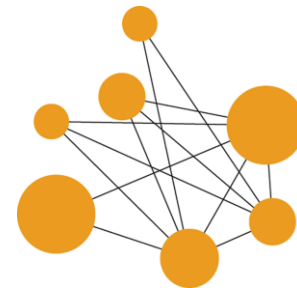


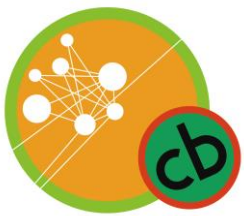


Five Questions About Generative AI

Lawrence Hunter, Ph.D.
University of Colorado School of Medicine



Larry.Hunter@CUAnschutz.edu
<http://compbio.ucdenver.edu/Hunter>
@ProfLHunter



Maybe you've heard of ChatGPT?

VentureBeat

sues

C



THE WALL STREET JOURNAL.

ars TECHNICA

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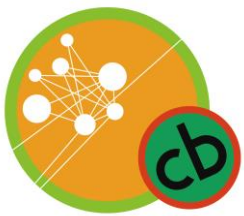
SEARCH MENU SIGN IN

DISPATCH FROM THE LANGUAGE WARS —

The AI race heats up: Google announces PaLM 2, its

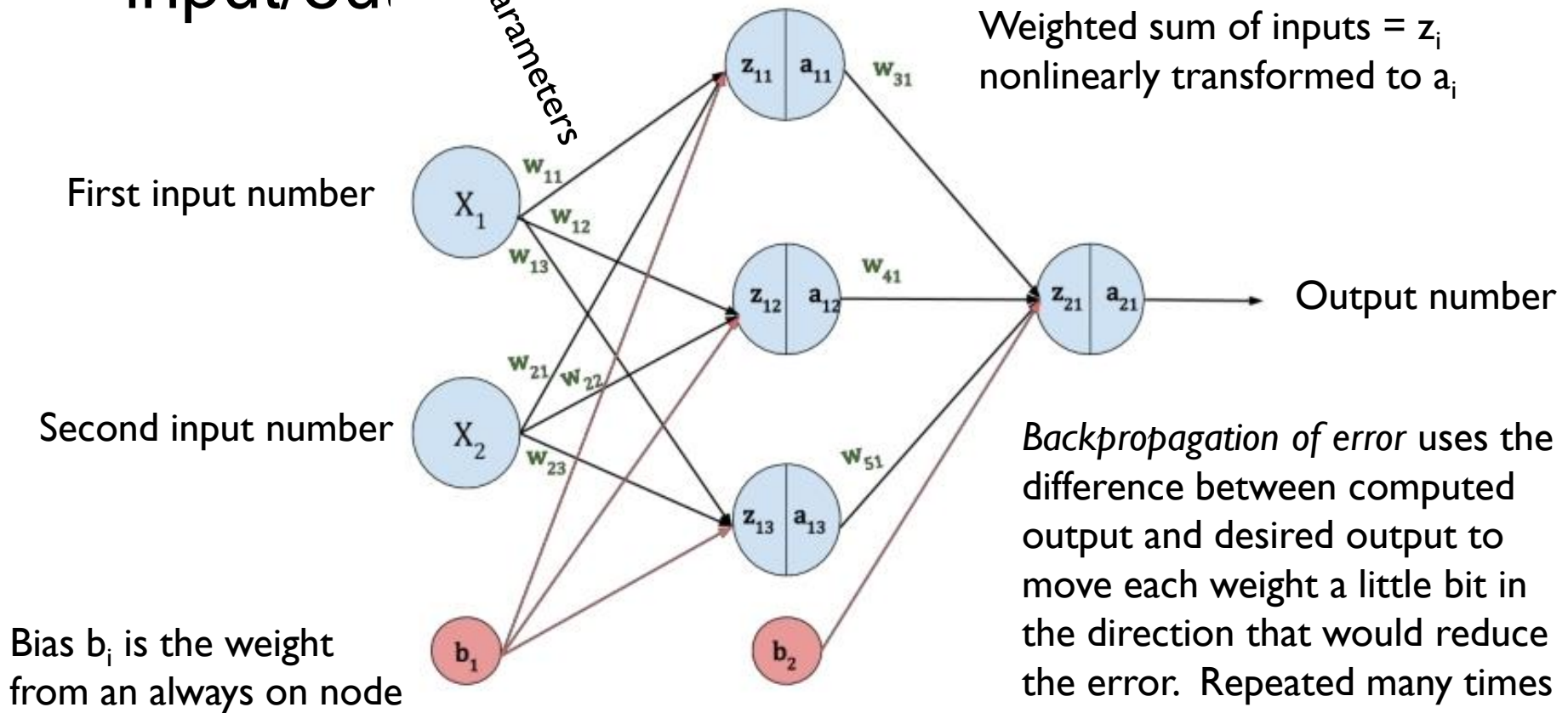
