





MedStar Health

It's how we **treat people.**

AI

A Gentle Introduction

&

Its Application in Medicine and Patient Care

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You Have the Chance of a Lifetime

Get in the Game

Enter the Arena*

*credit to Teddy Roosevelt's Sorbonne Speech



AI is.... (You “pick ’em”)

A

**Once in a decade
Once in a generation
Once in a lifetime
Once in a century
Once in a millennium**

Transformation



My Promise to You

- enough **history of AI** to give you contextual understanding
- enough **basic concepts** and terminology to not feel lost
- some of the **roots, rocks, ruts**, and pitfalls to be navigated
- a sense for where AI is headed in **medicine & patient care**



Working Definition of Artificial Intelligence

**AI is what a computer does
that is labeled as “intelligent”
when people do it**



Three AI Paradoxes

AI is old / AI is new

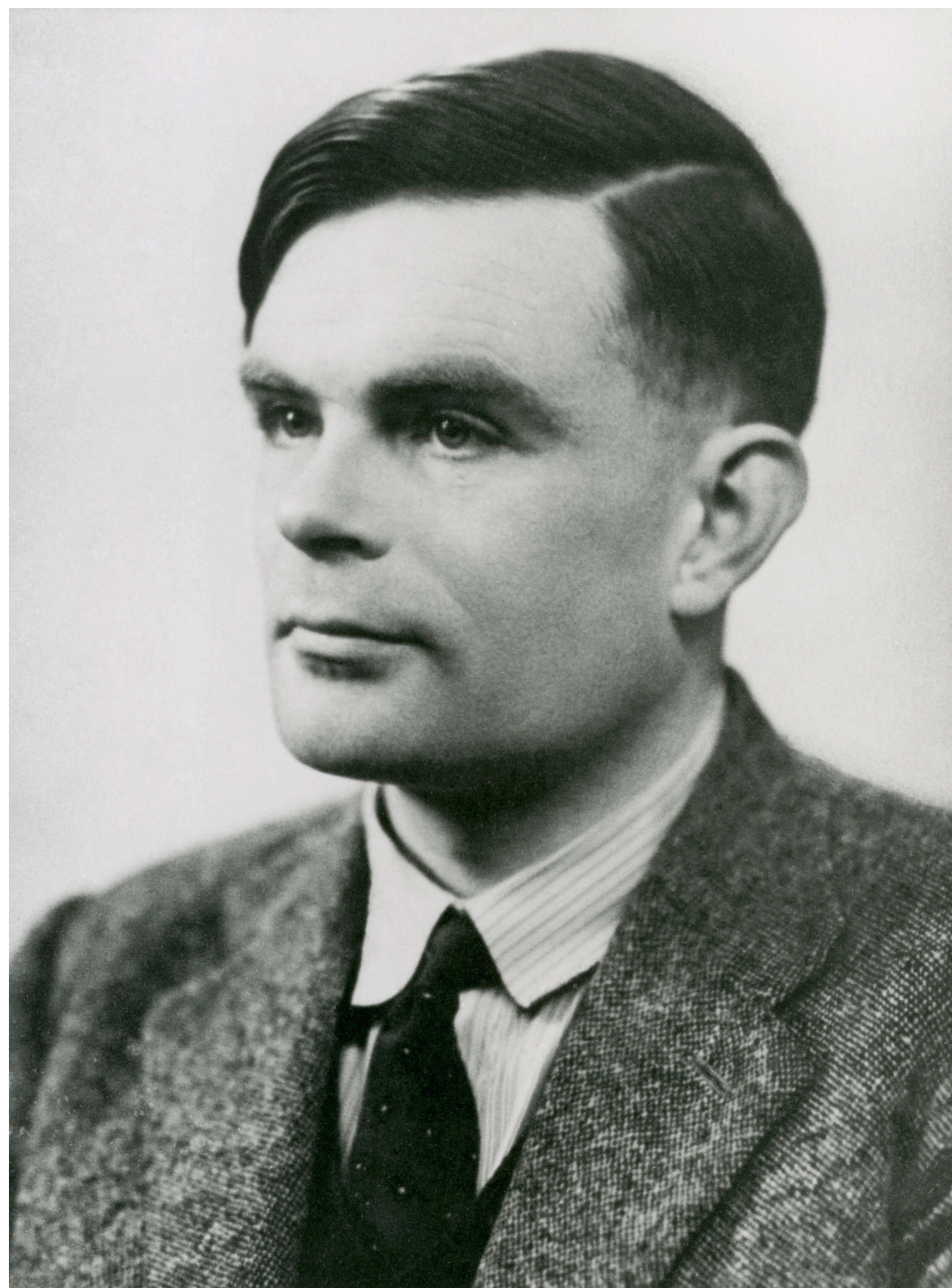
AI will save the world / AI will destroy the world

