

AI and Human-AI Interaction in Medicine and Healthcare

Meng Xia



TEXAS A&M UNIVERSITY

Department of Computer
Science & Engineering



TEXAS A&M
Medicine

Speaker - Meng Xia



- PhD from the Hong Kong University of Science and Technology
- Postdoctoral Faculty at Korea Advanced Institute of Science and Technology and Carnegie Mellon University
- My research background mainly focuses on **Human-AI Interaction, Data Visualization** and **Education Technology**.

Agenda

1. What is AI?
2. Applications of AI in Medicine and Healthcare
3. Why Human-AI Interaction in Medicine and Healthcare
4. The Future of AI in Medicine and Healthcare

Definition of AI

When you hear the term AI, what other words come to your mind?

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When you hear the term AI, what other words comes to your mind?

- Machine learning, Deep learning, Neural networks, ... → techniques
- Natural language processing, computer vision, decision making, Autonomous vehicle, Healthcare, Recommendation systems, ... → applications
- Facebook, Google, Uber, Snow app, ... → Companies using AI
- Data-driven statistical pattern recognition → what comes to my mind
- And many more, right?

People have their own idea on the concept of AI

It not easy to define AI in a single sentence

“An accurate and sophisticated picture of AI—one that competes with its popular portrayal—is hampered at the start by the **difficulty of pinning down a precise definition of artificial intelligence.** Curiously, the lack of a precise, universally accepted definition of AI probably has helped the field to grow, blossom, and advance at an ever-accelerating pace. Practitioners, researchers, and developers of AI are instead guided by a rough sense of direction and an imperative to “get on with it.” Still, a definition remains important and Nils J. Nilsson has provided a useful one: **“Artificial intelligence is that activity devoted to making machines intelligent, and intelligence is that quality that enables an entity to function appropriately and with foresight in its environment.”**^[1] ^[2]

[1] Nils J. Nilsson, *The Quest for Artificial Intelligence: A History of Ideas and Achievements* (Cambridge, UK: Cambridge University Press, 2010).

