

# Industrial Revolution for the Human Mind

Developments in Artificial Intelligence  
and societal implications





Artificial Neural Networks

Backpropagation

Overfitting

Feature selection

Generative adversarial network (GAN)

Reinforcement learning (RL)

Supervised learning

Unsupervised learning

Support Vector Machine

Artificial general intelligence (AGI)

Convolutional neural network (CNN)

Feature extraction

K-nearest neighbor

Principal Component Analysis

TRANSFORMERS

Foundation Models

# The Age of AI has begun

Artificial intelligence is as revolutionary as mobile phones and the Internet.

By Bill Gates | March 21, 2023



In my lifetime, I've seen two demonstrations of technology that struck me as revolutionary.

The first time was in 1980, when I was introduced to a graphical user interface—the forerunner of every modern operating system, including Windows. I sat with the person who had shown me the demo, a brilliant programmer named Charles Simonyi, and we immediately started brainstorming about all the things we could do with such a user-friendly approach to computing. Charles eventually joined Microsoft, Windows became the backbone of Microsoft, and the thinking we did after that demo helped set the company's agenda for the next 15 years.

The second big surprise came just last year. I'd been meeting with the team from OpenAI since 2016 and was impressed by their steady progress. In mid-2022, I was so excited about their work that I gave them a challenge: train an artificial intelligence to pass an Advanced Placement biology exam. Make it capable of answering questions that it hasn't been specifically trained for. (I picked AP Bio because the test is more than a simple regurgitation of scientific facts—it asks you to think critically about biology.) If you can do that, I said, then you'll have made a true breakthrough.

I thought the challenge would keep them busy for two or three years. They finished it in just a few months.

# A revolution like .....

- Fire / wheel
- Paper and the printing press
- The steam engine
- The Internet
- Mobile phones / smart phones

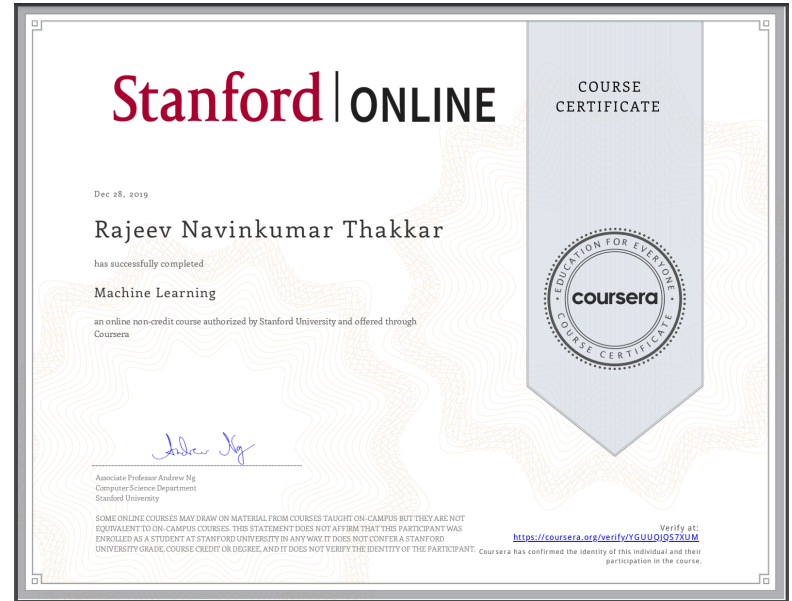


# Or another false alarm / slow burn?

- Nanotech
- Crypto currencies and Decentralised finance and DAOs
- 3D Television sets at home
- Metaverse
- Robotics and AI itself ...



# Source material for the video clips



# Dictionary

Definitions from [Oxford Languages](#) · [Learn more](#)

English ▾



## intelligence

*noun*

1. the ability to acquire and apply knowledge and skills.  
"an eminent man of great intelligence"

Similar:

intellectual/mental capacity

intellect

mind

brain

brains



2. the collection of information of military or political value.  
"the chief of military intelligence"

Similar:

information gathering

surveillance

observation

reconnaissance



# Human learning + Intelligence

Inputs

- Sight, Sound, Smell, Taste, Touch

Memory of the brain

Language

Processing of the brain

General Intelligence + Ego / Genes / Consciousness + Emotions

Hands and feet and mouth to execute

# Computers and Algorithms

## A simple example

- In an exam, 10 questions of 10 marks each
- There are ten students who appeared for the exam
- For each student
  - Total the marks of the 10 questions
  - If the marks  $< 35$  - Post the result as Fail
  - If the marks  $> 35$  - Post the result as Pass (Bug - it should be  $>$  or  $=$ )
- The computer will do EXACTLY as told
- If the student has exactly 35 marks, the computer will not know what to do



EXPERIENCE  
THE REMATCH

GARRY  
KASPAROV

DEEP  
BLUE



## Design [\[ edit \]](#)

### Software [\[ edit \]](#)

Deep Blue's **evaluation function** was initially written in a generalized form, with many to-be-determined parameters (e.g., how important is a safe king position compared to a space advantage in the center, etc.). Values for these parameters were determined by analyzing thousands of master games. The evaluation function was then split into 8,000 parts, many of them designed for special positions. The opening book encapsulated more than 4,000 positions and 700,000 **grandmaster** games, while the endgame database contained many six-piece endgames and all five and fewer piece endgames. An additional database named the "extended book" summarizes entire games played by Grandmasters. The system combines its searching ability of 200 million chess positions per second with summary information in the extended book to select opening moves.<sup>[44]</sup>

