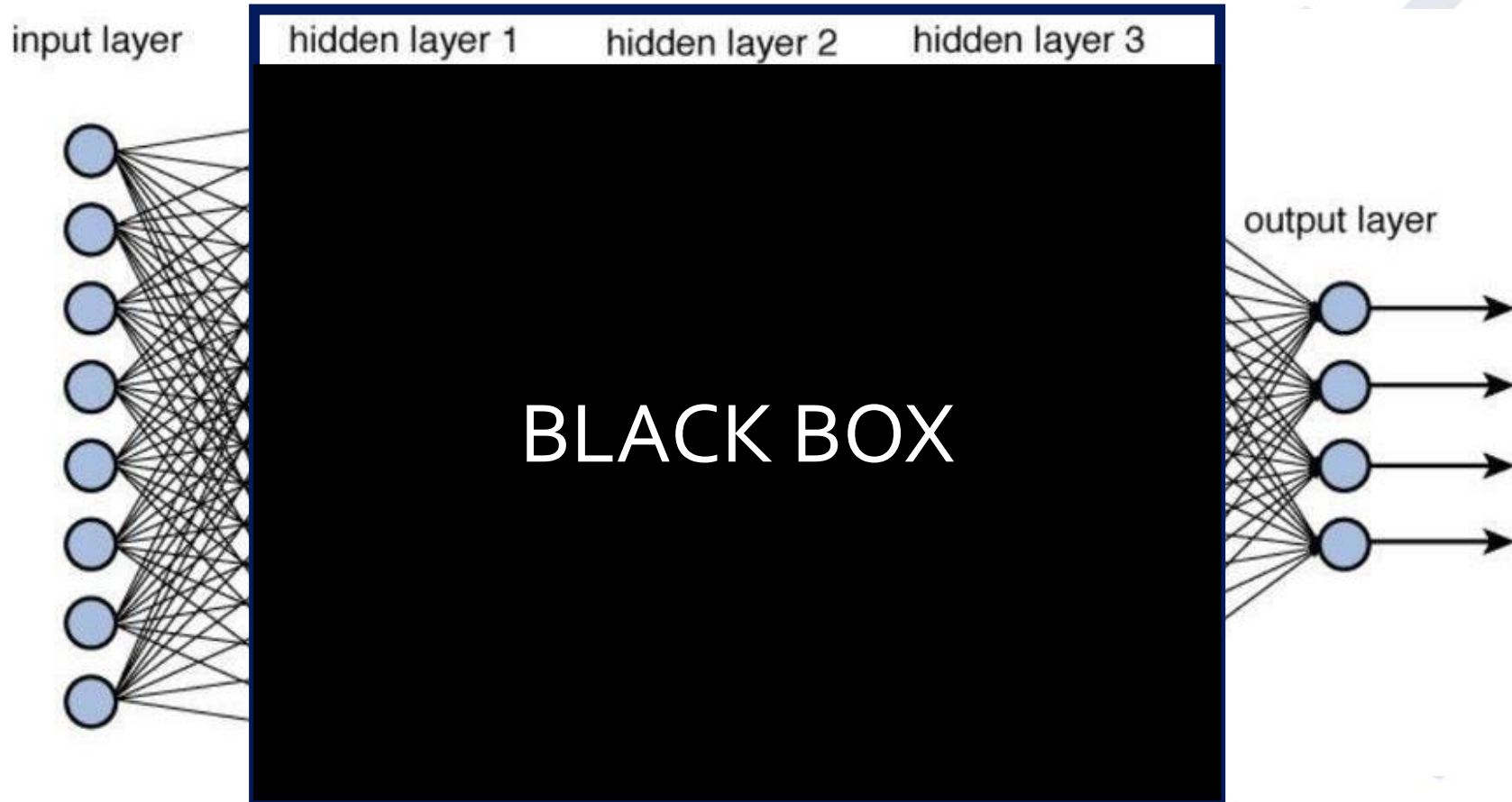
Deep learning: A type of machine learning based on **artificial neural networks** in which multiple layers of processing are used to extract progressively higher level features from data.



OxfordLanguages



NEURAL NETWORK



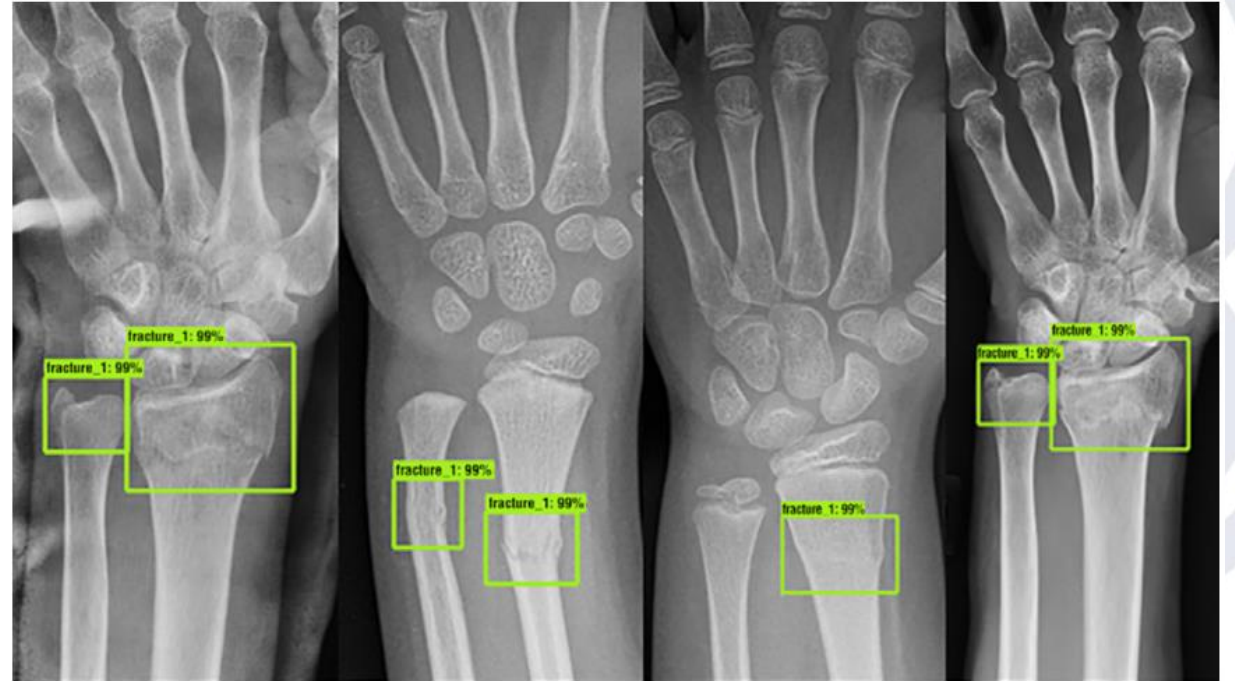
<https://towardsdatascience.com/training-deep-neural-networks-9fdb1964b964>