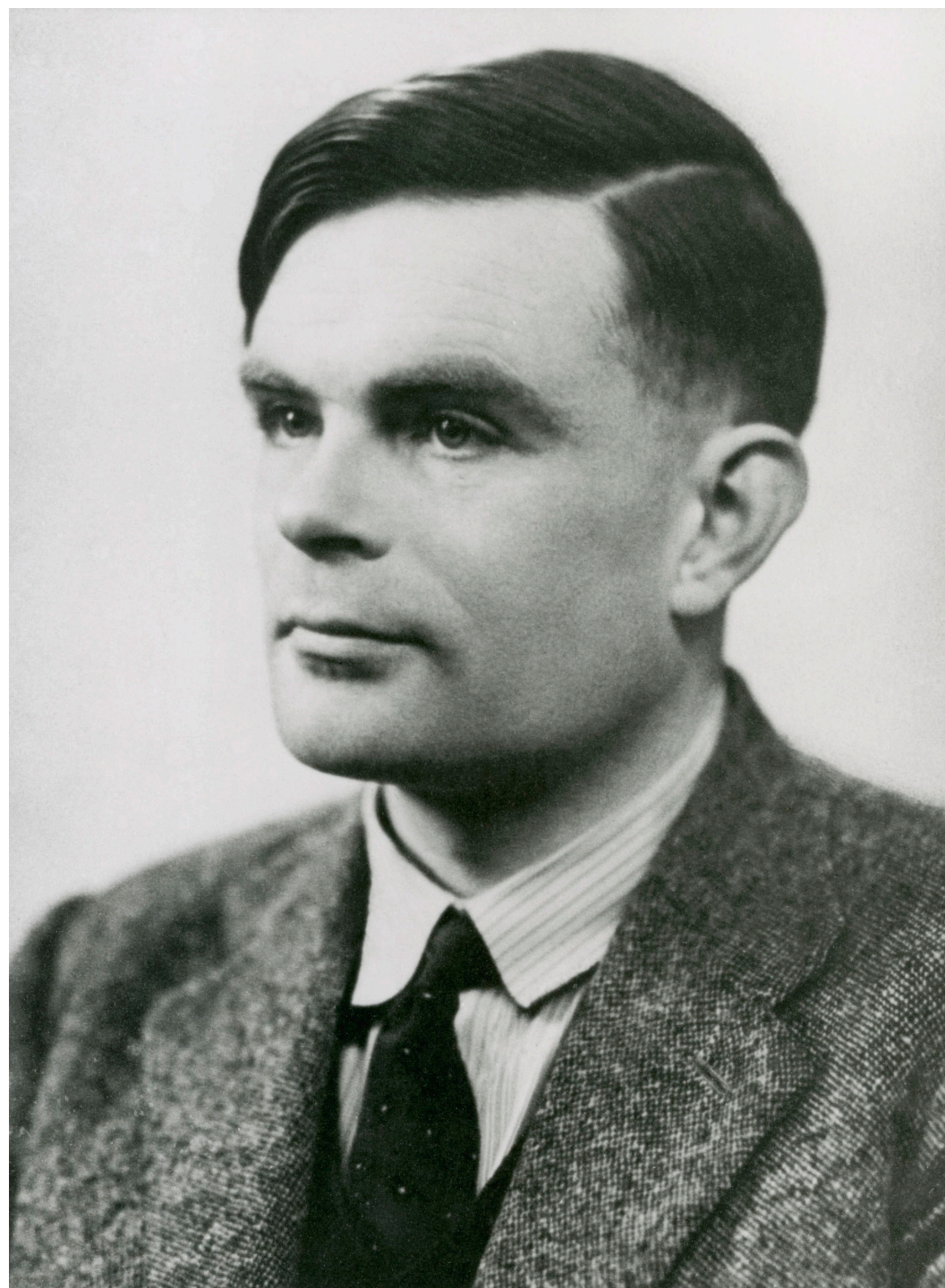
AI is becoming superintelligent / AI is a stochastic parrot