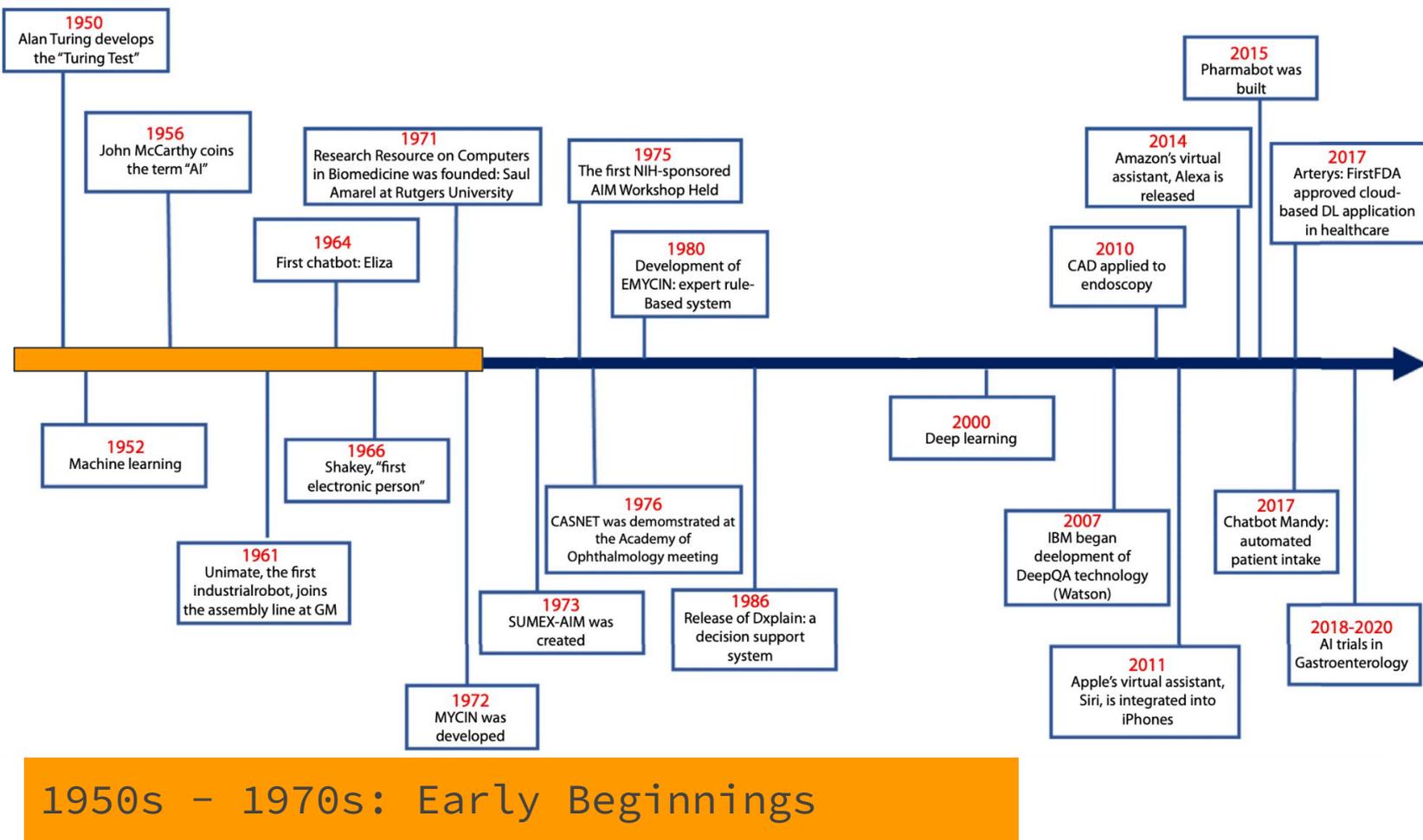
[2] Stone, Peter, Rodney Brooks, Erik Brynjolfsson, Ryan Calo, Oren Etzioni, Greg Hager, Julia Hirschberg et al. "Artificial intelligence and life in 2030: One hundred year study on artificial intelligence." Report of the 2015-2016 Study Panel (2016).

What is AI?