USE CASE: RADIOLOGY

- Detection and localization of fractures:
 - Radius: 91.2% (n = 310/340), AUC 95.7%
 - Ulna: 96.3% (n = 236/245), AUC 96.7%

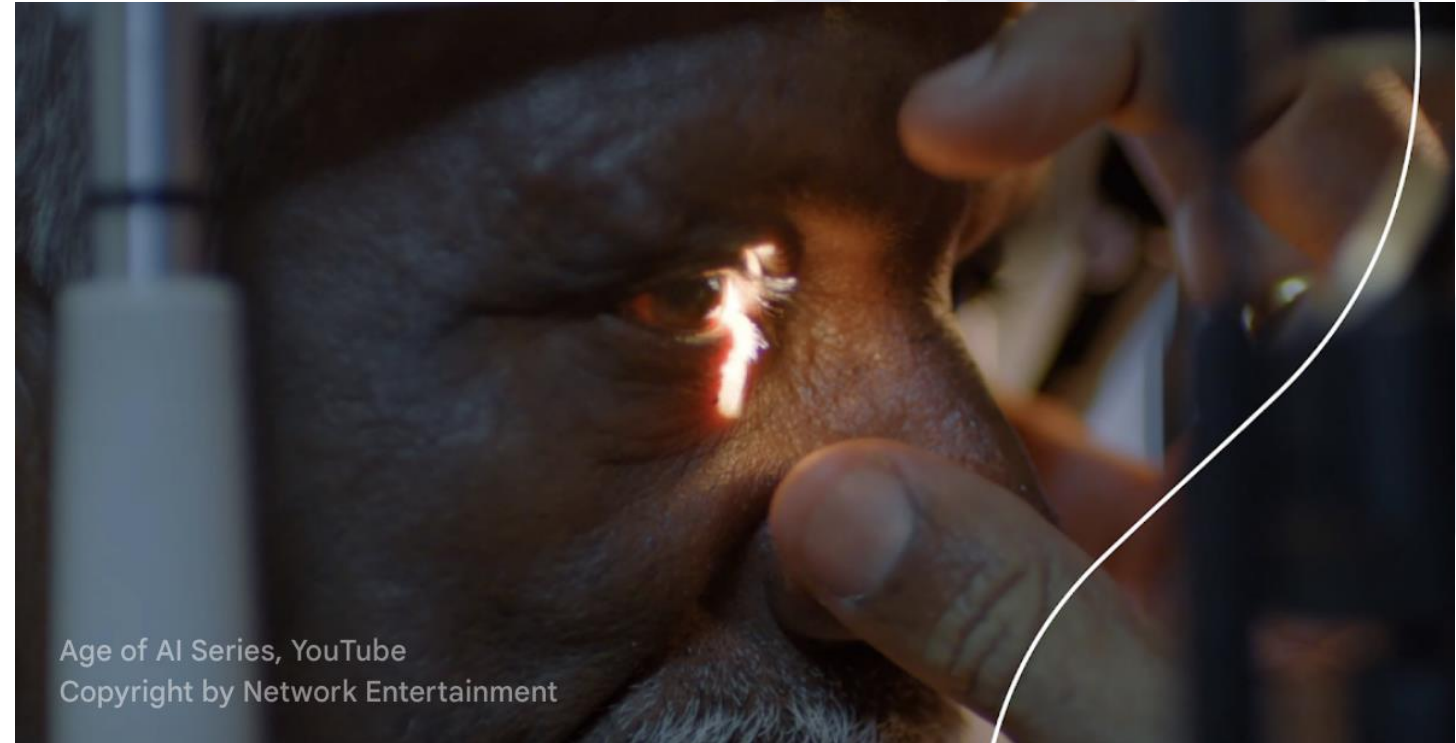




USE CASE : OPHTHALMOLOGY



- Automated Retinal Disease Assessment, or ARDA, uses artificial intelligence to help healthcare workers detect diabetic retinopathy
- Over 420 million people have diabetes globally, making widespread screening unfeasible.