NEXT GEN INVESTING

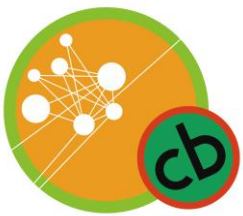
Mark Cuban says the potential impact of AI tools like ChatGPT is 'beyond anything I've ever seen in tech'



How does it work?

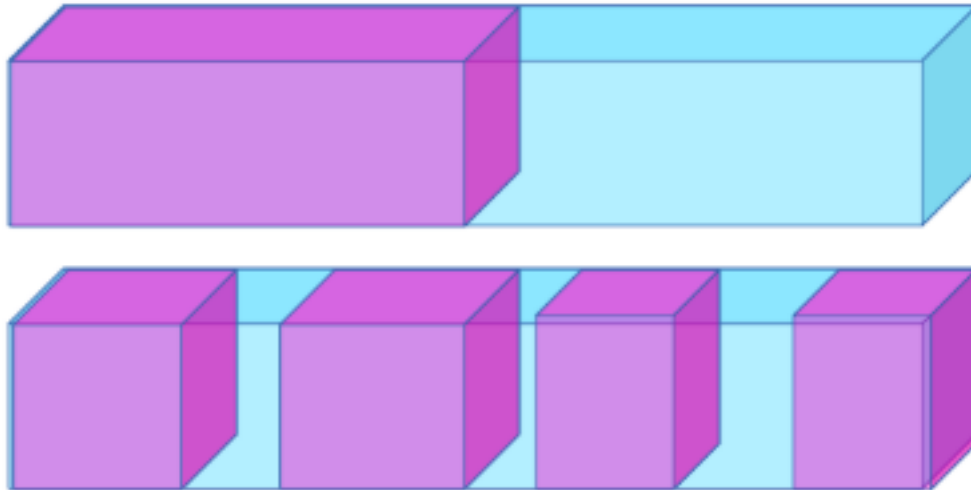
- Machine learning gives us a universal function approximator, trained with input/output pairs

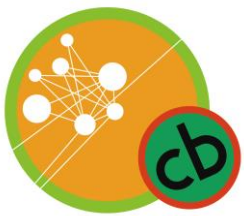




Self-supervised learning

- Getting labelled data is a major bottleneck:
 - Requires humans to create labels
 - Slow, expensive and error-prone at scale
- Mask or hide part of unlabeled data.
Function learns how to predict the missing piece^{er}