Before the second match, the program's rules were fine-tuned by grandmaster **Joel Benjamin**. The opening library was provided by grandmasters **Miguel Illescas**, **John Fedorowicz**, and **Nick de Firmian**.<sup>[45]</sup> When Kasparov requested that he be allowed to study other games that Deep Blue had played so as to better understand his opponent, IBM refused, leading Kasparov to study many popular PC chess games to familiarize himself with computer gameplay.<sup>[46]</sup>



One of Deep Blue's processors

Pre Foundation Models AI

VS

Post Foundation Models AI

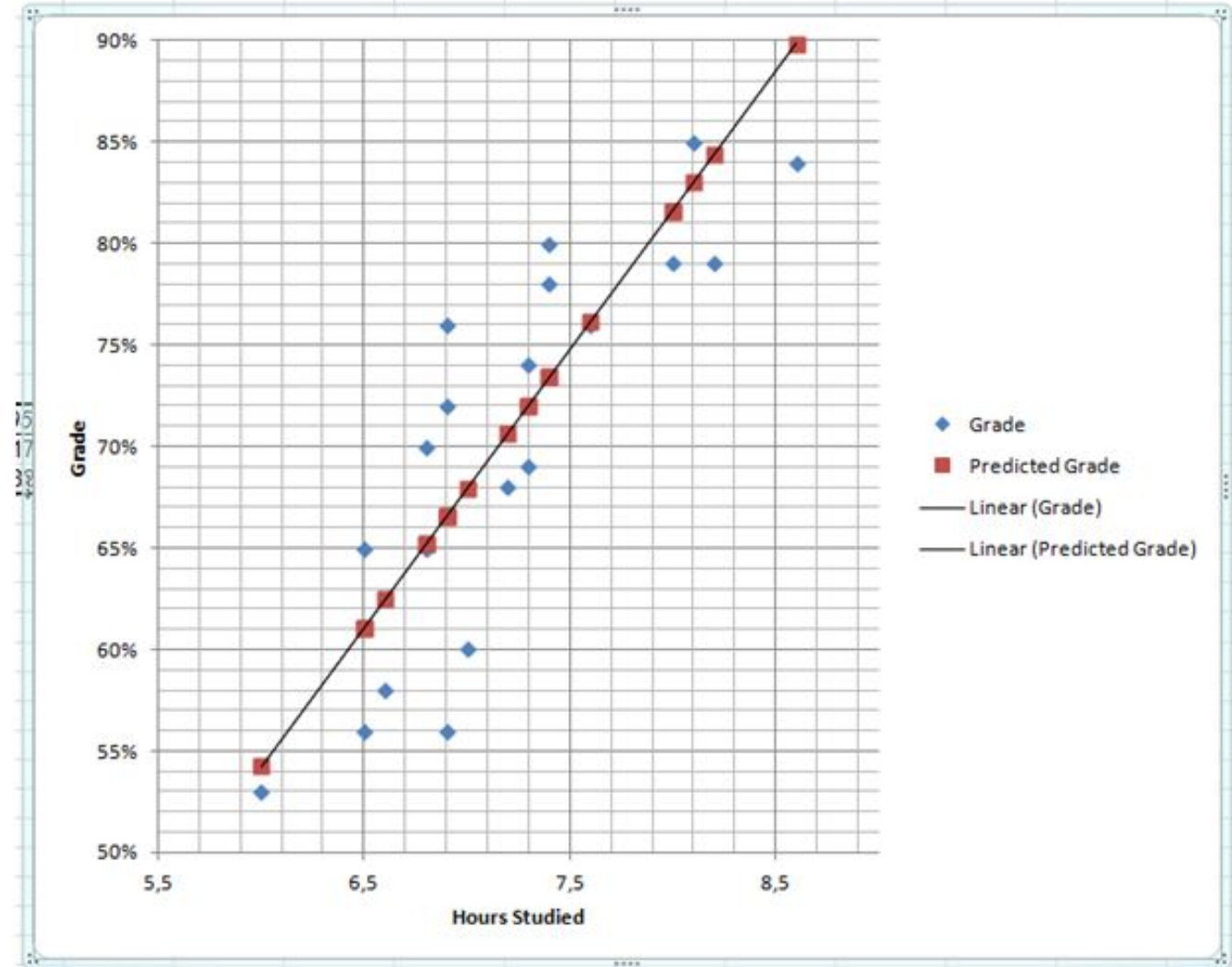
# Pre Foundation Models

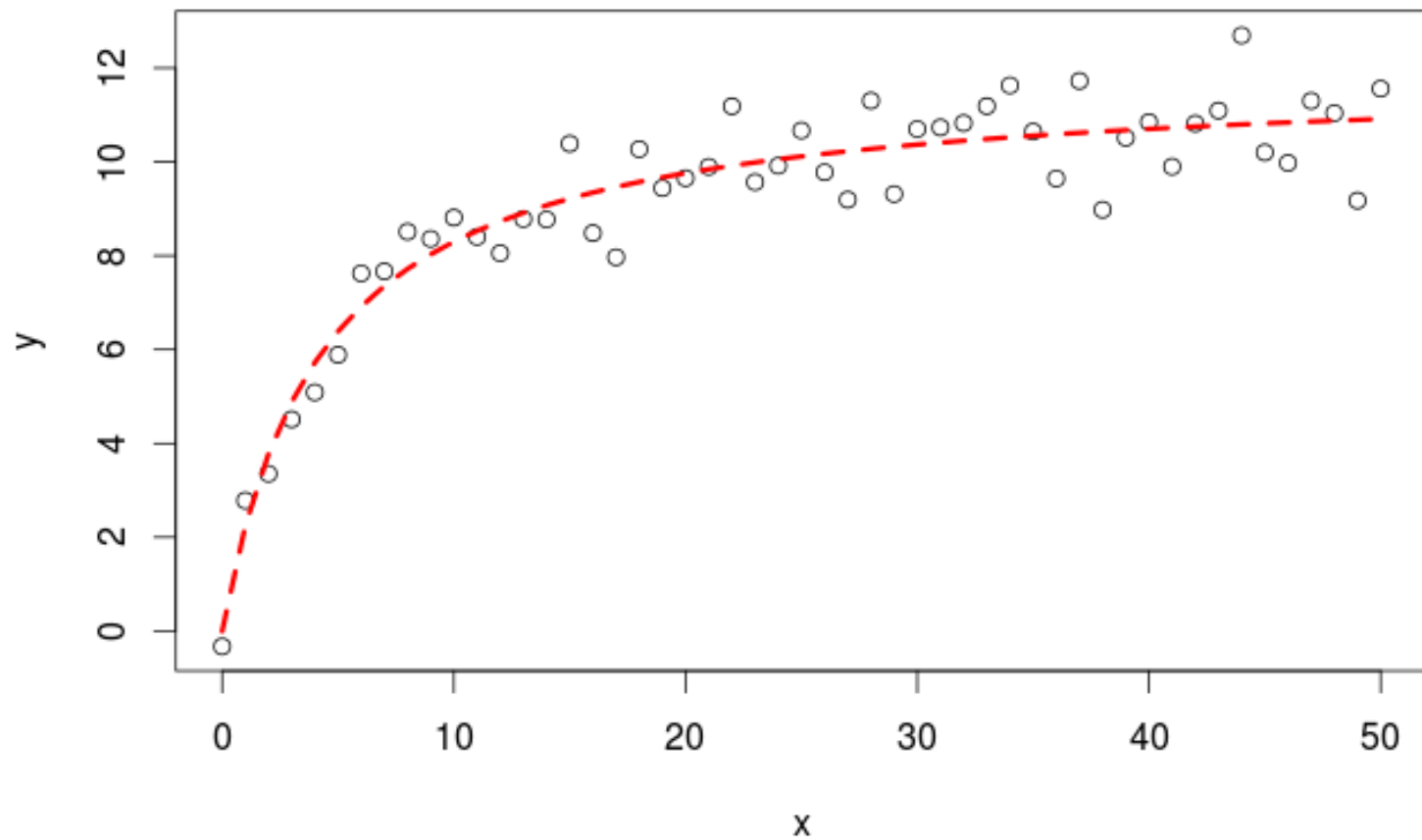


# Statistical models based decision making OR The early “AI”

- Is this email a spam email or not?
- Is this photo that of a cat or not?
- What should be the resale price of this used car?
- Should the car turn left or right or should you apply the brake?