Age of AI Series, YouTube
Copyright by Network Entertainment

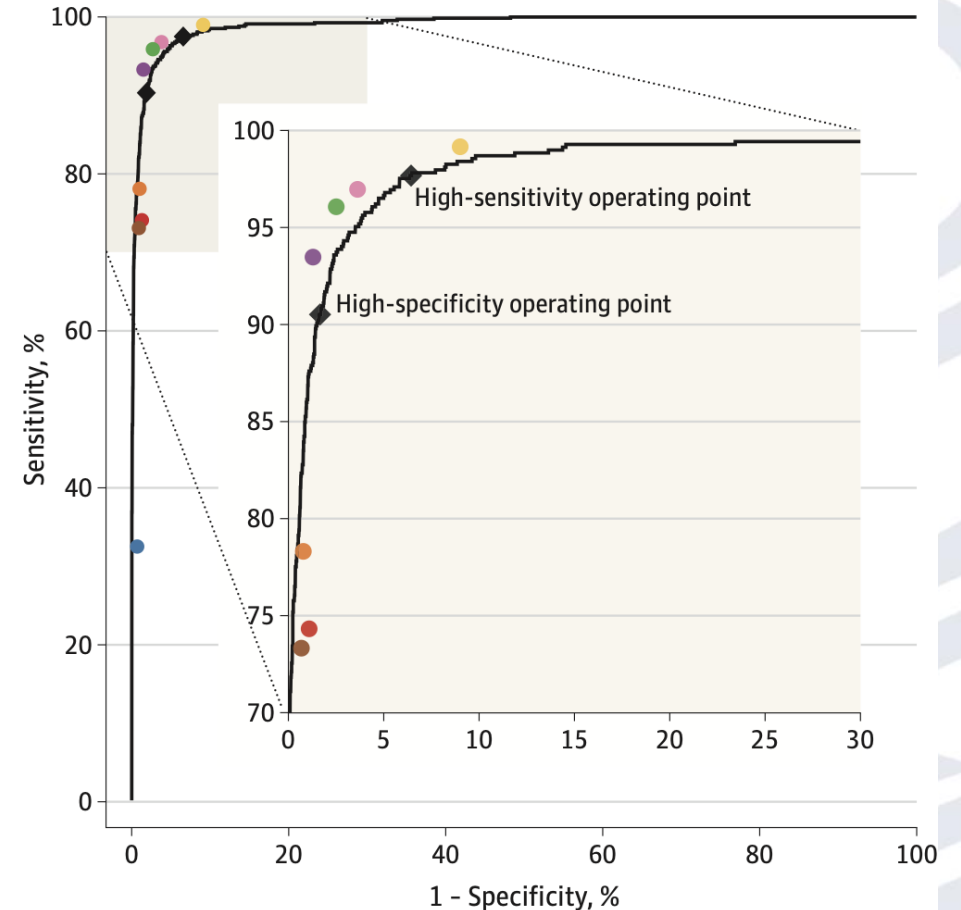


USE CASE : OPHTHALMOLOGY



- Detection of diabetic retinopathy (high sensitivity):
 - Sensitivity = 97.5%
 - Specificity = 93.4%
- Detection of diabetic retinopathy (high specificity):
 - Sensitivity = 90.3%
 - Specificity = 98.1%

A EyePACS-1: AUC, 99.1%; 95% CI, 98.8%-99.3%





USE CASE : DERMATOLOGY



AI assistant:

- ≤5 Top-matching skin conditions and AI confidence
- Additional information about each condition

3 Matching conditions

SCC/SCCIS, Basal Cell Carcinoma, Actinic Keratosis

SCC/SCCIS

Assistant confidence

Keratinocyte malignancy, often characterized by tender, pink scaly, bleeding nodules and plaques, often found on head, neck dorsal hands/forearms, and legs, and constituting the second most common type of skin cancer. SCCIS, or Bowen disease, which often presents as scaly, pink-brown plaque, represents noninvasive (in situ, not penetrating dermis) stage of SCC that may progress to invasive disease if left untreated.

Textbook images

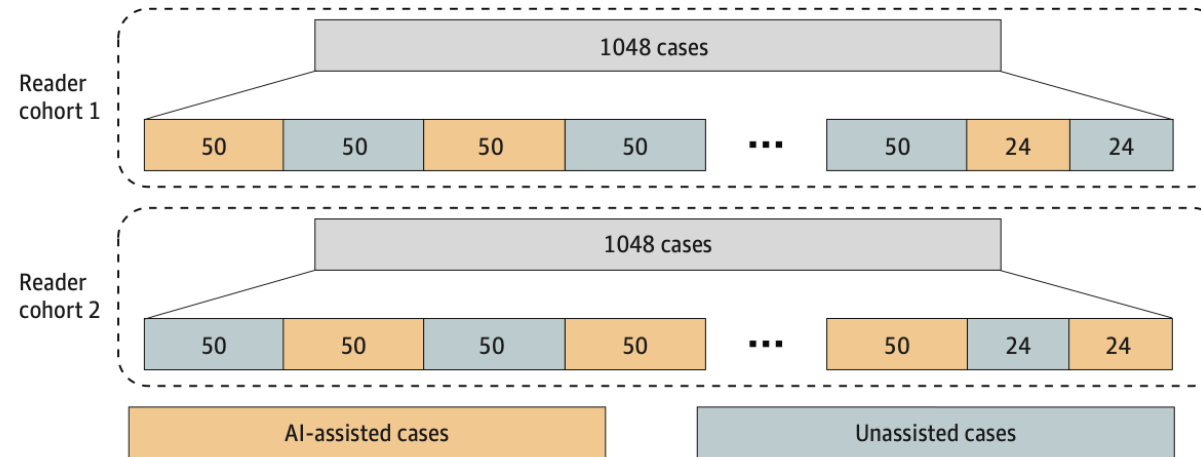
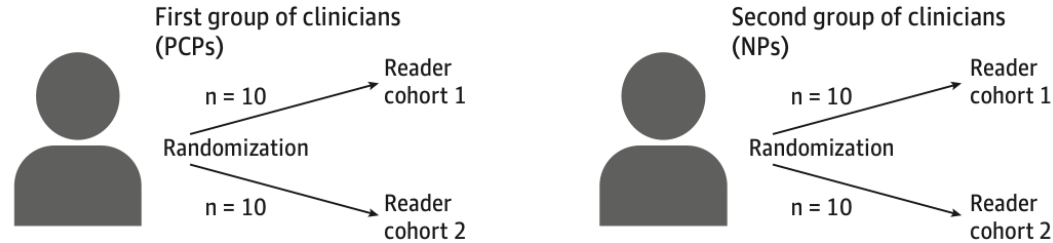
Images of SCC/SCCIS similar to patient's presentation