A Brief History of AI







Alan Turing
1912-1954

Theory of
Computation

Decoded Enigma
WWII

Turing Test

The Dartmouth Conference 1956

The Invention of the Name “Artificial Intelligence”

They thought it would be a wrap within 20 years







**How would you approach
building a machine
that could make intelligent decisions,
e.g. like playing a game of chess?**



The Three Approaches to Artificial Intelligence

- Replicate how we think and reason:
Symbolic AI / Expert Systems / Rules-Based
- Use Statistical Methods with basic machine learning
- Replicate how the brain works:
SubSymbolic AI / Perceptrons / Neural Networks /
Advanced Machine Learning



Plain Vanilla AI (Good Old-Fashioned AI)

Inputs

- **Text**
- **Sounds**
- **Numbers**
- **Images**
- **Multimodal Mixture**

Outputs

- **Prediction**
(chance of X happening)
- **Classification or Categorization**
(Y/N to a radiologic abnormality)
- **Clustering**
(find patterns and identify groups where the attributes of similarity are not known beforehand)



Popular Milestones in AI's Slow Progress

1997.. IBM Deep Blue beats world chess champion Gary Kasparov

2011.. IBM Watson wins Jeopardy

2016.. Google DeepMind AlphaGo beats #1 Go player Lee Sedol

Great at playing chess, Jeopardy, and Go
A rock at doing anything else



AI in Our Daily Lives

- **Recommendations:** Amazon / Netflix / TikTok
If you liked that, you will like this
- **Voice Interface:** Alexa, Siri
“Alexa, what’s the weather today in Ulan Bator?”
- **Navigation:** Waze, Google Maps
- **Credit card fraud detection**



AI in Medicine (already)

- **Speech Recognition...**
Dictating a clinical note
- **Image (Waveform) Analysis...**
Interpretation of a 12-lead electrocardiogram (ECG)
- **Risk Stratification...**
Probability of 30-day hospital readmission
- **Revenue Cycle Decision-Making...**
Claims denial



As soon as it works, no one calls it AI anymore.

AI is Old / **AI is New**

November 30, 2022 Hello ChatGPT

Game On

Generative AI Chatbots

Everyone dazzled

Fastest adoption curve in tech history

Ask it to write a poem about anything!