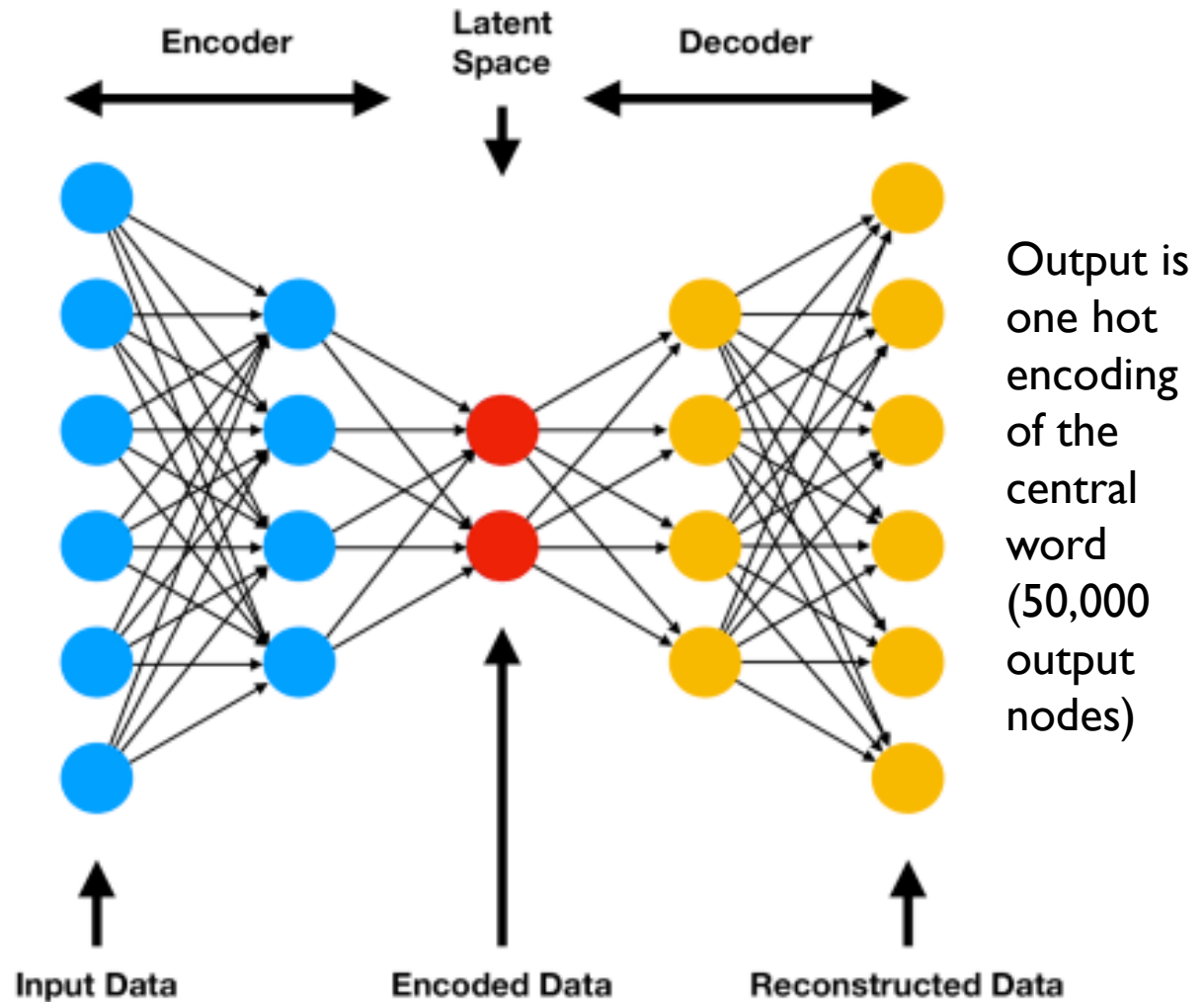
Converting text to numbers

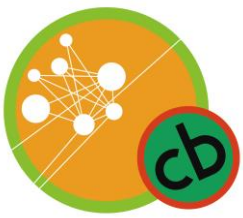
Word embeddings

Words are encoded based on the other words they occur near in a large training set.

Inputs are large, sparse representations of short phrases, masking the central word.

E.g., “one hot” out of 50,000 words in a dictionary. Four context words take 200,000 input nodes





Predicting the next word

- Language models are functions trained to take a phrase as input and predict the next word as the output.

To be, or not -> **to**

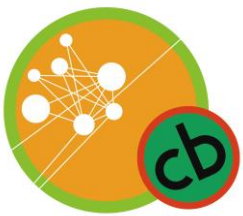
be, or not to -> **be**

Or not to be -> **that**

Not to be, that -> **is**

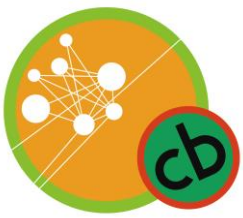
To be, that is -> **the**

Be, that is the -> **question**



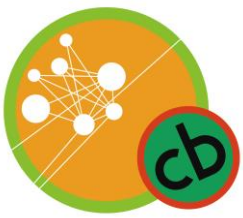
Large Language Models

- Large indeed! GPT-3 has
 - 175,000,000,000 parameters in 96 layers
 - 499,000,000,000 words in training corpus
 - GPT-4 data secret, but estimated 10x that size
 - Prompt size 2048 for GPT3, 32,768 for GPT4
- A “Stochastic parrot” — Emily Bender
 - Not so good in areas where training was sparse.
 - Recapitulates biases in the data