View textbook images

View similar images

More about this condition

Scrolling shows more conditions and information



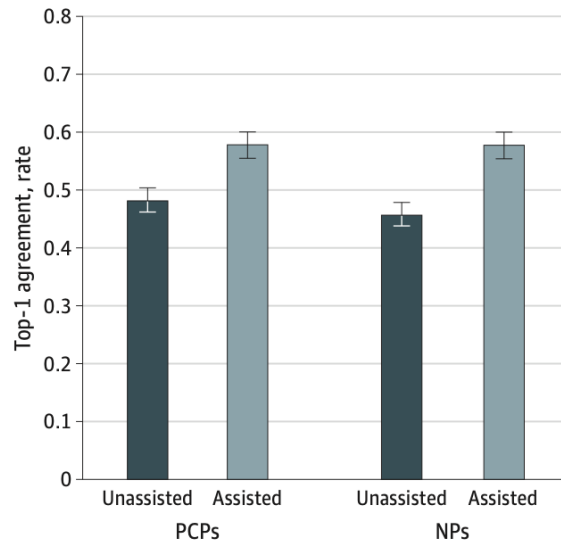
- 40 clinicians each reviewed 1048 teledermatology cases (50% assisted – 50% unassisted)
- The AI assistant shows as many as 5 top predictions of skin conditions



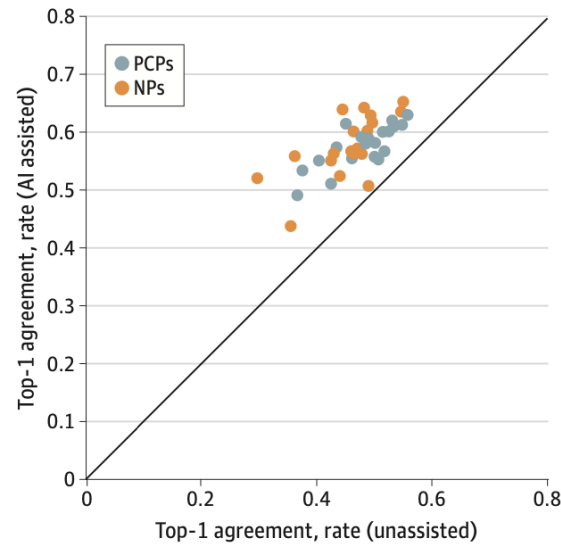
USE CASE : DERMATOLOGY



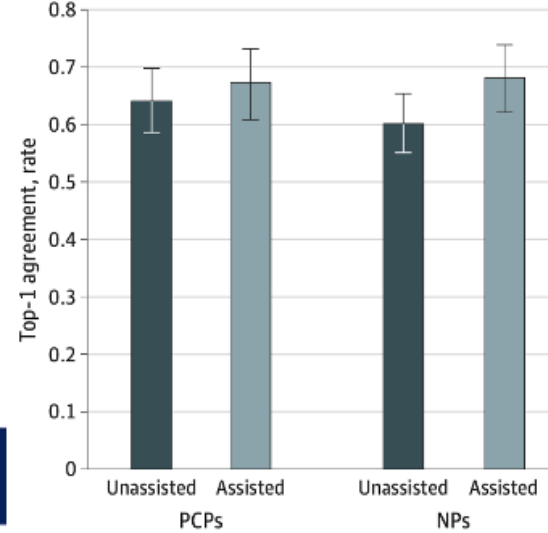
A Agreement with reference diagnoses for all cases



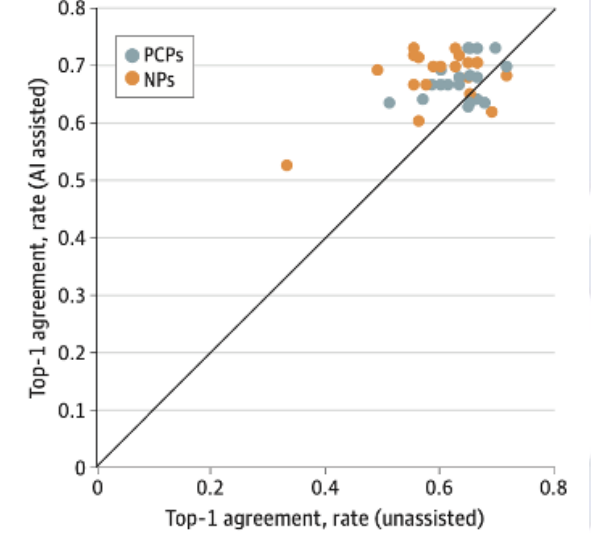
B Agreement with reference diagnoses for all cases, assisted vs unassisted diagnoses



C Agreement with reference diagnoses for all biopsy specimens



D Agreement with reference diagnoses for all biopsy specimens, assisted vs unassisted diagnoses



- Artificial intelligence assistance was associated with a higher agreement rate with dermatologists' reference diagnoses for both PCPs and NPs.
- **Lower rates** of recommending a **biopsy** or **specialist referral**.
- The absolute effect sizes of 10% and 12% correspond to **an improved diagnosis for 1 in every 8 to 10 cases**.

Generative AI

An AI capable of generating text, images, or other data based on the patterns and structure of their input training data and then generating new data that has similar characteristics.