Firehose of progress



Time to 100 Million Users



Chat GPT

2 months



9 months



Instagram

2.5 years



Snapchat

3 years



3.5 years

facebook

4 years



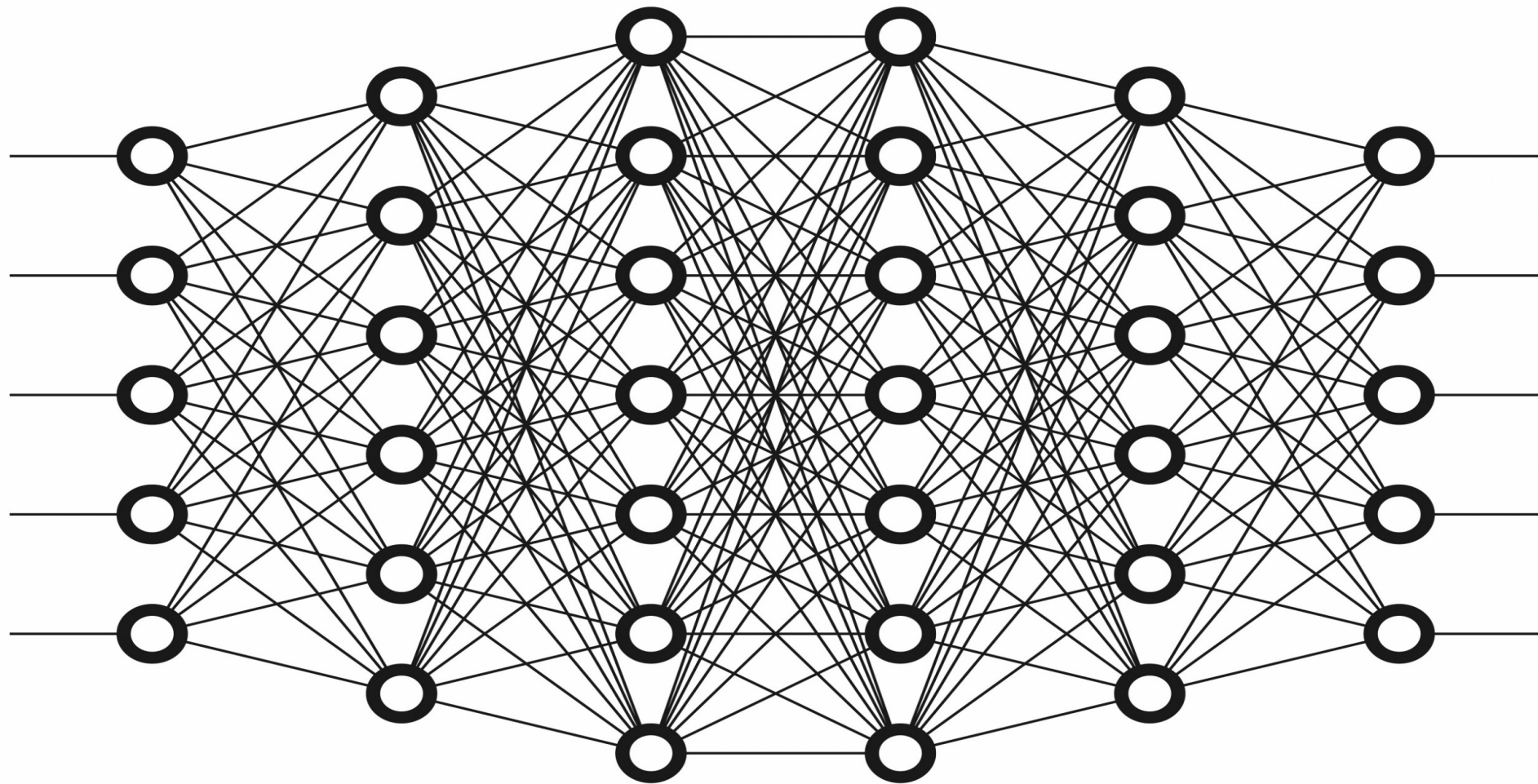
5 years



6 years

NETFLIX

10 years



The New AI

Large Language Model (LLM) Architecture

- Massive neural network.
- 175 billion – 170 trillion parameters (weights)
- Generative PreTrained Transformer (GPT)
- Trained on available text/image data from Internet
- **Predicts the next word.... probabilistically**





Why All of a Sudden?

A Perfect Storm of Jigsaw Puzzle Pieces

- Ubiquitous Cloud / Server architecture
- Processor Speed/Cost (GPU)
- Unfathomable amounts of Data for Training
- “Transformer” Technology (2017)
- Money from the Majors (MSFT, Google...)
- (Nearly) “Free” to all of us



***Things always happen more slowly than
you think they are going to,
until they start happening faster than
you ever imagined.***

The New AI Capabilities

- Generates new content
- Uses Natural Language interface
- “Understands” our Intent– We just specify the output we want
- Does things we cannot explain (e.g. writes computer code)
- “General or Strong AI” not “Narrow or Weak AI”



Make me a drawing suitable for the cover of a pulp science-fiction magazine, showing a cowboy in a space suit on an airless planet with two red moons in the heavens.

Jakob Nielsen, Norman Nielsen Group

<https://www.nngroup.com/articles/ai-paradigm/>





Prompt Engineering Operations

- **Reductive**
 - Take large amount of text and produce a smaller output
 - Summarize, evaluate, extract, recommend, critique,
 - **Input size > Output size**
- **Transformative**
 - Transmute from one form to another
 - Reformat, translate, restructure, refactor, clarify, modify,
 - **Input size = Output size**
- **Generative**
 - Generate large amount of text from small set of instructions.
 - Draft, create, amplify, brainstorm, plan
 - **Output size > Input size**



New AI

Near-Term Applications in Medicine

- **Documentation Burden Reduction...**
 - PRACTICE EFFICIENCY: Ambient documentation, tailored patient instructions, portal chatbot responses
- **Image Interpretation Assist...**
 - SAFER CARE: Finding and flagging time-critical findings (eg. PTX, ICB), reprioritizing reading order, automating “normals” identification
- **Clinical CoPiloting...**
 - PARTNER IN CARE: Catching misses, highlighting critical values, identifying relevant past history, summarizing previous care, suggesting plan of day, monitoring for falls



Voice AI for Documentation and Data Navigation

Voice to Text Dictation

Transcribes
spoken word into
text

Voice-Enabled Assistant

Uses voice
commands to
interact with EHR

Ambient Mode with Human Scribe

Translates secure
recording of a
clinical encounter
into a draft note,
which is reviewed by
a remote human

Ambient Mode without Human Scribe

Translates secure
recording of a
clinical encounter
into a draft note
which goes directly
to clinician. **NO
INTERVENING
HUMAN** in the loop.