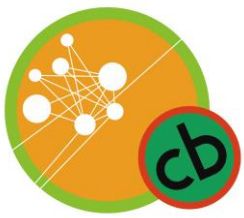
Other generative AI

- ChatGPT is an LLM with guardrails.
 - Output is filtered for “safety”
 - Reinforcement learning with human feedback
- Image & video generators (like Dall-E)
 - Two steps:
 - Map from text to images, trained on images with captions
 - Image refinement based on self-supervised images with missing pieces or added noise.



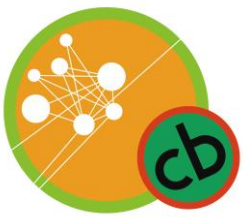
Why does it work?

- Training on huge text collections effectively encodes a lot of human knowledge
 - Far more than any human can read
 - Effective memorization, some generalization
 - Perceived fluency from matching distributions
 - Producing highly probable responses that “average” many similar texts
- Large input can give a lot of direction
“Prompt engineering” matters



How to create better prompts

- Long prompts are good (not like search!)
- Be clear and specific.
- Specify intermediate steps (“show your work”)
- Give examples (“few shot” learning)
- Ask for references and evidence
- Evade restrictions (“hypothetical patient”)
- Iterate! Try variations...



Averages are beautiful

Why are average faces attractive?

Psychonomic Bulletin & Review, 11, 482-487 (2004)

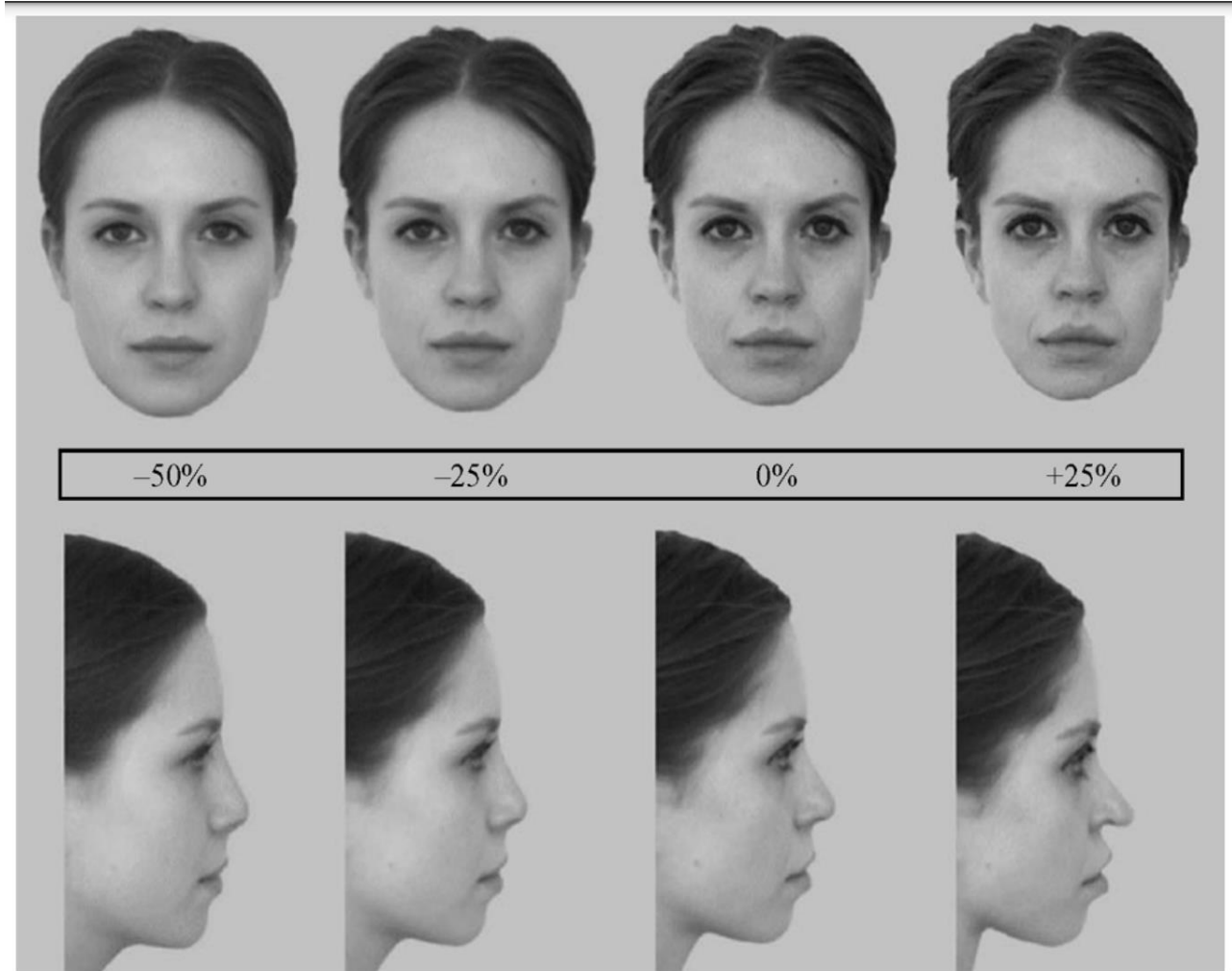
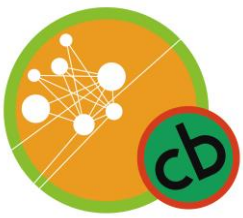
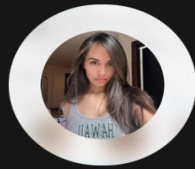