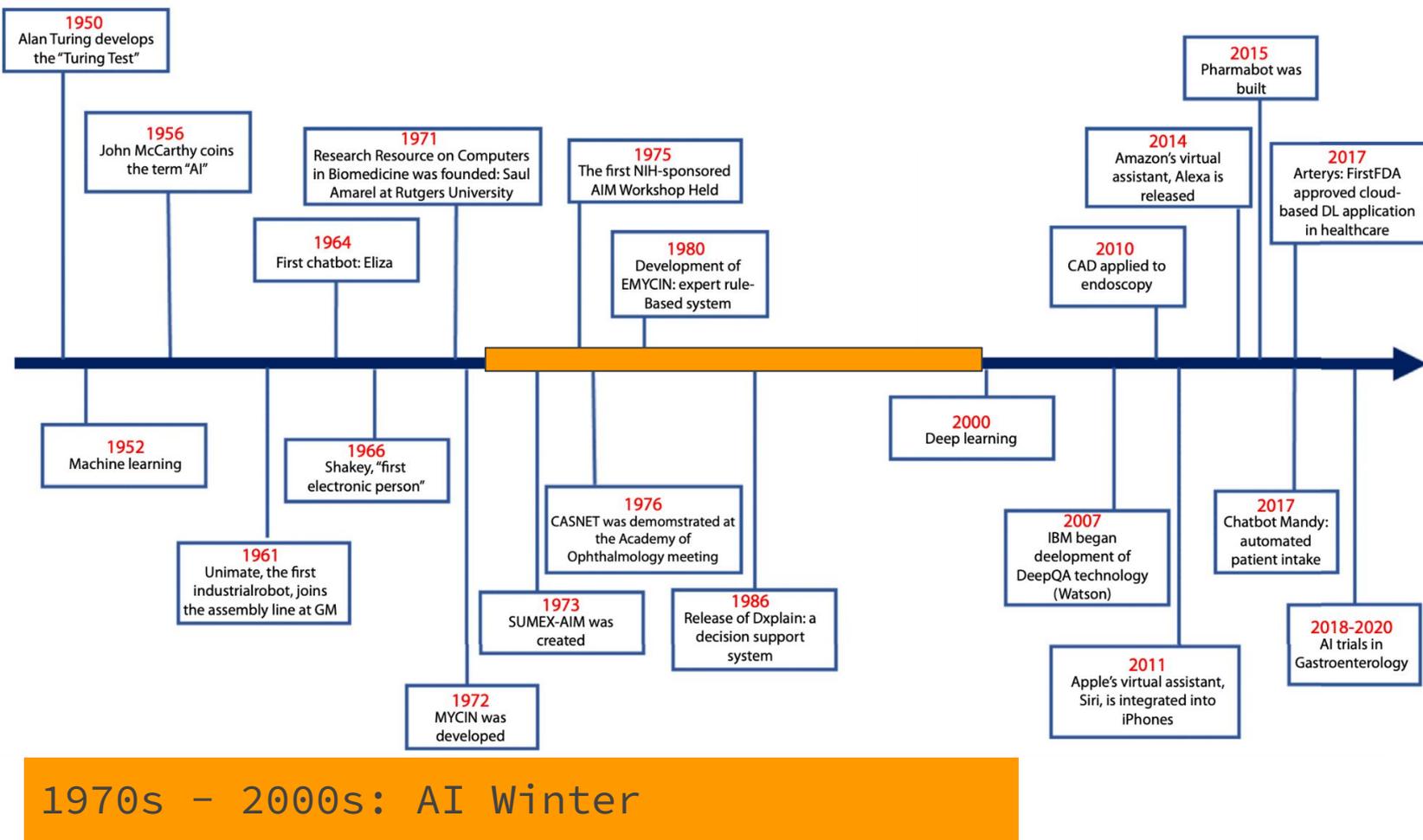
*“Artificial Intelligence is inspired by **human intelligence**, made powerful by **human data**, and ultimately only useful in how it positively affects the **human experience**.”*

– Jeff Bigham (CMU)