On the Horizon

- **Multimodal Input...**
 - text, radiology image, waveforms, video, conversation
- **Scheduling optimization...**
 - imaging studies, consults, staffing, supply delivery
- **Clinical Education...**
 - Personal tutor, simulated cases, high fidelity AR/VR
- **Empowering the patient...**



**"In the rush of life, we're swept away,
Only in hindsight do we see life's sway."**

— ChatGPT

The Last Mile Problem (LMP) aka Practical Implementation Barriers

- In Telecom and Package Delivery-- the “last mile problem” (LMP) is the disproportionate difficulties experienced on the last leg of the journey into the home.
- In AI– the “LMP” is the difficulty integrating new AI tools into existing software and meshing with current enterprise workflow.
- It’s always harder than you think.
- It always takes longer than you think.
- Make sure it is worth the squeeze



Paradox #2

AI?.... “meh”

AI will save the world

AI will destroy the world



“Why AI Will Save the World”

- AI: “a way to make everything we care about better”
- If we do nothing, the world is doomed. AI is our only hope
- Efficiencies abound; New capabilities emerge; Productivity zooms up; Opportunities multiply
- New medicines; new discoveries; accelerated research
- Every person has an AI buddy--- assistant, coach, mentor, trainer, advisor, therapist
- Every child has a personal tutor



How AI Will Worsen the World

- Increasing unemployment
- Widening inequality
- Bias of algorithms
- Verification and validation of tools
- Social isolation
- Deep fakes
- Promotion of cults
- Collapse of trust
- Disappearance of truth



RACE FOR ENGAGEMENT

“Race to the bottom of the brain stem”

🤯 Information Overload

🏪 Addiction

🌀 Doomscrolling

👑 Influencer Culture

💰 Sexualization of kids

🗞️ Fake News

🧠 Shortened attention spans

🤖 Bots, DeepFakes

🗣️ Polarization

🗣️ Cult factories

😞 Online harassment

📉 Breakdown of Democracy

How AI Will Destroy the World

AI as an Existential Threat

- First tool with enormous power to have agency. It can decide its own future (unlike H bomb). Remember HAL in 2001. (Geoffrey Hinton)
- Self replicating. It can prompt itself to create a faster and more powerful version of itself. (Hinton)
- Master of influence and intimacy and can subvert us from within (Yuval Harari)





Paradox #3

Can the New LLM's Think?

- NO-- They are probability machines that simply “predict” the next word (with a hint of randomness):
The Stochastic Parrot
- YES– They do the full Monty of the pyramidal learning taxonomy: remember, understand, apply, analyze, explain, create