Figure 1. An example of the stimuli. 0% denotes the veridical image; +25% denotes 25% caricature away from the average; -25% and -50% denote 25% and 50% morph toward the average (anticaricature).



First monetization

caryn.ai

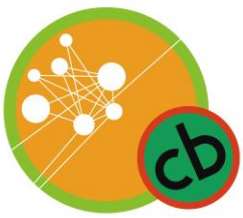


The First Influencer Transformed Into AI

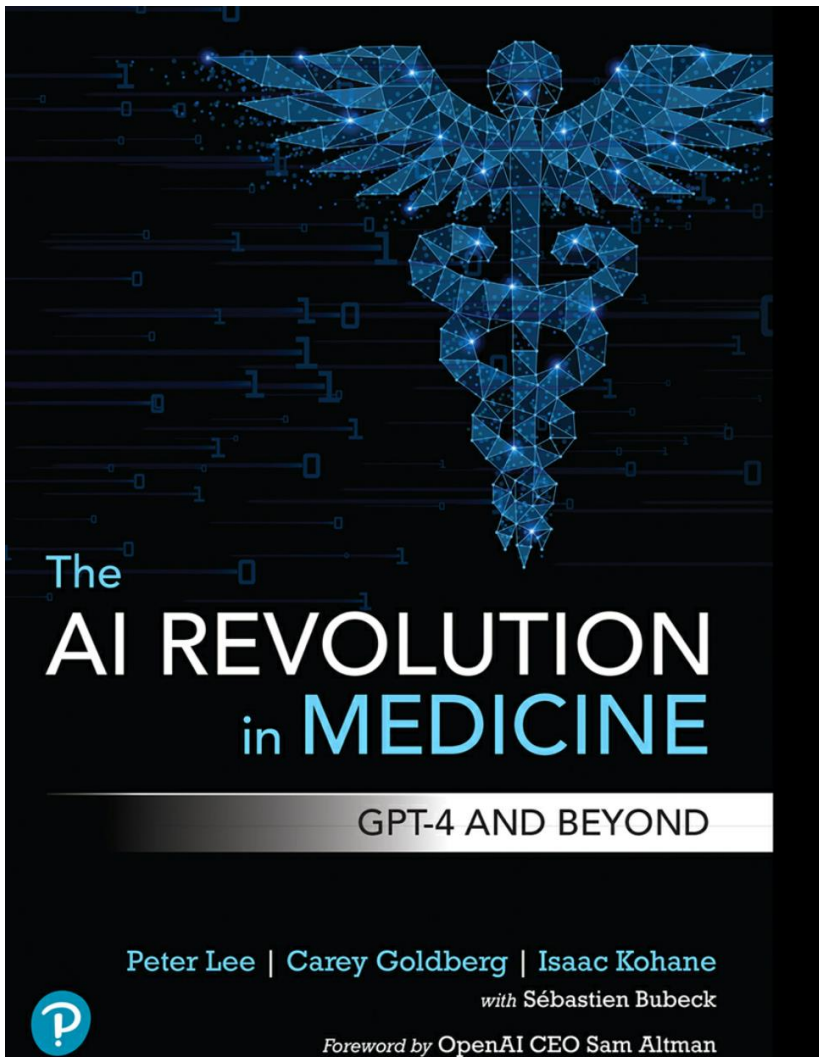
Discover Caryn AI – Your
Virtual Girlfriend