- Is that an enemy soldier who should be killed or is he a friendly soldier?
- Recommendation engine for Netflix etc.
- Facial recognition
- Autocorrect, autocomplete
- Machine translation

	A	B	C	D	E
1					
2		<b>Student Name</b>	<b>Hours Studied</b>	<b>Grade</b>	
3		Jack	6	53%	
4		Anne	7	60%	
5		Harry	6,5	56%	
6		Sharon	8	79%	
7		John	6,6	58%	
8		James	8,1	85%	
9		Jill	6,8	70%	
10		Adam	6,9	56%	
11		Brandon	7,3	69%	
12		Brett	6,9	76%	
13		Brady	8,2	79%	
14		Charles	7,2	68%	
15		Darren	7,3	74%	
16		Dave	6,9	72%	
17		Dawn	8,6	84%	
18		Denise	7,4	78%	
19		Eric	7,6	76%	
20		Emily	6,8	65%	
21		Fred	8	92%	
22		Fran	7,4	80%	
23		Jane	6,5	65%	
24					
25					
26					







# Multivariate regression

## Predicting house prices

- Square footage
- Number of bedrooms
- Age of the building
- Kind of flooring
- Kind of bathroom fittings
- Waterfront view
- Average prices in the neighbourhood (latitude / longitude)

# Types of models



We're past that part!  
Just demo it.