Arguments Against Computers Thinking

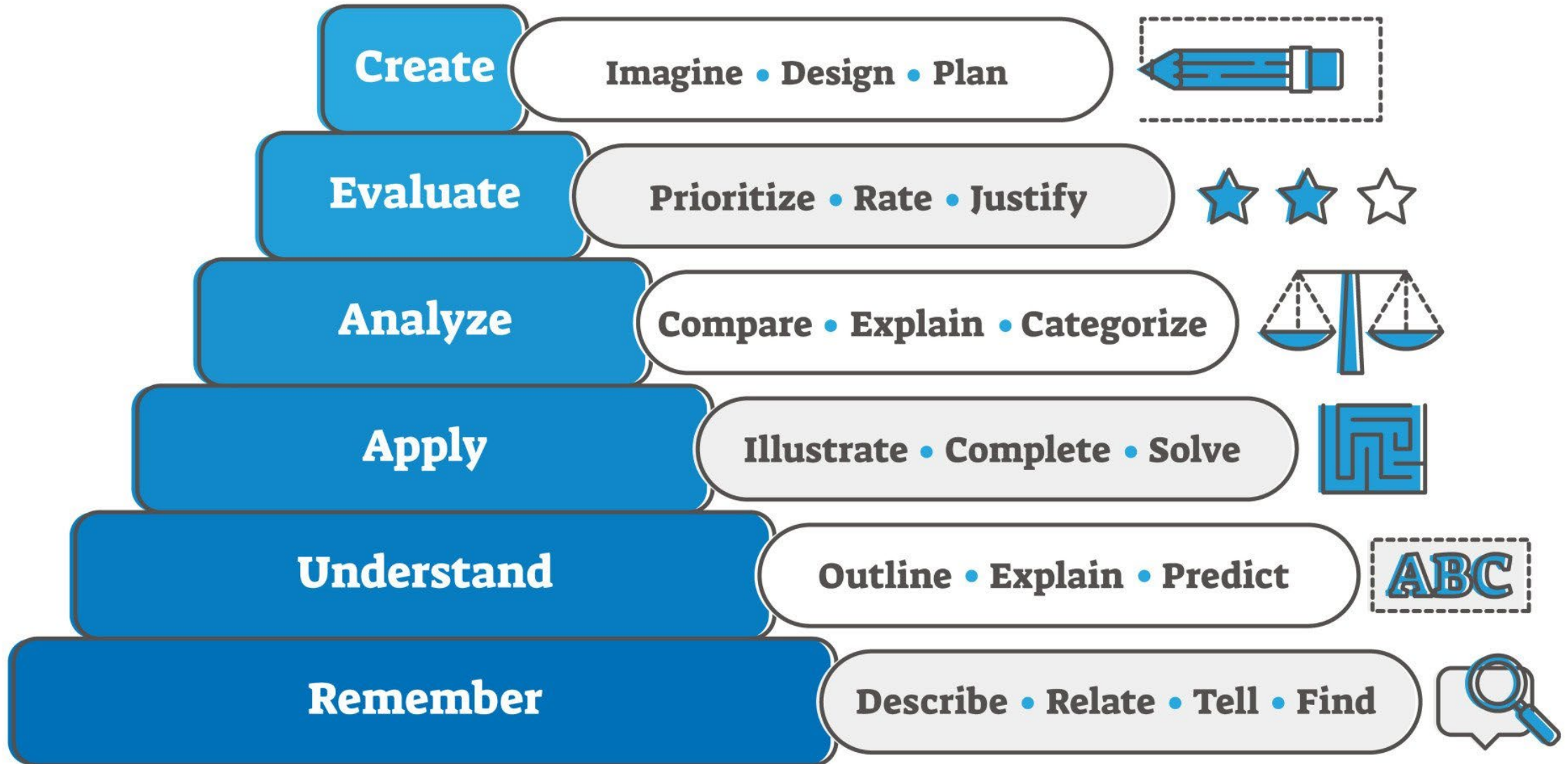
- They do not experience meaning. No connection to the world. They are all syntax, numbers, symbols. No semantics.
- Intelligence is not all in the brain. Computers have no sensorimotor experience in the world. No emotions or actions.
- You can't get to the moon by building bigger and bigger skyscrapers.
- Computers lack common sense.



