

# Welcome



(queue to 8:40)

# **Understanding Artificial Intelligence**

**What a well informed person should know**

**Marc Cohen**

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# Prerequisites

- **You are human (bots not allowed)**
- **You are curious about AI and want to learn more**
- **No technical knowledge required**
- **No programming required**
- **No maths required**

# Goals

- **Gain a conceptual understanding of how AI works**
- **Find out about the state of the art in AI**
- **Consider the ethical issues raised by AI**
- **Think critically about AI in your life and in the world**
- **Help you prepare for the continuing revolution**

# Non-Goals

- Deep dive into technology or maths
- Definitely answer difficult ethical or societal questions
- Predict the future

# Agenda

- My Fave AI App
- Definitions
- History
- Mechanics
- State of the Art
- Ethics
- The Future



Photo by Domenico Loia on [Unsplash](#)

# My Fave AI App

# August 2016

## Option 1 - Interactive Trivia Quiz Challenge Game

Inspired by [quizup](#) but a PWA rather than a native app and used as a way to illustrate backend design principles. We'll build this app in steps and highlight important lessons as they arise in the design process.

### Requirements

- Usage flow
  - Visit site ([quizr.io](#))
  - Anonymous mode works out of the box
    - Ability to do quiz challenges with random other users but no user profile, no persistence of results, no leaderboard, no history
  - Establish a user profile
  - Challenge random or selected opponent to real time trivia challenge
  - Challenger selects subject, responder accepts or rejects (repeat until agreement)
  - Quiz conducted in real time using webRTC data (with optional video)
  - Results are persistent
  - Leaderboards maintained
  - Questions are accessed dynamically via network (caching is not particularly helpful because real time contents won't work while offline)
- Utilize an [open trivia question database](#)
- Implemented as a PWA
- Both a hosted service and an open source code example
- FE uses either react or Angular 2 (TBD)
- Use to illustrate state of the art back end capabilities

### App Stages

1. FE - UI starts with anonymous mode only.
2. Add successive features by implementing an API (REST or gRPC). With each step, highlight options and considerations in choosing backend technology
  - a. sign in and user profile management

**March 2023**

**Wouldn't it be  
cool to have a  
free quiz game  
for everyone  
powered by AI?**



**quizaic**

(pronounced like **mosaic**)

# Let's play!

The screenshot shows the Quizaic app interface. At the top, there is a navigation bar with the Quizaic logo and the text "AI Powered Infinitrivia". On the right side of the bar is a circular profile picture of a man wearing a green cap. Below the navigation bar is a vertical sidebar containing five menu items: "Home" (selected), "Browse", "Create", "Play", and "About". The main content area features a large blue banner with the "Quizaic" logo in white and red. Below the banner, the text "AI Powered Infinitrivia" is displayed in a large, bold, blue font. A detailed description follows: "Quizaic leverages the power of generative AI to create and play unlimited trivia quizzes and online surveys. Quizaic is a demonstration app to illustrate what's possible with the combination of Google Cloud services, Flutter, and Vertex AI. Quizaic is not an official Google product and should not be used for commercial purposes."

Quizaic

AI Powered Infinitrivia

AI Powered Infinitrivia

Quizaic leverages the power of generative AI to create and play unlimited trivia quizzes and online surveys. Quizaic is a demonstration app to illustrate what's possible with the combination of Google Cloud services, Flutter, and Vertex AI. Quizaic is not an official Google product and should not be used for commercial purposes.

# Early Prompt

Generate a {num\_questions} multiple choice quiz questions based on category {topic}.

Generate a {num\_questions} multiple choice quiz questions **in Swedish** based on category {topic}.

Generate a {num\_questions} multiple choice quiz questions based on category {topic} **in Swedish**.

# Current Prompt

You are a trivia expert.  
Generate a set of multiple choice quiz questions.

Category: {topic}

Quiz difficulty level: {difficulty}

Number of questions: {num\_questions}

Number of responses per question: {num\_answers}

Quiz language: {language}

RULES:

- Accuracy is critical.
- Each question must have exactly one correct response, selected from the responses array.
- Output should be limited to a json array of questions, each of which is an object containing quoted keys "question", "responses", and "correct".
- Don't return anything other than the json document.