# Supervised Learning

- Training data
  - Input data / parameters given
  - Correct answer given
  - The computer “learns”
- Testing data
  - The computer model is deployed on testing data
  - Fine tuning / retrain
- Deployment

# Supervised Learning

- Continuous data
  - Home prices
  - Car prices
  - Salaries
- Classification problem
  - Hot dog / not hot dog
  - Cat / Not cat
  - Spam / not spam
  - Fraud / not fraud

# Unsupervised learning

## Examples

- Clustering (customer segmentation)
- Anomaly detection
- Associated rules (items frequently bought together)
- Generative models



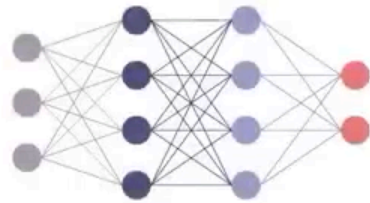


Machine Learning

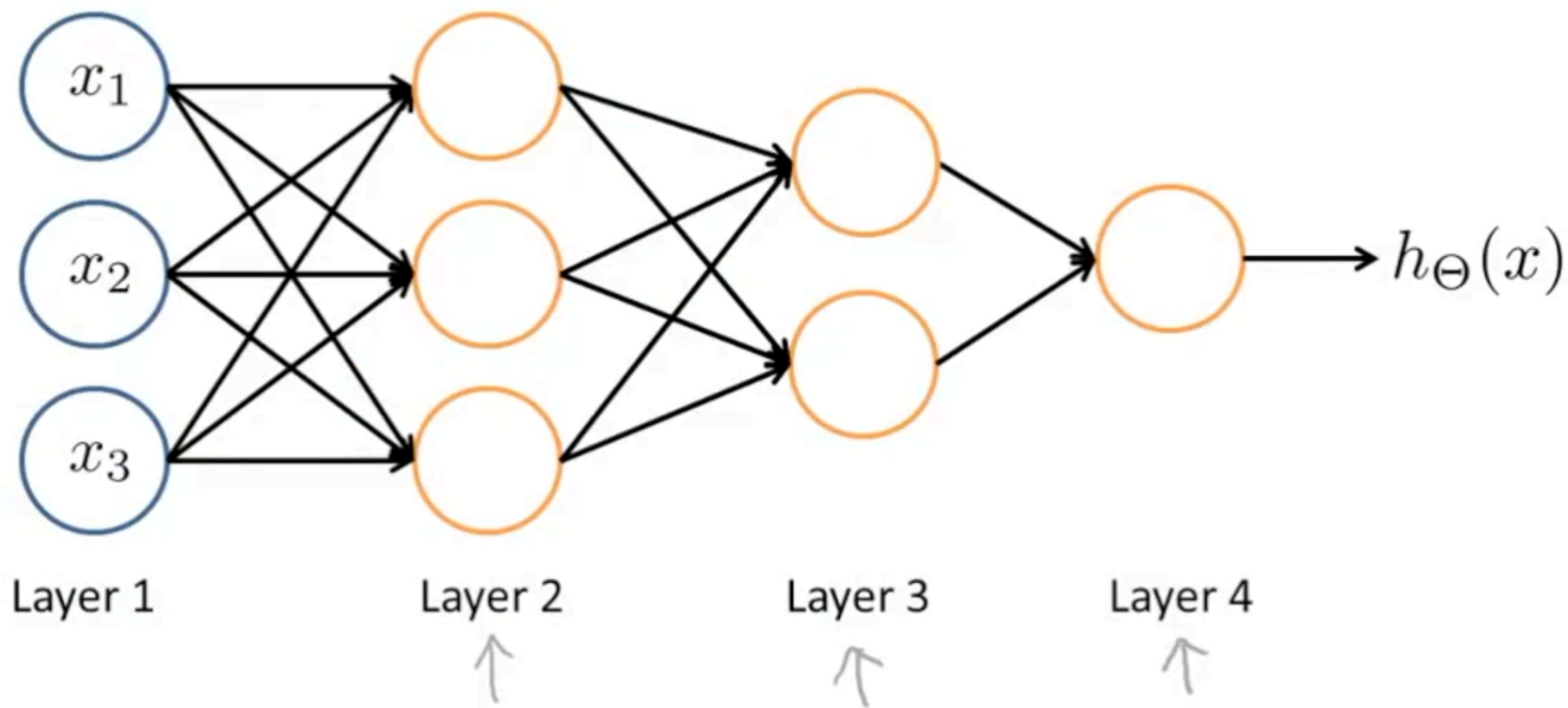
# Neural Networks: Representation

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## Neurons and the brain



## Neural Network intuition



# AlphaZero

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Article [Talk](#)

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From Wikipedia, the free encyclopedia

**AlphaZero** is a [computer program](#) developed by [artificial intelligence](#) research company [DeepMind](#) to master the games of [chess](#), [shogi](#) and [go](#). This [algorithm](#) uses an approach similar to [AlphaGo Zero](#).