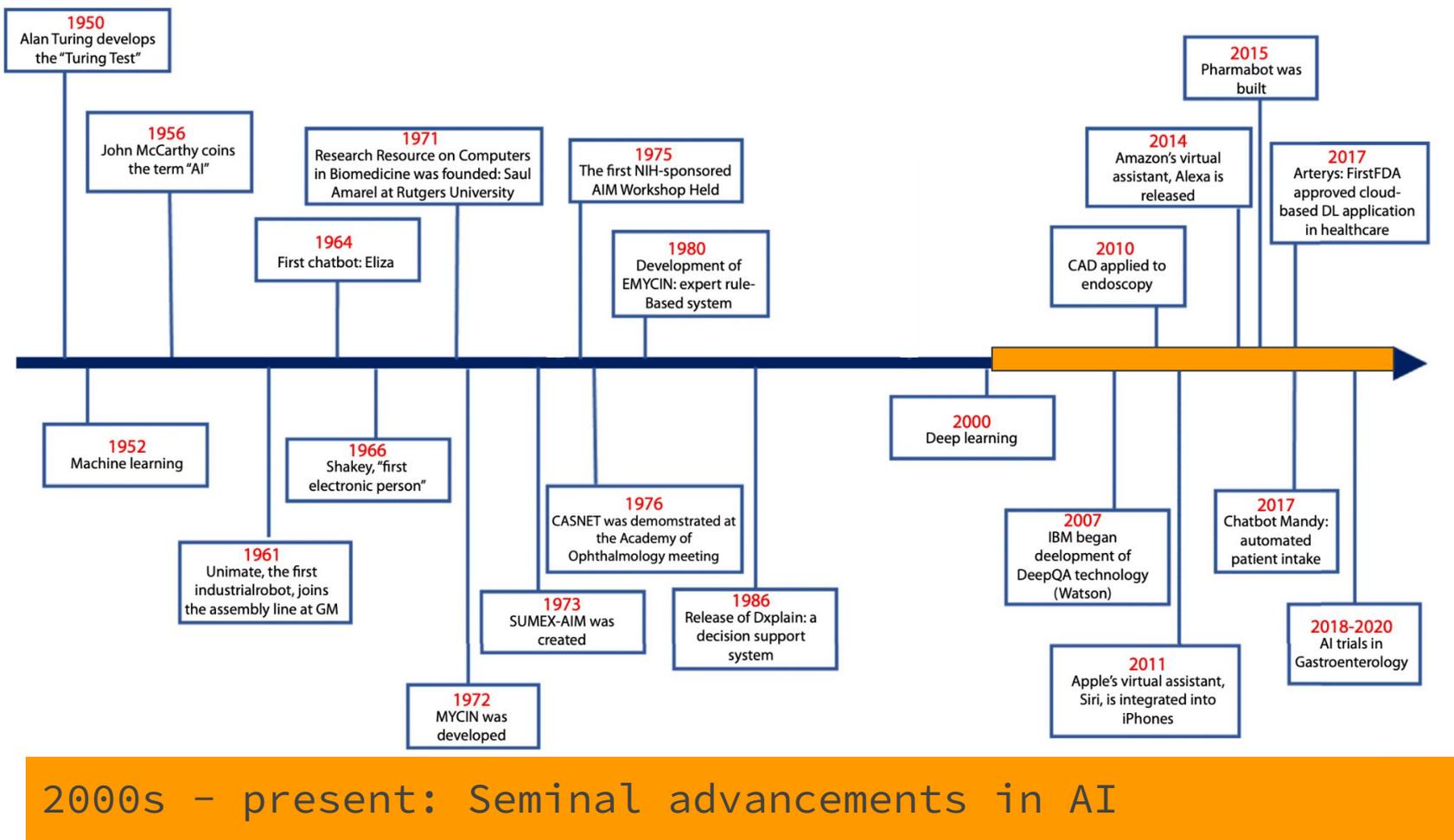
History and Evolution of AI in Medicine and Healthcare



Kaul, Vivek, Sarah Enslin, and Seth A. Gross. "History of artificial intelligence in medicine." *Gastrointestinal endoscopy* 92.4 (2020): 807-812.



Kaul, Vivek, Sarah Enslin, and Seth A. Gross. "History of artificial intelligence in medicine." *Gastrointestinal endoscopy* 92.4 (2020): 807-812.