[https://arxiv.org/abs/2307.15208;](https://arxiv.org/abs/2307.15208)

<https://www.nytimes.com/article/ai-artificial-intelligence-glossary.html>





You

I will hold a presentation on artificial intelligence focusing on the medical field. I would like to have one single slide where I introduce ChatGPT. Reply with the identical output that I should then screenshot and paste on my presentation.



ChatGPT

For your presentation on artificial intelligence in the medical field, you can introduce ChatGPT with the following slide content:

Introducing ChatGPT in Medicine

ChatGPT: An Advanced AI Model by OpenAI

- **What is ChatGPT?**

- A state-of-the-art language model developed by OpenAI, capable of understanding and generating human-like text based on the input it receives.
- Utilizes deep learning techniques to process and produce language across a wide range of topics and tasks.

- **Applications in Medicine**

- **Medical Information Retrieval:** Quickly provides medical information, supporting healthcare professionals in accessing vast amounts of data.





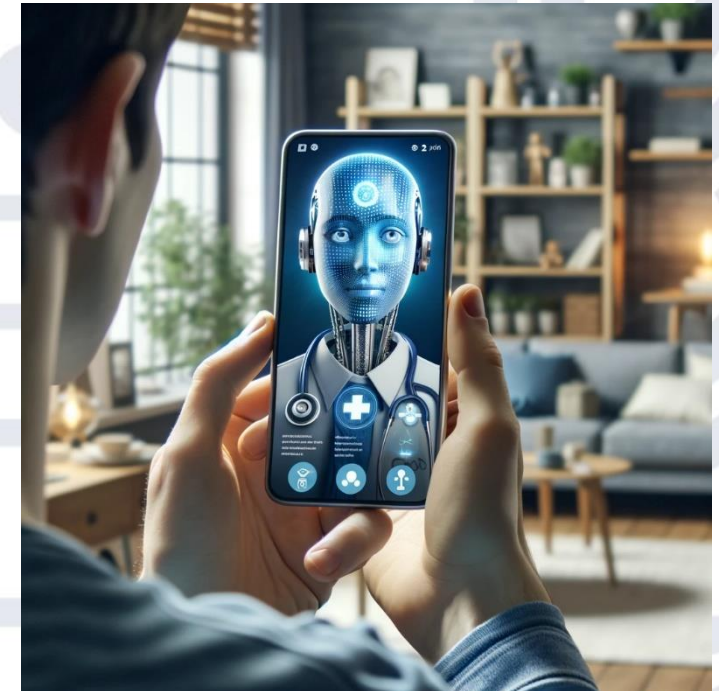
Towards Conversational Diagnostic AI



Tao Tu^{*,1}, Anil Palepu^{*,1}, Mike Schaeckermann^{*,1},
Khaled Saab¹, Jan Freyberg¹, Ryutaro Tanno², Amy Wang¹, Brenna Li¹, Mohamed Amin¹,
Nenad Tomasev², Shekoofeh Azizi², Karan Singhal¹, Yong Cheng², Le Hou¹, Albert Webson²,
Kavita Kulkarni¹, S. Sara Mahdavi², Christopher Semturs¹,
Juraj Gottweis¹, Joelle Barral², Katherine Chou¹, Greg S. Corrado¹, Yossi Matias¹,
Alan Karthikesalingam^{†,1} and Vivek Natarajan^{†,1}

¹Google Research, ²Google DeepMind

- Articulate Medical Intelligence Explorer (Amie)
- Simulation of an online patient – physician chat