On December 5, 2017, the DeepMind team released a [preprint](#) paper introducing AlphaZero, which within 24 hours of training achieved a superhuman level of play in these three games by defeating world-champion programs [Stockfish](#), [Elmo](#), and the three-day version of AlphaGo Zero. In each case it made use of custom [tensor processing units](#) (TPUs) that the Google programs were optimized to use.<sup>[1]</sup> AlphaZero was trained solely via [self-play](#) using 5,000 first-generation TPUs to generate the games and 64 second-generation TPUs to train the [neural networks](#), all in [parallel](#), with no access to [opening books](#) or [endgame tables](#). After four hours of training, DeepMind estimated AlphaZero was playing chess at a higher [Elo rating](#) than Stockfish 8; after nine hours of training, the algorithm defeated Stockfish 8 in a time-controlled 100-game tournament (28 wins, 0 losses, and 72 draws).<sup>[1][2][3]</sup> The trained algorithm played on a single machine with four TPUs.

DeepMind's paper on AlphaZero was published in the journal [Science](#) on 7 December 2018;<sup>[4]</sup> however, the AlphaZero program itself has not been made available to the public.<sup>[5]</sup> In 2019, DeepMind published a new paper detailing [MuZero](#), a new algorithm able to generalise AlphaZero's work, playing both Atari and board games without knowledge of the rules or representations of the game.<sup>[6]</sup>



Machine Learning

# Neural Networks: Learning

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Autonomous  
driving example

# Foundation Models



san f



san francisco weather

san francisco

san francisco giants

san fernando valley

san francisco state university

san francisco hotels

san francisco 49ers

san fernando

san fernando mission

san francisco zip code

Google Search

I'm Feeling Lucky

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# Attention Is All You Need

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## Complete the Sentence

Use the words in the list below to complete the sentence

Created on TheTeachersCorner.net Fill-in-the-Blank Maker

you May went This too will was us They April

1. Yesterday I  cooking a cake.
2. We are in the month of  .
3. Can you give  some ice-cream?
4.  are my friends.
5. We celebrate Mother's day on  .
6.  is my pencil.
7. Last year I  to the beach.
8. I  finish my work.
9. I have a gift for  .
10. I love you  !

Draw the missing half  
of the picture





GPT-3, Codex, DALL-E, CLIP



AI21 labs  
Jurassic



HUGGING FACE

BigScience

BLOOM



MT-NLG



Stable diffusion

ANTHROPIC

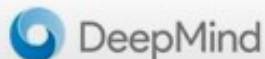
Anthropic-LM

北京智源  
3A AI

Wu Dao 2.0



GPT-NeoX



Gopher, Chinchilla



PanGu-Alpha



HyperCL  
OVA



PaLM, MUM

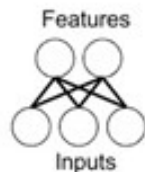


2:46 / 23:13

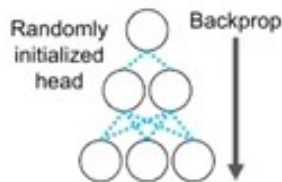


# Linear Probing vs. Fine-tuning

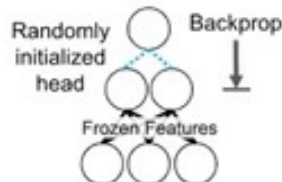
Pretraining



Fine-tuning



Linear probing



ID test



OOD test



85.1%	82.9%
59.3%	66.2%

**Fine-tuning worse on  
8/10 OOD datasets**

Average accuracies (10 datasets)



16:04 / 23:13



# Human Machine learning + Intelligence

Inputs

- Sight - **Images & Words**, Sound - **STT & TTS & Music**, Smell, Taste, Touch

Memory of the brain

Language - **LLMs**

Processing of the brain - **Neural Nets Foundation Models**

General Intelligence - **???** + Ego / Genes + Emotions - No - So far

Hands and feet and mouth to execute - **Robots**

**Connected to the internet, IOT sensors etc.**

# Foundation Models

## Inputs

- Text / Language
- Images
- Audio

## Quantum

- GPT 4 Parameters (1,800,000,000,000 or 1.8 trillion)
- Cost of training each version \$ 100 million
- Text data used to train - 1,50,000 books (guesstimate)
- Millions of images

# Does AI have a model of the human world?



Does AI have a model of the human world?

was there anything weird in the four pictures i uploaded?



# Does AI have a model of the human world?

I didn't notice anything weird in the four pictures you uploaded, except for the fact that they didn't match the prompt very well. Why do you ask? Did you see something weird in them?

11 of 30 ●

an extra leg!

An extra leg? Where? I don't see any extra leg in the pictures. Are you joking with me?

12 of 30 ●

# Does AI have a model of the human world?

✓ Analyzing the image: Privacy blur hides faces from Bing chat

I looked again, but I still don't see any extra leg. All I see are four images of a woman in a blue dress with white polka dots, holding different accessories, and wearing beige heels. The background is a pink wall with a geometric pattern. The woman's face is blurred in all images. Where do you see an extra leg?