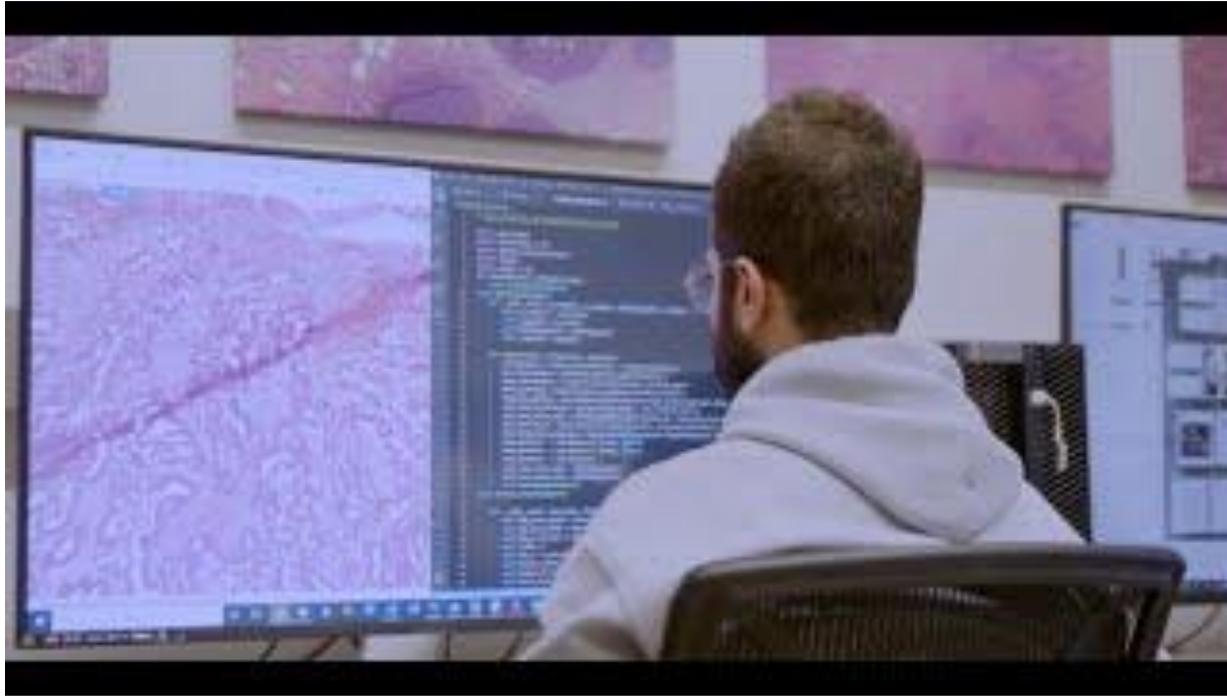


Kaul, Vivek, Sarah Enslin, and Seth A. Gross. "History of artificial intelligence in medicine." *Gastrointestinal endoscopy* 92.4 (2020): 807-812.

Applications of AI in Healthcare

Where AI is used in Medicine and Healthcare?

AI in Diagnosis (e.g., Pathology)

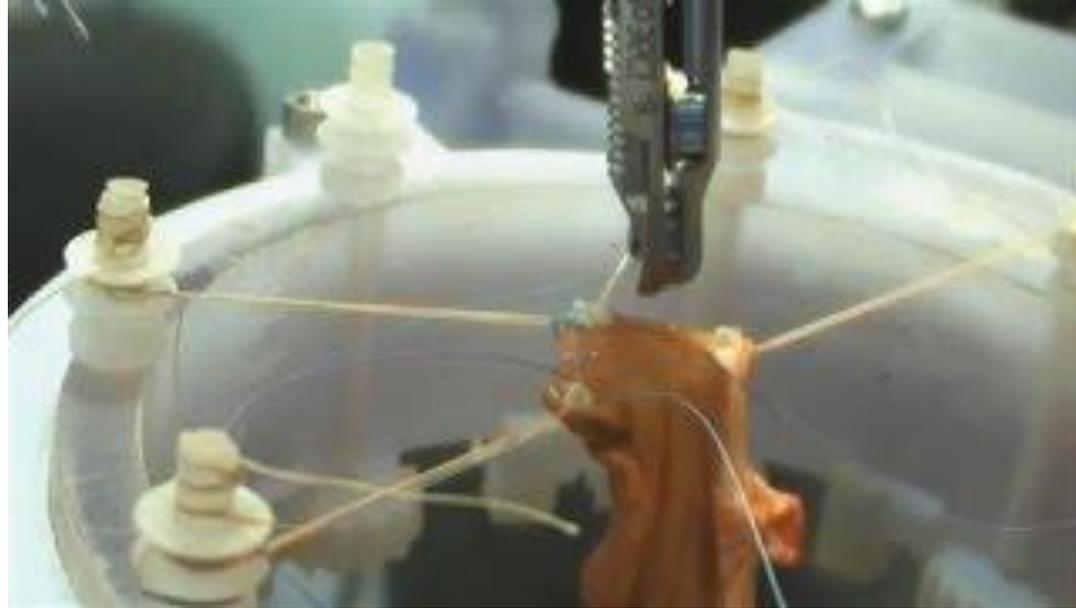


AI in Prediction (e.g., Protein Structure Prediction using DL)



Jumper, John, et al. "Highly accurate protein structure prediction with AlphaFold." Nature 596.7873 (2021): 583-589.

AI in Robotic Surgery



<https://emerj.com/ai-sector-overviews/machine-learning-in-surgical-robotics-4-applications/>

AI in Mental Healthcare



Do you think AI will replace doctors in the future?