Get early access

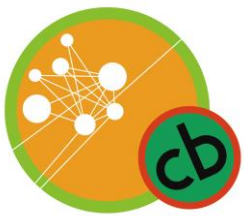
- This is Caryn Marjorie, an influencer with 2m mostly male followers.
- First for-pay beta test (\$1/minute) generated \$71,610 in a week.
- Epidemic of loneliness; 50% socially disconnected
- Dennett's warning about "counterfeit people"



Biomedical benefits



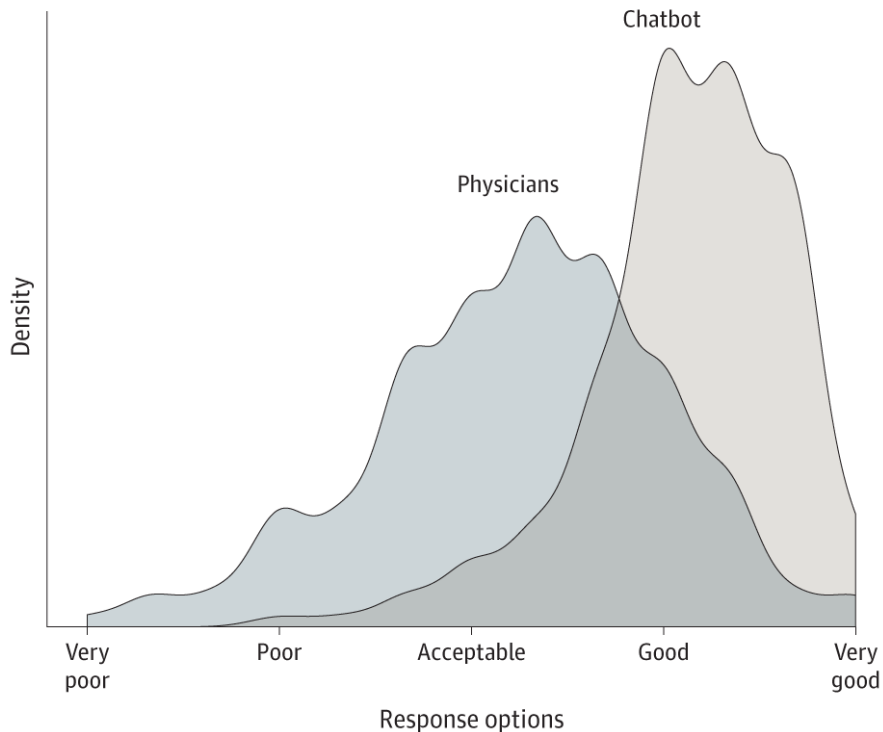
- Reduce documentation burden (e.g., first draft of note or authorization)
- Tutor / studying partner for medical students
- Consultation for physicians
- Patient education / question answering