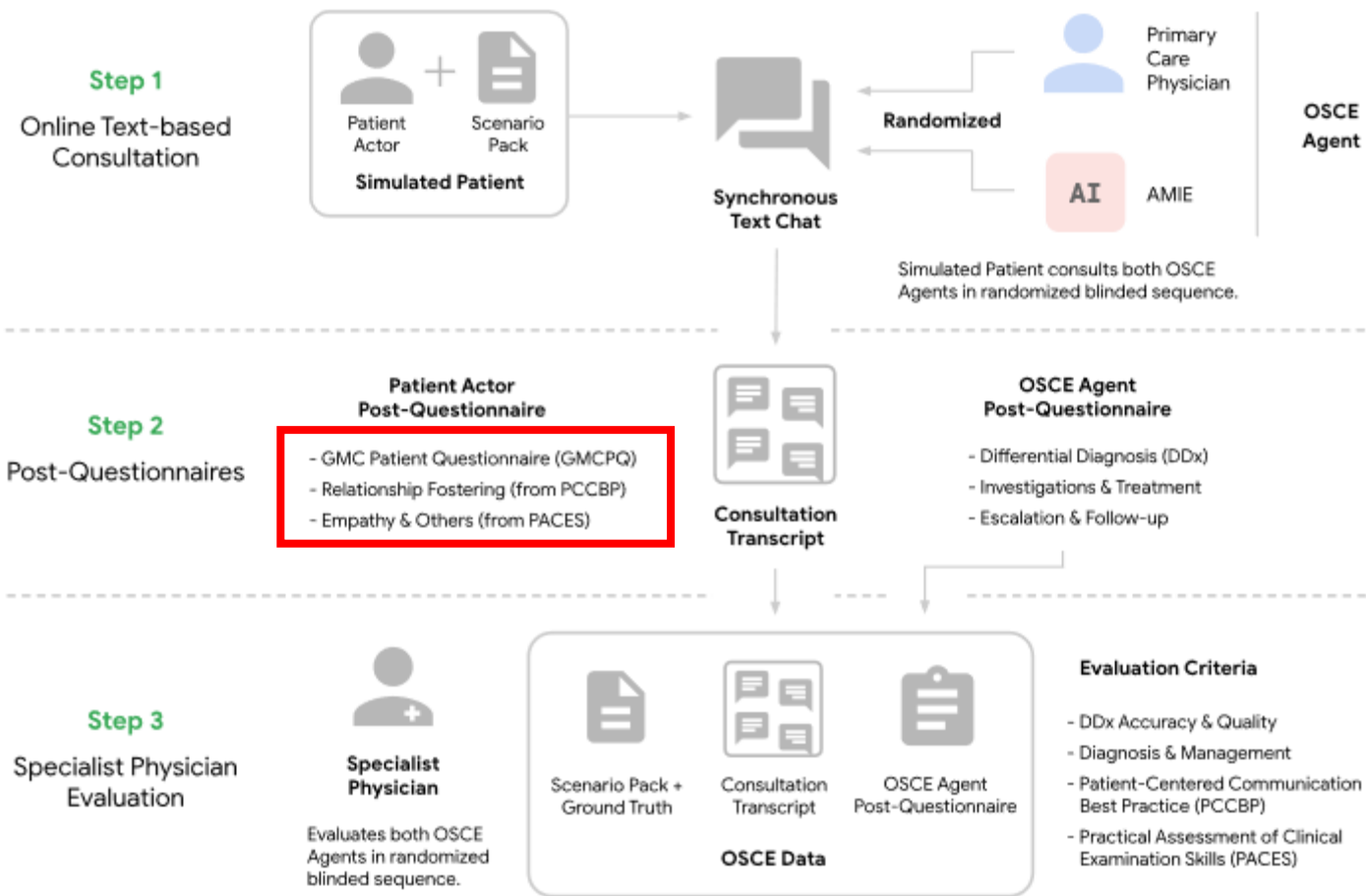


Figure 2 | Overview of randomized study design. A primary care physician (PCP) and AMIE perform (in a randomized order) a virtual remote Objective Structured Clinical Examination (OSCE) with simulated patients via online multi-turn synchronous text chat and produce answers to a post-questionnaire. Both the PCP and AMIE are then evaluated by both the patient actors as well as specialist physicians.

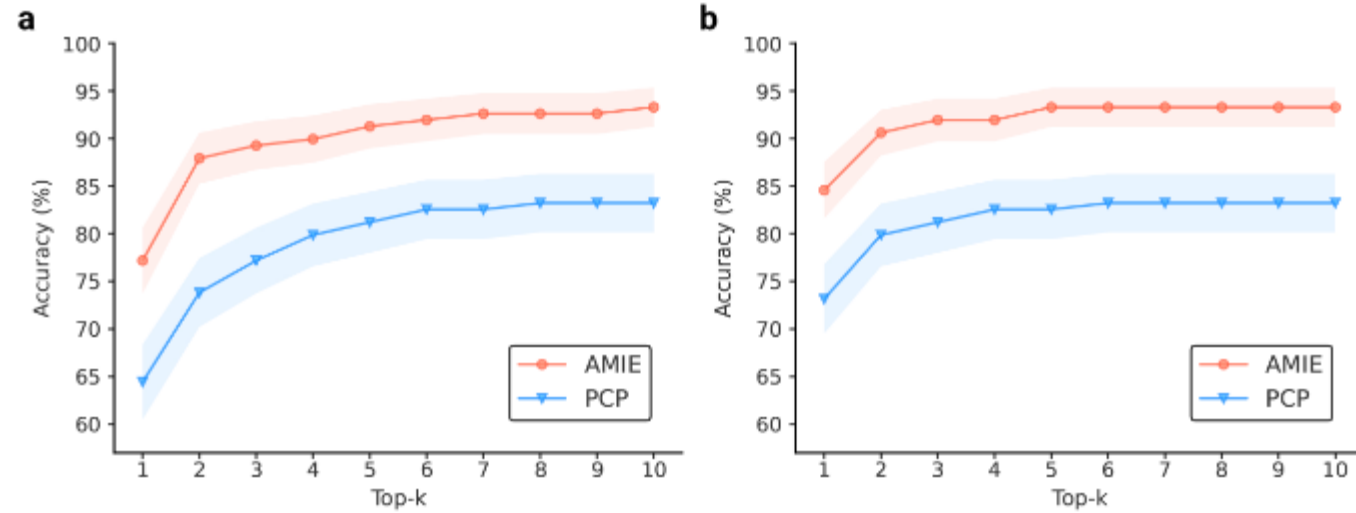
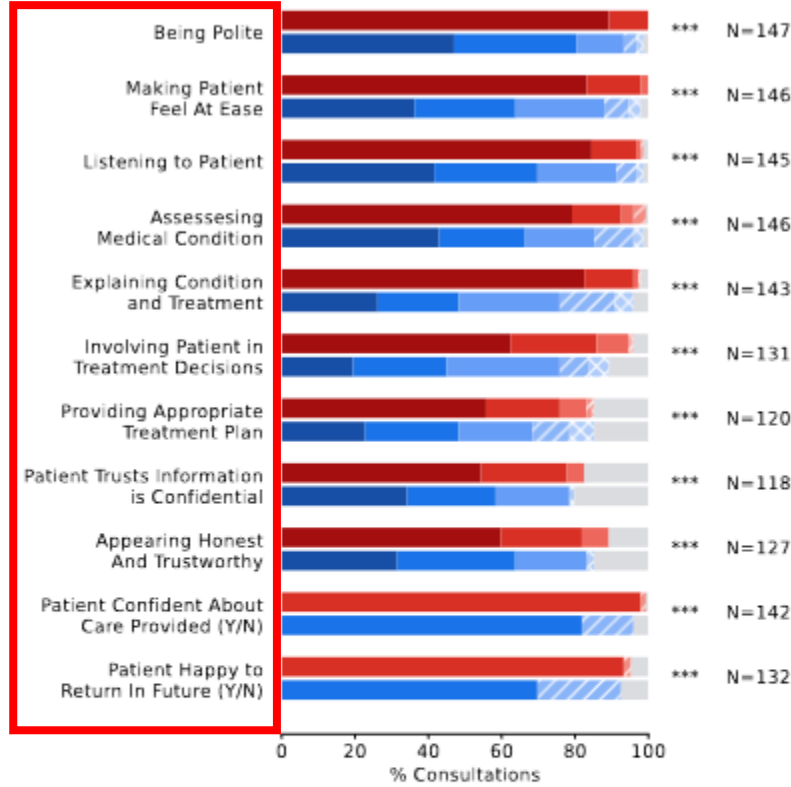