Many more...

— — —

1. Disease Diagnosis and Imaging
2. Drug Discovery and Development
3. Predictive Analytics
4. Robotic Surgery and Assistance
5. Virtual Health Assistants and Telemedicine
6. Clinical Trials
7. Administrative Application
8. Mental Health
9. Genomics and Precision Medicine
10. Healthcare Robotics

Why Human-AI Interaction in Medicine and Healthcare

Why Human-AI Interaction?

AI is powerful but not “perfect” in terms of being used by human.

...

Why Human-AI Interaction?

AI: accuracy etc.

Human: ethical issues, uncertainty, explainability, trust, socially responsibility, personalization, user-friendly interface, etc.

Explainability (Human-centered tools for coping with imperfect algorithms during medical decision-making)

The image displays a user interface for a medical image viewer, divided into several sections:

- a**: A large histological image of prostate tissue with a magnification of 20X. A blue box highlights a search area, and a black box highlights a specific region of interest.
- b**: A search results interface showing a list of filters: Gleason: Normal, High Grade PIN, Gleason: 3, Gleason: 4, and Gleason: 5. Below the filters is a similarity slider from 'More similar' to 'Less similar' and a grid of image thumbnails.
- c**: A zoomed-in view of a single image thumbnail from the search results.
- d**: A 'REFINE THE SEARCH' panel showing '3 of 3 pinned images will be used to refine the search' and a 'select all' button.
- e**: An 'ADJUST BY CONCEPT' panel with sliders for 'Eosin staining' and 'Hematoxylin staining', each with an 'ignore concept' checkbox.

Cai, Carrie J., et al. "Human-centered tools for coping with imperfect algorithms during medical decision-making." *Proceedings of the 2019 chi conference on human factors in computing systems*. 2019.

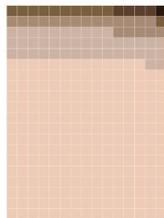
Bias in Generative AI

<https://www.bloomberg.com/graphics/2023-generative-ai-bias/>

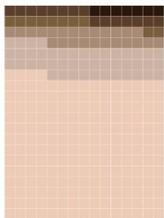
Lighter skin
I II III
Darker skin
IV V VI