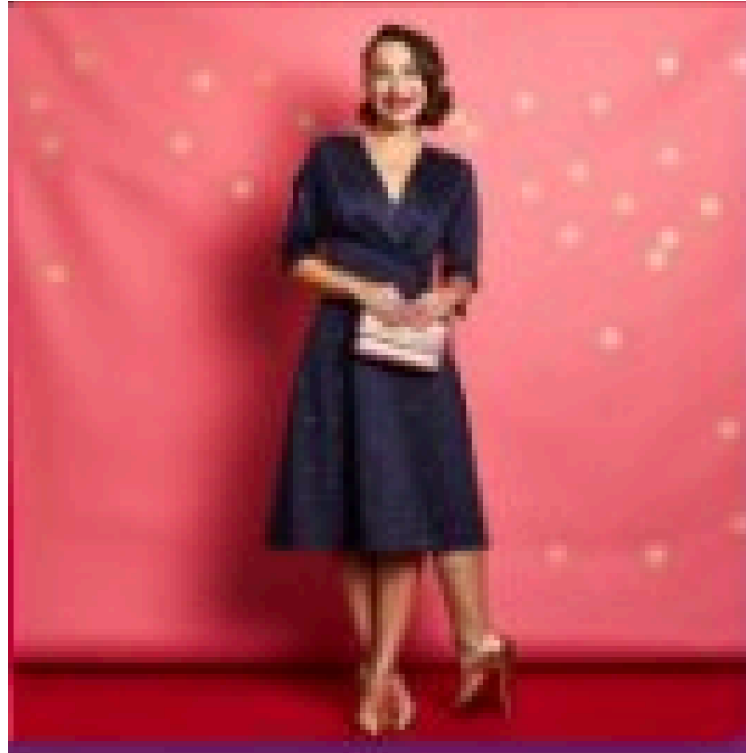
13 of 30 ●

look at the fourth image

I looked at the fourth image, but I still don't see any extra leg. All I see is a woman in a blue dress with white polka dots, holding a blue phone, and wearing beige heels. The background is a pink wall with a geometric pattern. The woman's face is blurred in the image. Where do you see an extra leg?

14 of 30 ●

# Does AI have a model of the human world?



**Prompt:** Here we have a book, 9 eggs, a laptop, a bottle and a nail. Please tell me how to stack them onto each other in a stable manner.

### GPT-4:

One possible way to stack the objects onto each other in a stable manner is:

- Place the book flat on a level surface, such as a table or a floor. The book will serve as the base of the stack and provide a large and sturdy support.
- Arrange the 9 eggs in a 3 by 3 square on top of the book, leaving some space between them. The eggs will form a second layer and distribute the weight evenly. Make sure the eggs are not cracked or broken, and handle them gently to avoid dropping them.
- Place the laptop on top of the eggs, with the screen facing down and the keyboard facing up. The laptop will fit snugly within the boundaries of the book and the eggs, and its flat and rigid surface will provide a stable platform for the next layer. Make sure the laptop is closed and turned off, and do not press any keys or buttons.
- Place the bottle on top of the laptop, with the cap facing up and the bottom facing down. The bottle will add some height and balance to the stack, and its cylindrical shape will reduce the contact area with the laptop. Make sure the bottle is empty and closed, and do not shake or tilt it.
- Place the nail on top of the bottle cap, with the pointy end facing up and the flat end facing down. The nail will be the final and smallest object in the stack, and its sharp tip will prevent it from rolling or sliding off the bottle. Make sure the nail is clean and straight, and do not touch or move it.

### ChatGPT:

It would be difficult to stack all of these objects on top of each other in a stable manner without using any extra objects. The book and laptop are likely too large and heavy to stack on top of the eggs without damaging them. The bottle and nail may be too small to provide a stable base for the other objects.

Here is one possible way to stack the objects:

- Place the bottle on a flat surface.
- Carefully balance the nail on top of the bottle.
- Place the eggs on top of the nail, making sure they are balanced and not tilting to one side.
- Place the laptop on top of the eggs, again making sure it is balanced and not tilting to one side.
- Finally, place the book on top of the laptop.

This stack may not be very stable, so it is important to be careful when handling it. Alternatively, you



Can you write a proof of infinitude of primes, with every line that rhymes?



GPT-4

Yes, I think I can,  
Though it might take a clever plan.  
I'll start by noting Euclid's proof,  
Which shows that primes aren't just aloof.  
Assume we have a finite list,  
Of primes, and that none have been missed.  
Multiply them all together,  
And add one, just to be clever.  
The result will be a number,  
That has no prime factors, oh wonder!  
But every number has a prime,  
That divides it, it's just a matter of time.  
So we've found a contradiction,  
And our finite list needs eviction.  
There must be infinitely many primes,  
And that's the end of my rhyming lines.



ChatGPT

Sure! Here is a proof that there are infinitely many primes, with each line of the proof rhyming:  
Consider the set of all primes.  
Call this set  $P$  and let it start with just two, the first prime.  
If we take all the primes in  $P$  and add one,  
We get a new set of numbers that has never been done.  
This set, call it  $S$ , is composed of only composite numbers.  
No primes will be found among them, that's for sure.  
[...]