Figure 3 | Specialist-rated top-k diagnostic accuracy. AMIE and PCPs top-k DDX accuracy are compared across 149 scenarios with respect to the ground truth diagnosis (a) and all diagnoses in the accepted differential (b). Bootstrapping ($n=10,000$) confirms all top-k differences between AMIE and PCP DDX accuracy are significant with $p < 0.05$ after FDR correction.

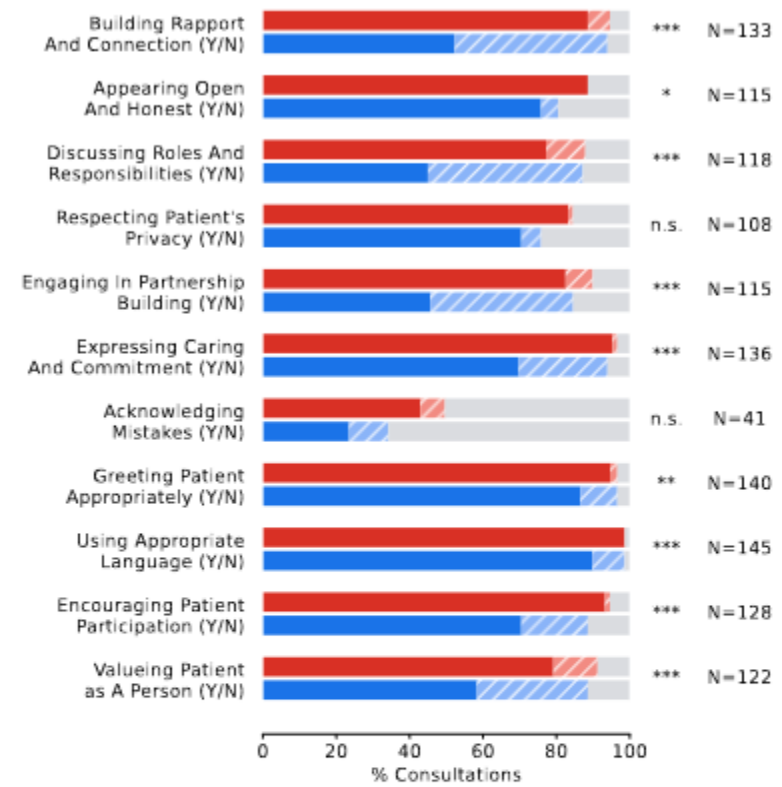




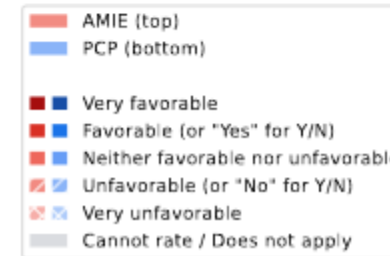
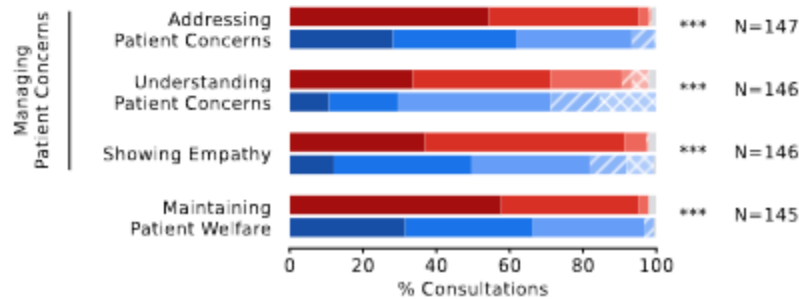
GMCPQ