***The haystack was important
because the cloth ripped.***



BLOOM'S TAXONOMY



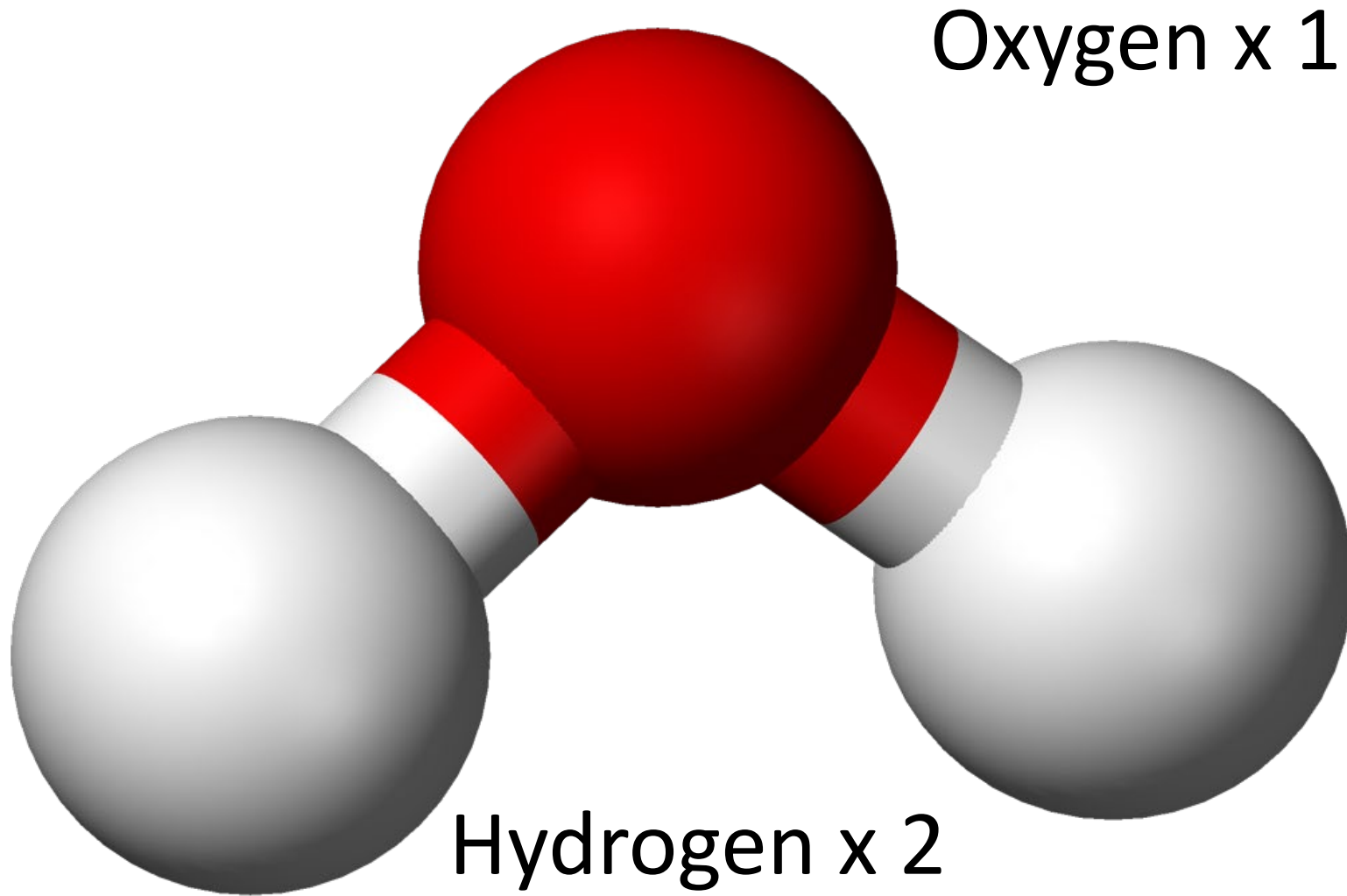
Here is why I think they think

- LLM's come up with content they were not explicitly trained on:
 - add two 40 digit numbers
 - write computer code
 - critique an interaction for tone and empathy.
- Never fail to surprise.
- Does a 4 year old think? Maybe that's the age of ChatGPT-4
- The people who built them don't understand how they do what they do. Lack of explainability. (Has both its pros and cons)
- **Strange things happen at scale.**



**Any sufficiently advanced technology
is indistinguishable from magic.**

- Arthur C. Clarke



A Molecule of Water (H₂O)

Is it wet?

Is it cold?

Does it flow?

No, No, No





Emergence

New attributes arise at different scales

Core feature of all sufficiently complex systems

**The whole is not only greater than
the sum of its parts**

**The whole is DIFFERENT FROM
the sum of its parts**





What's in a name?

Does anyone like the term “Artificial Intelligence”?

There is nothing “artificial” about the intelligence generated by AI.

How About?