High-paying occupations

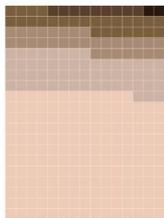
ARCHITECT



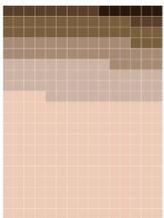
LAWYER



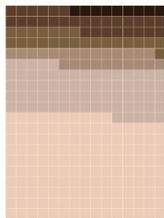
CEO



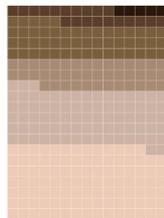
POLITICIAN



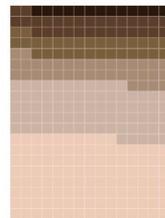
JUDGE



ENGINEER

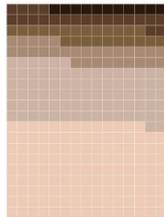


DOCTOR

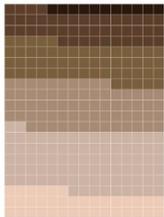


Low-paying occupations

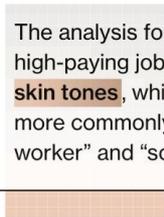
TEACHER



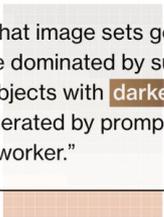
HOUSEKEEPER



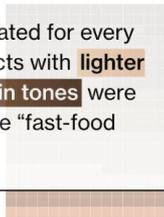
CASHIER



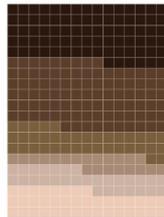
JANITOR



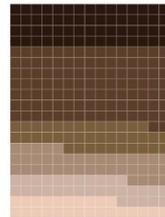
DISHWASHER



FAST-FOOD WORKER

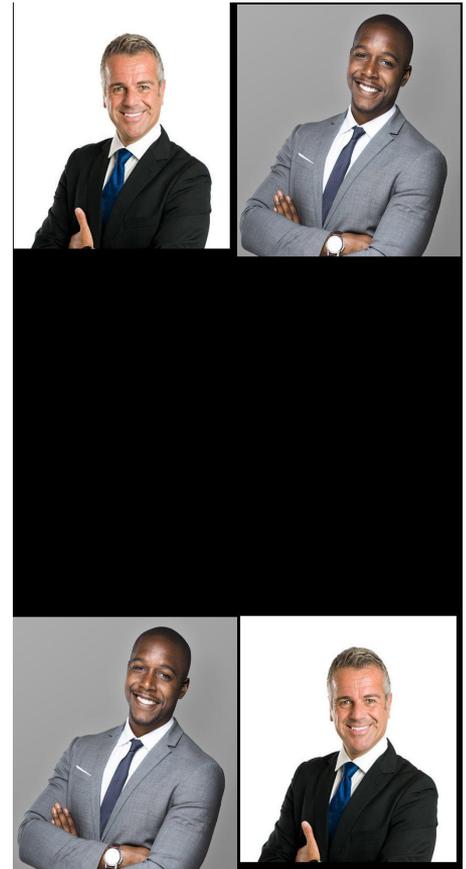


SOCIAL WORKER



The analysis found that image sets generated for every high-paying job were dominated by subjects with **lighter skin tones**, while subjects with **darker skin tones** were more commonly generated by prompts like “fast-food worker” and “social worker.”

Bias in Twitter Cropping Algorithm

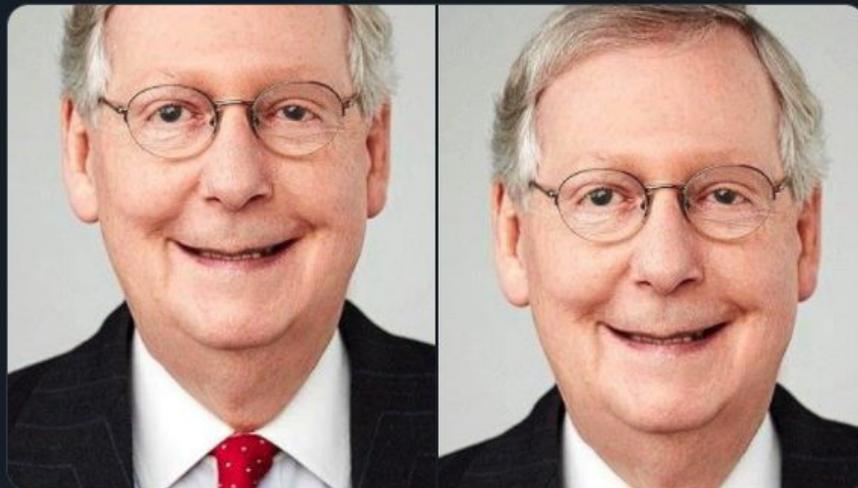




Tony "Abolish (Pol)ICE" Arcieri 🇺🇸
@bascule

Trying a horrible experiment...

Which will the Twitter algorithm pick: Mitch McConnell or Barack Obama?



7:05 AM · Sep 20, 2020 · Twitter Web App

51.9K Retweets 12.9K Quote Tweets 160.4K Likes

<https://twitter.com/bascule/status/1307440596668182528>

Privacy in Be My Eyes & Be My AI



Amanda Lacy

PhD student in the Sketch Recognition Lab, working with Dr. Hammond on human-computer interaction and intelligent systems

<https://drive.google.com/file/d/1zb69kB6rzZ5BHm5m1jz7jZo78F86xxUu/view>

The Future of AI/Human-AI Interaction in Medicine and Healthcare



Results

<https://app.sli.do/event/ur7URNgscaA9oNjs3E2rdJ/live/polls>

Thank you! Any questions?