PCCBP

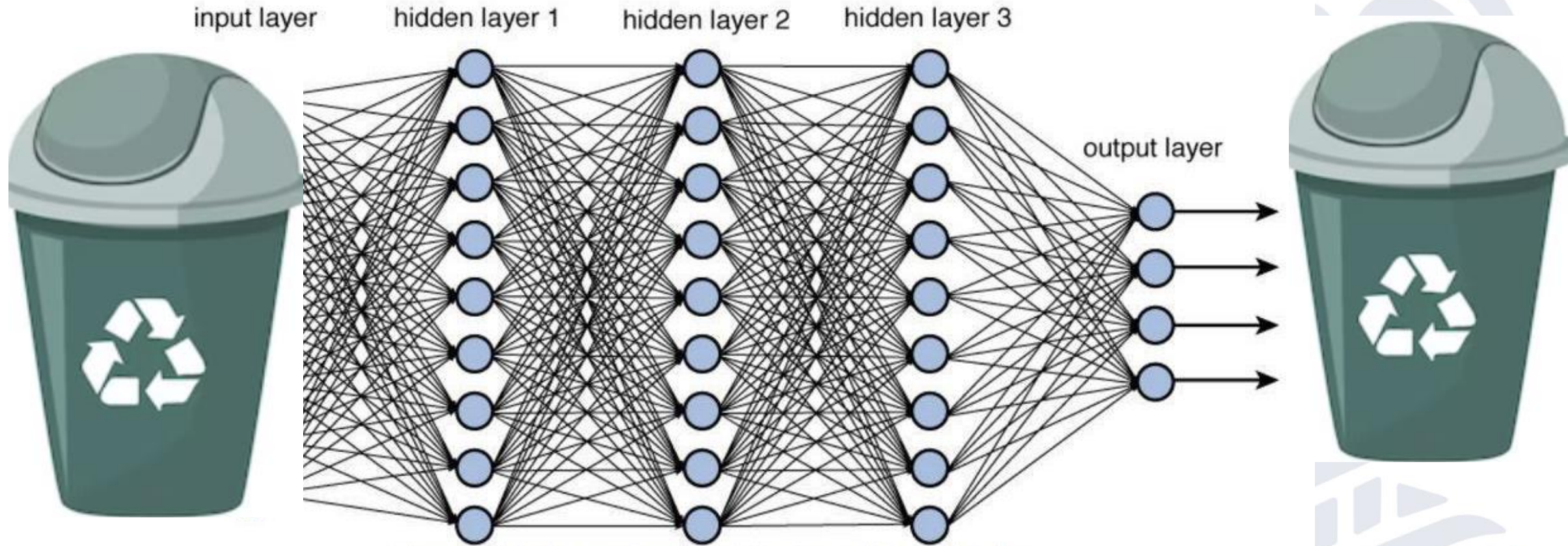


PACES





NEURAL NETWORKS



<https://towardsdatascience.com/training-deep-neural-networks-9fdb1964b964>





LARGE LANGUAGE MODELS

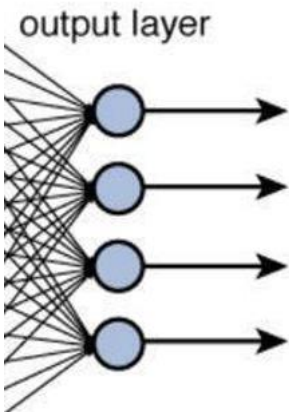
BRIEF COMMUNICATION

OPEN



Large language models propagate race-based medicine

Jesutofunmi A. Omiye^{1,2,6}, Jenna C. Lester^{3,6}, Simon Spichak⁴, Veronica Rotemberg^{5,7} and Roxana Daneshjou^{1,2,7}✉



Large language models (LLMs) are being integrated into healthcare systems; but these models may recapitulate harmful, race-based medicine. The objective of this study is to assess whether four commercially available large language models (LLMs) propagate harmful, inaccurate, race-based content when responding to eight different scenarios that check for race-based medicine or widespread misconceptions around race. Questions were derived from discussions among four physician experts and prior work on race-based medical misconceptions believed by medical trainees. We assessed four large language models with nine different questions that were interrogated five times each with a total of 45 responses per model. All models had examples of perpetuating race-based medicine in their responses. Models were not always consistent in their responses when asked the same question repeatedly. LLMs are being proposed for use in the healthcare setting, with some models already connecting to electronic health record systems. However, this study shows that based on our findings, these LLMs could potentially cause harm by perpetuating debunked, racist ideas.

npj Digital Medicine (2023)6:195 ; <https://doi.org/10.1038/s41746-023-00939-z>

<https://towardsdatascience.com/training-deep-neural-networks-9fdb1964b964>



NARROW ARTIFICIAL INTELLIGENCE

- Focused on one single task
- Mimicking how humans perform basic actions such as remembering things, perceiving things, and solving simple problems





ARTIFICIAL GENERAL INTELLIGENCE (AGI)

A **hypothetical** type of intelligent agent which, if realized, could learn to accomplish any intellectual task that human beings can perform.





SUPER ARTIFICIAL INTELLIGENCE

A hypothetical agent that possesses intelligence far surpassing that of the brightest and most gifted human minds.

"Any intellect that greatly exceeds the cognitive performance of humans in virtually all domains of interest"





SIIAM

Società Italiana Intelligenza Artificiale in Medicina



SIIAM

La SIIAM si pone l'obiettivo di essere **principale portavoce** a livello **nazionale** della causa dell'integrazione dell'IA nel Sistema Sanitario Nazionale, in maniera etica e sostenibile, per il beneficio dei *cittadini*, dei *pazienti*, e dei *professionisti sanitari*, **entro 5 anni**.





SIIAM

Mission: Guidare l'adozione dell'intelligenza artificiale nella sanità attraverso l'innovazione, la collaborazione e l'educazione, garantendo standard etici e migliorando i risultati per i pazienti.

1. Dare impulso al **progresso scientifico e culturale** nel campo dell'Intelligenza Artificiale in Medicina, in tutte le sue possibili articolazioni funzionali;
2. Promuovere la **cooperazione** dei professionisti coinvolti, sia nella ricerca e sviluppo dei mezzi informatici di intelligenza artificiale che nella loro implementazione e applicazione in ambito sanitario;
3. Attuare **iniziative scientifiche, tecniche e formative**, volte a **sviluppare e consolidare conoscenze**, competenze e pratiche nel campo dell'Intelligenza Artificiale in Medicina, rivolte ai professionisti e studenti del campo sanitario;
4. Sviluppare una **rete di scambio proficuo di conoscenze**, informazioni ed idee atta a favorire la plasticità ed apertura all'innovazione necessarie per affrontare il continuo e rapido cambiamento tecnologico che investe il campo sanitario;
5. Promuovere, favorire ed organizzare **relazioni scientifiche e culturali con enti governativi, università, società scientifiche e altri portatori di interesse**, nazionali e internazionali, nel campo dell'Intelligenza Artificiale in Medicina;





NETWORKING

4) Sviluppare una **rete**
conoscenze, informazioni
plasticità ed apertura
per affrontare il continuo
tecnologico che investe i





THANK YOU



<https://www.linkedin.com/company/siam-it/mycompany/>

<https://www.instagram.com/siam.it?igsh=MTBhNDR0ajFuNml5eA==>