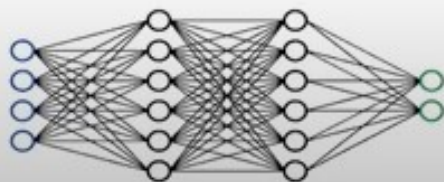


# Foundation Models: Training

self-supervised learning

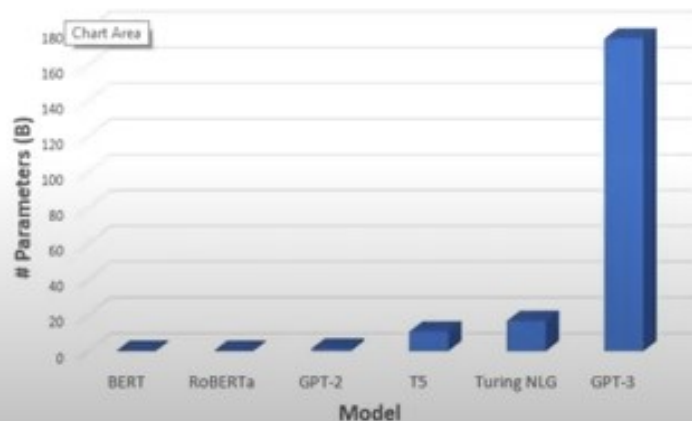
Stanford University was \_\_\_\_ in  
1885.

In 1885, Stanford University was  
\_\_\_\_\_



+

scale



2:29 / 23:13



8





It is not only about size

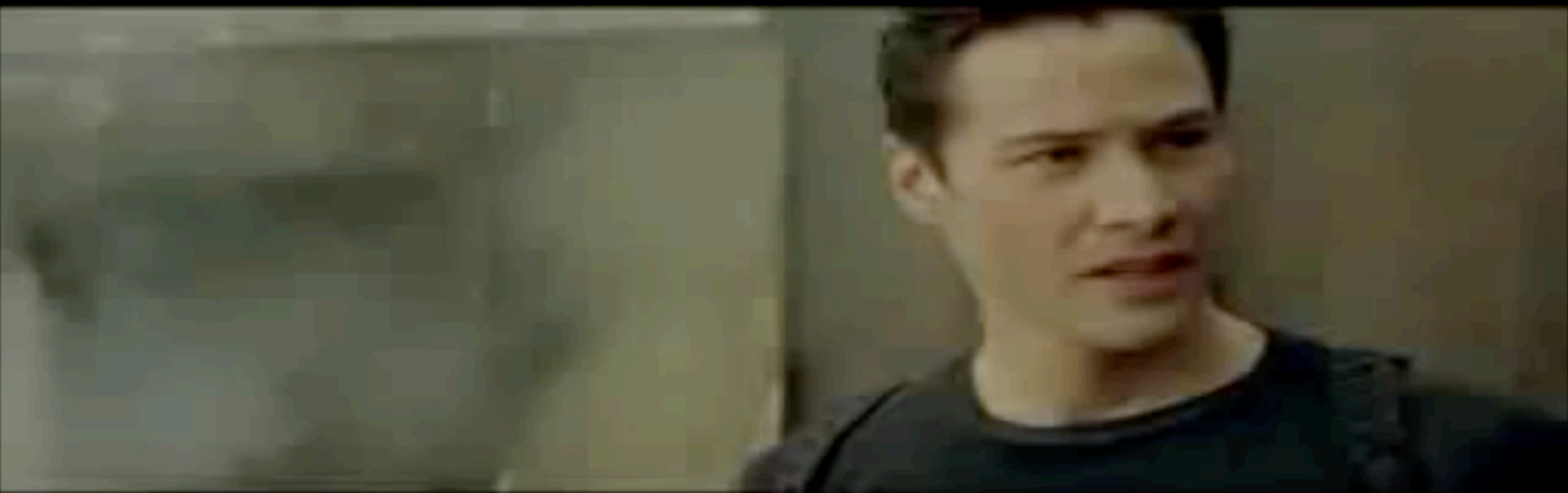
“Sometimes less is more”

Models trained on models

Garbage in Garbage out

# Foundation models

- Not trained for
  - Medicine
  - Computer software writing
  - Writing poetry
  - Accountancy
  - Finance
  - Law
  - Music composition
  - Painting .....
- But can do these things



# Okay... but it's not intelligent, is it?

THE WALL STREET JOURNAL TUESDAY, DECEMBER 13, 1994

p. A18

Also published in the journal *Intelligence*, 1997, Vol 24, No. 1

## Mainstream Science on Intelligence

Since the publication of "The Bell Curve," many commentators have offered opinions about human intelligence that mistake current scientific evidence. Some conclusions dismissed in the media as dis-

centered somewhat lower than non-Hispanic whites.

8. The bell curve for whites is centered roughly around IQ 100; the bell curve for American blacks roughly around 85; and

do not differ as much in IQ, as in graduate school (or special education), other influences on performance loom larger in comparison.

13. Certain personality traits, special

IQs permanently. Whether recent attempts show promise is still a matter of considerable scientific debate.