OUTPUT:

# Definitions

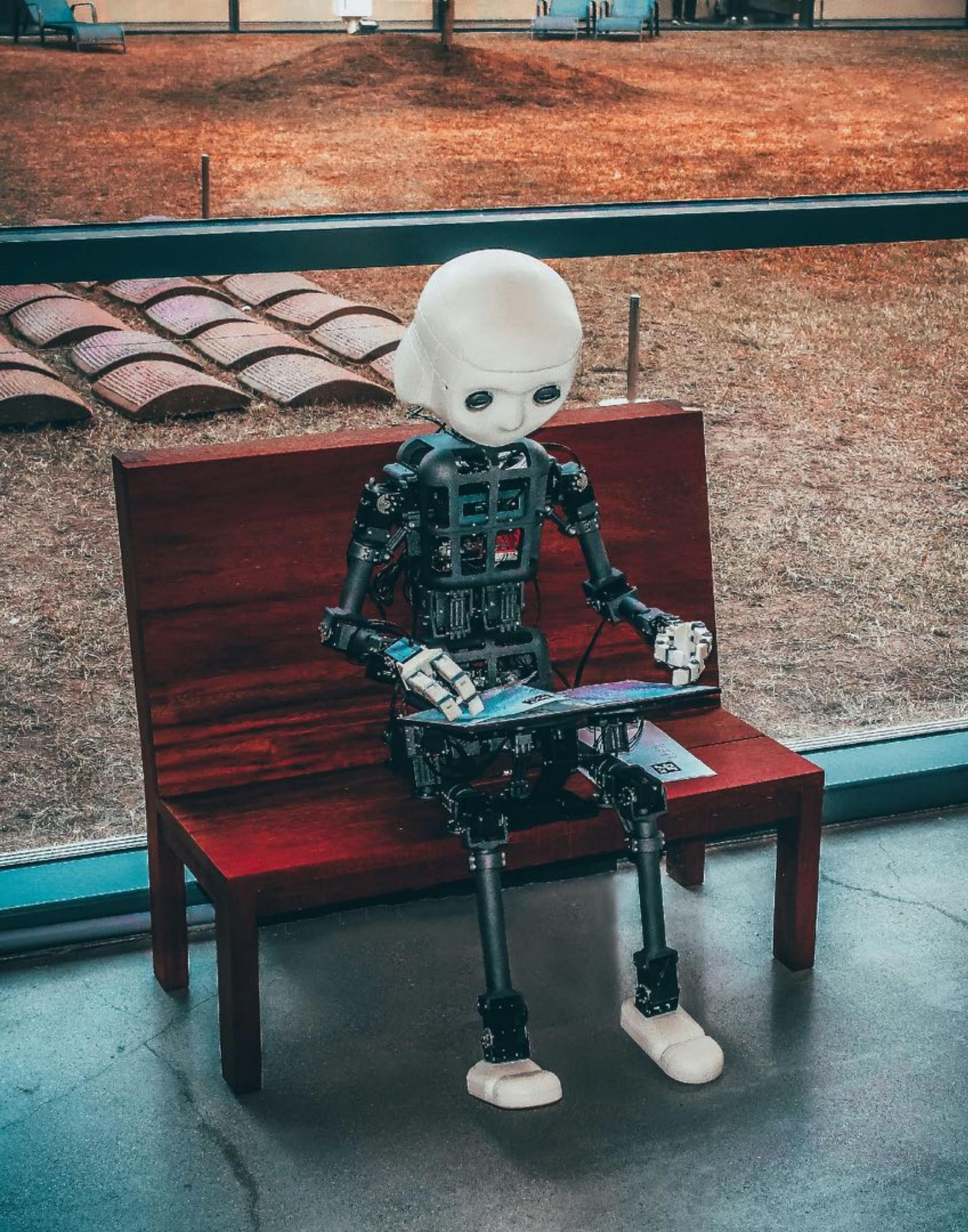
- **Artificial Intelligence**
- **Machine Learning**
- **Neural Network**
- **Deep Learning**
- **Generative AI**