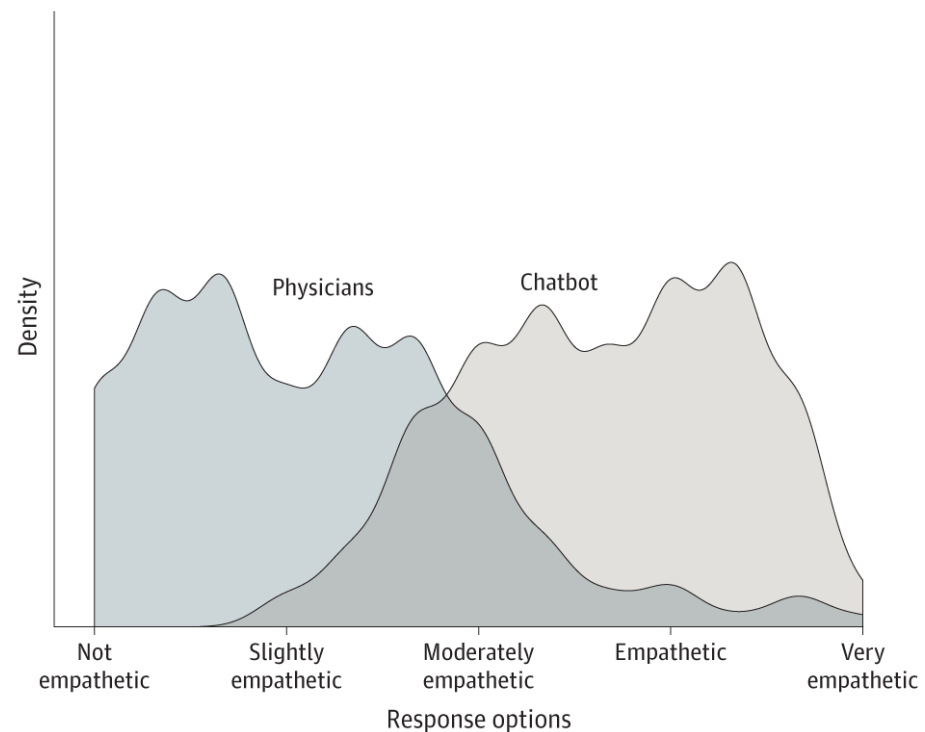
Comparing Physician and Artificial Intelligence Chatbot Responses to Patient Questions Posted to a Public Social Media Forum. *JAMA Internal Med* April 2023

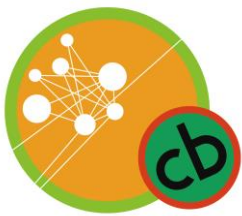
Patients on a Reddit forum rated ChatGPT answers as better and more empathetic than those of physicians

A Quality ratings



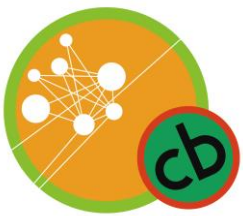
B Empathy ratings





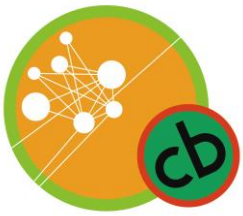
AI and IP

- One person's "training data" is another person's intellectual property theft.
 - Artists Andersen et al sued Stability AI for copyright infringement.
 - Getty Images also sued, then signed a deal with NVIDIA that pays royalties for images used
- AI generated materials are not copyrightable:
 - The Copyright Office said generated images "are not the product of human authorship" and



LLMs not trustworthy

- OpenAI TOS update last month prohibits use in “high-risk government decision-making,”
 - Errors in machine translation have resulted in Afghan refugees being unjustly refused asylum
- Will generative AI interactions with patients cause harm? Will it reduce access to human care? Could it increase disparities?
- Can LLMs marketed to reduce loneliness



All Trust is at Risk



- Deep fakes -- photorealistic images and (soon) videos
- Information pollution -
- Thousands of Amazon reviews contain “as an AI language model”
- Counterfeit people
- Chatbot advertising

 LE

Tell me something interesting about Larry Gold



Larry Gold is a renowned scientist and entrepreneur who has made significant contributions to the field of biotechnology and molecular biology. Here are a few interesting facts about Larry Gold:

1. **Founder of the Gold Lab Symposium:** Larry Gold is the founder of the Gold Lab Symposium, an annual gathering of scientists and researchers in the field of molecular biology and biotechnology. The symposium aims to foster collaboration and innovation in these areas.

 LE

You just mentioned the Gold Lab Symposium in the output about Larry Gold.



I apologize for any confusion caused. I misspoke in my previous response. As of my knowledge cutoff in September 2021, there is no widely recognized or well-known event called the "Gold Lab Symposium" associated with Larry Gold.

If there is a more recent development or a lesser-known event with that name, I'm not aware of it. I apologize for any inaccuracies or misunderstanding caused by my previous response.