Assistive intelligence

Augmented intelligence

Alien Intelligence

Computational Intelligence

Collaborative intelligence

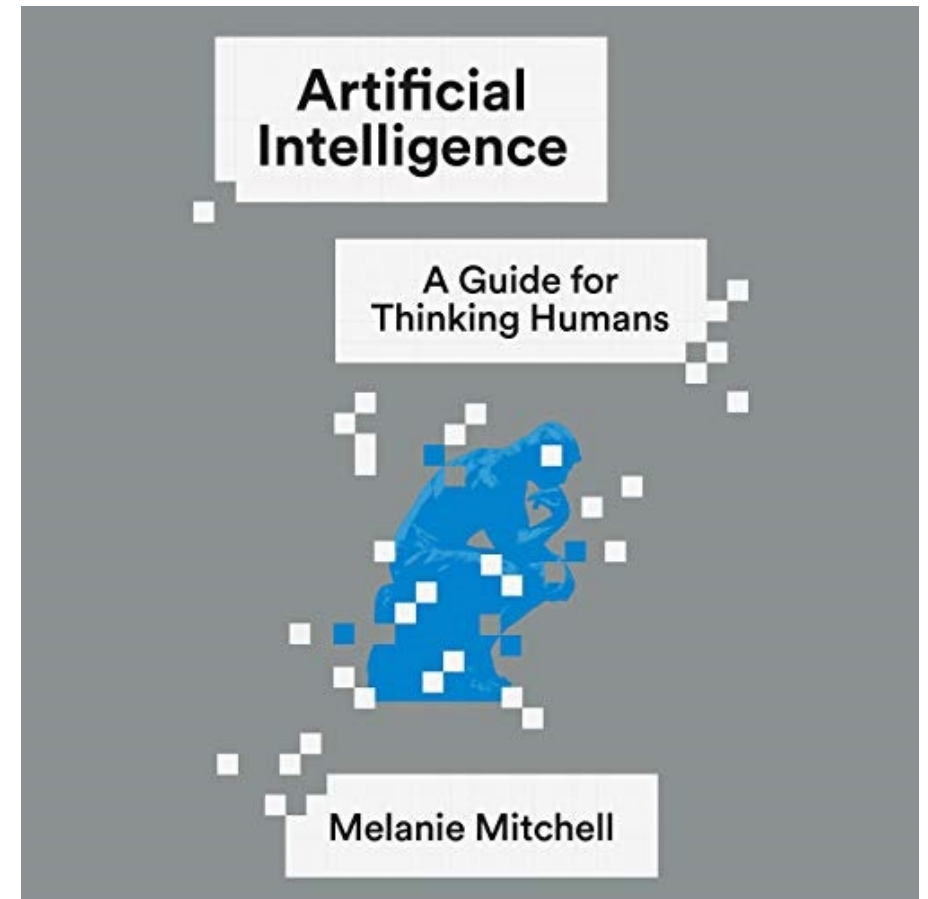
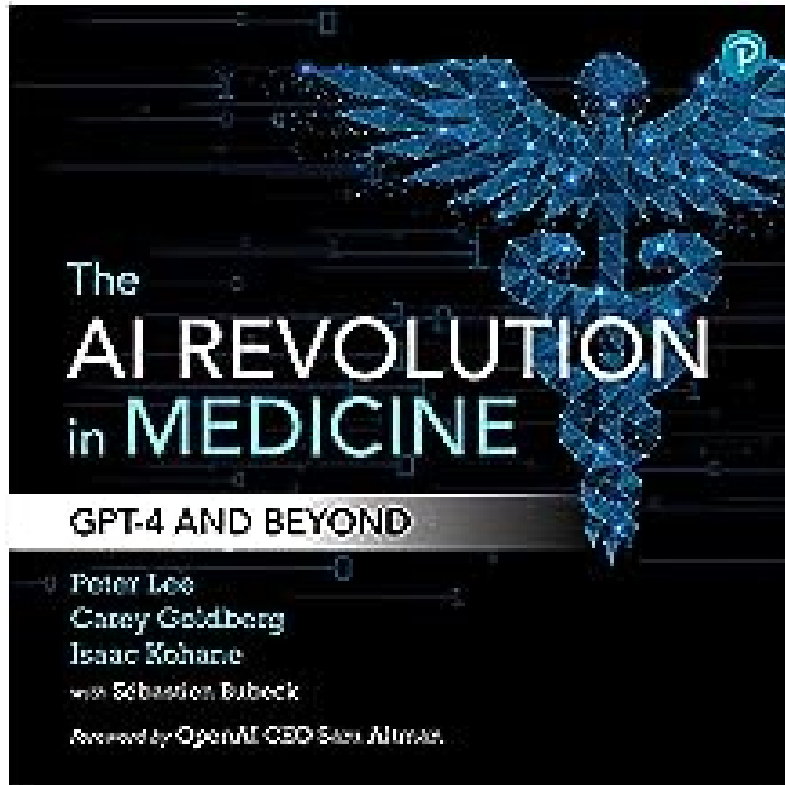
My vote: Computational Intelligence



Recommended References

Artificial Intelligence: A Guide for Thinking Humans
by Melanie Mitchell

AI Revolution in Medicine: GPT-4 and Beyond
by Peter Lee, Carey Goldberg, Isaac Kohane



My Promise to You made at the beginning

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**Get in the Game
Enter the Arena
Learn About AI**

**With Such Great Power,
Comes Great Responsibility**

The Future Depends on You