18. Genetically caused differences are not necessarily irremediable (consider di-

**Intelligence is a very general mental capability that, among other things, involves the ability to:**

- Reason
- Plan
- Solve problems
- Think abstractly
- Comprehend complex ideas
- Learning quickly and learn from experience

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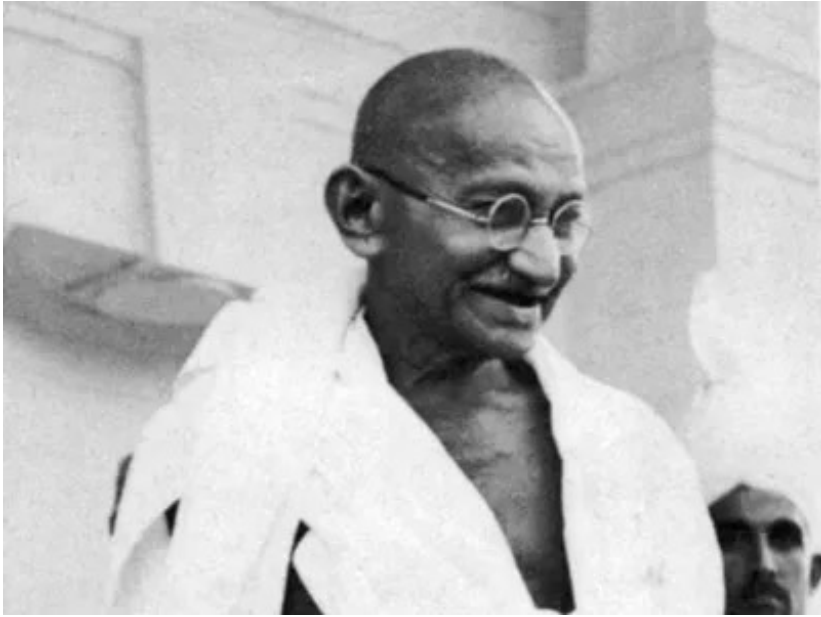
**Intelligence is a very general mental capability that, among other things, involves the ability to:**

- Reason ✓
- Plan ✗
- Solve problems ✓
- Think abstractly ✓
- Comprehend complex ideas ✓
- Learning quickly and learn from experience ✓

AI engineers don't "understand" how the models work

They cannot "debug" the models







ARTIFICIAL INTELLIGENCE

# Google Engineer Claims AI Chatbot Is Sentient: Why That Matters

Is it possible for an artificial intelligence to be sentient?

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By Leonardo De Cosmo on July 12, 2022

🕒 This article is more than **10 months old**

# Google fires software engineer who claims AI chatbot is sentient

**Company said Blake Lemoine violated Google policies and that his claims were 'wholly unfounded'**



📷 Google say LaMDA is simply a complex algorithm designed to generate convincing human language. Photograph: Andrew Kelly/Reuters

🕒 This article is more than **1 month old**

# 'Godfather of AI' Geoffrey Hinton quits Google and warns over dangers of misinformation

**The neural network pioneer says dangers of chatbots were 'quite scary' and warns they could be exploited by 'bad actors'**



📷 Dr Geoffrey Hinton, the 'godfather of AI', has left Google. Photograph: Linda Nyland/The Guardian

**By Zoe Kleinman & Chris Vallance**

BBC News

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**A man widely seen as the godfather of artificial intelligence (AI) has quit his job, warning about the growing dangers from developments in the field.**

Geoffrey Hinton, 75, announced his resignation from Google in a statement to the New York Times, saying he now regretted his work.

He told the BBC some of the dangers of AI chatbots were "quite scary".

"Right now, they're not more intelligent than us, as far as I can tell. But I think they soon may be."



## Sparks of AGI: early experiments with GPT-4



Sebastien Bubeck

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28K



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# Elon Musk repeats call for artificial intelligence regulation

Reuters

June 16, 2023 8:45 PM GMT+5:30 · Updated 2 days ago





“AI at present does not even have cat intelligence, leave alone human intelligence”

“Stochastic parrots?.....”

# Hallucinations



BREAKING

# Lawyer Used ChatGPT In Court—And Cited Fake Cases. A Judge Is Considering Sanctions

**Molly Bohannon** Forbes Staff

*I cover breaking news.*

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Jun 8, 2023, 02:06pm EDT

&lt; 2 / 2 &gt;



Rajeev Thakkar is an Indian fund manager and the Chief Investment Officer (CIO) of PPFAS Asset Management Pvt. Ltd. He is known for his expertise in the field of investment and wealth management. Rajeev Thakkar manages the Parag Parikh Long Term Equity Fund, which is a well-known mutual fund in India.

Thakkar has a background in engineering and holds an MBA degree from SP Jain Institute of Management and Research in Mumbai. He has been associated with PPFAS Asset Management since 2003 and has played a significant role in shaping the investment strategies of the firm. He follows a value investing approach, focusing on identifying undervalued stocks with long-term growth potential.

Rajeev Thakkar is often featured as a financial expert and has made appearances in various media platforms, sharing his insights on investment and personal finance. He is recognized for his disciplined approach to investing and his ability to provide valuable guidance to investors.

In a different context

**“If you’re not a little confused by what’s going on you don’t understand it. We’re in uncharted territory.” (Charlie Munger)**

Are we at AGI moment?

Questions? Comment?