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mal~on<sup>2</sup>; mal~o min kaptas  
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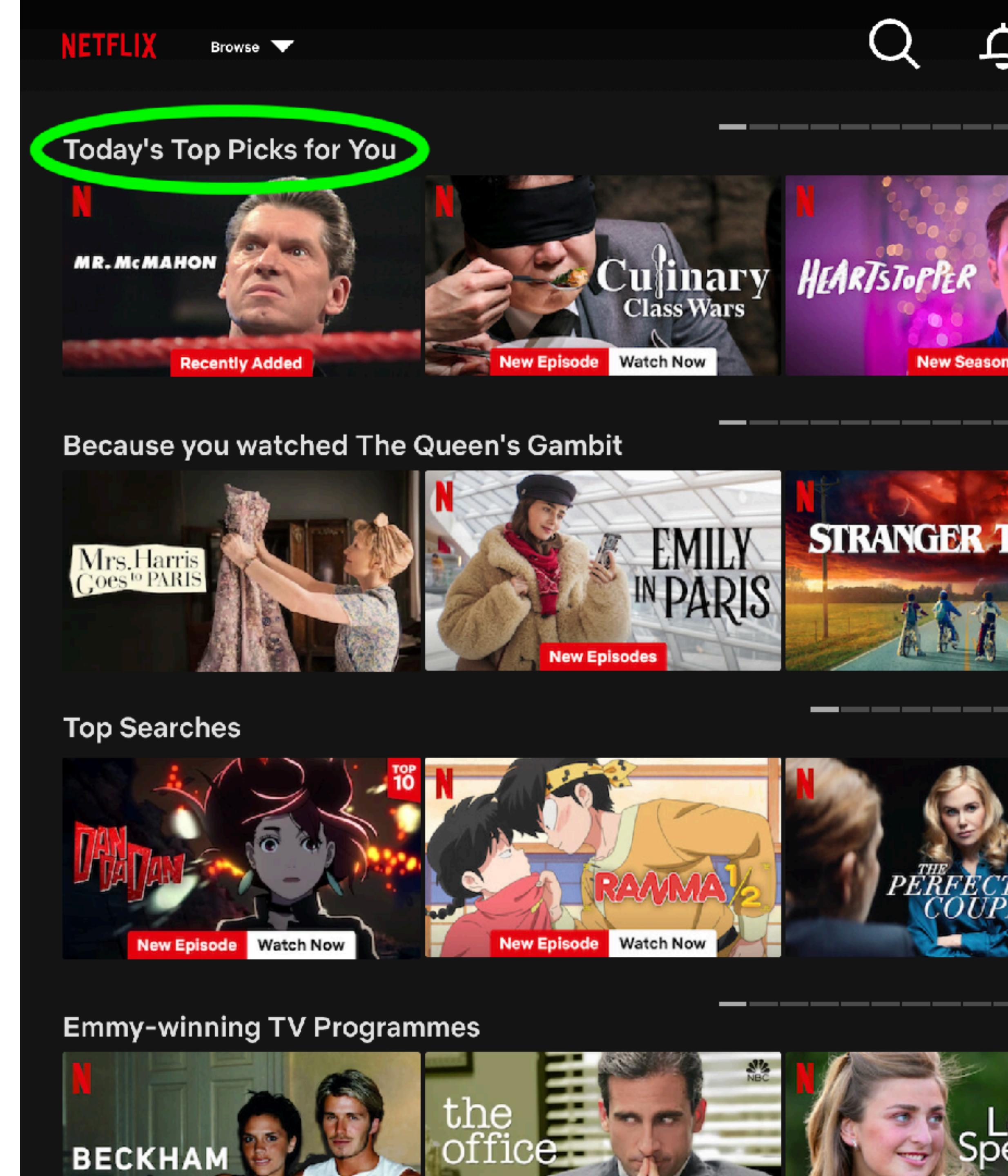
# Definition: Artificial Intelligence

The creation of algorithms and systems capable of performing tasks that typically require human cognition, such as learning, reasoning, perception, decision-making, and natural language processing.



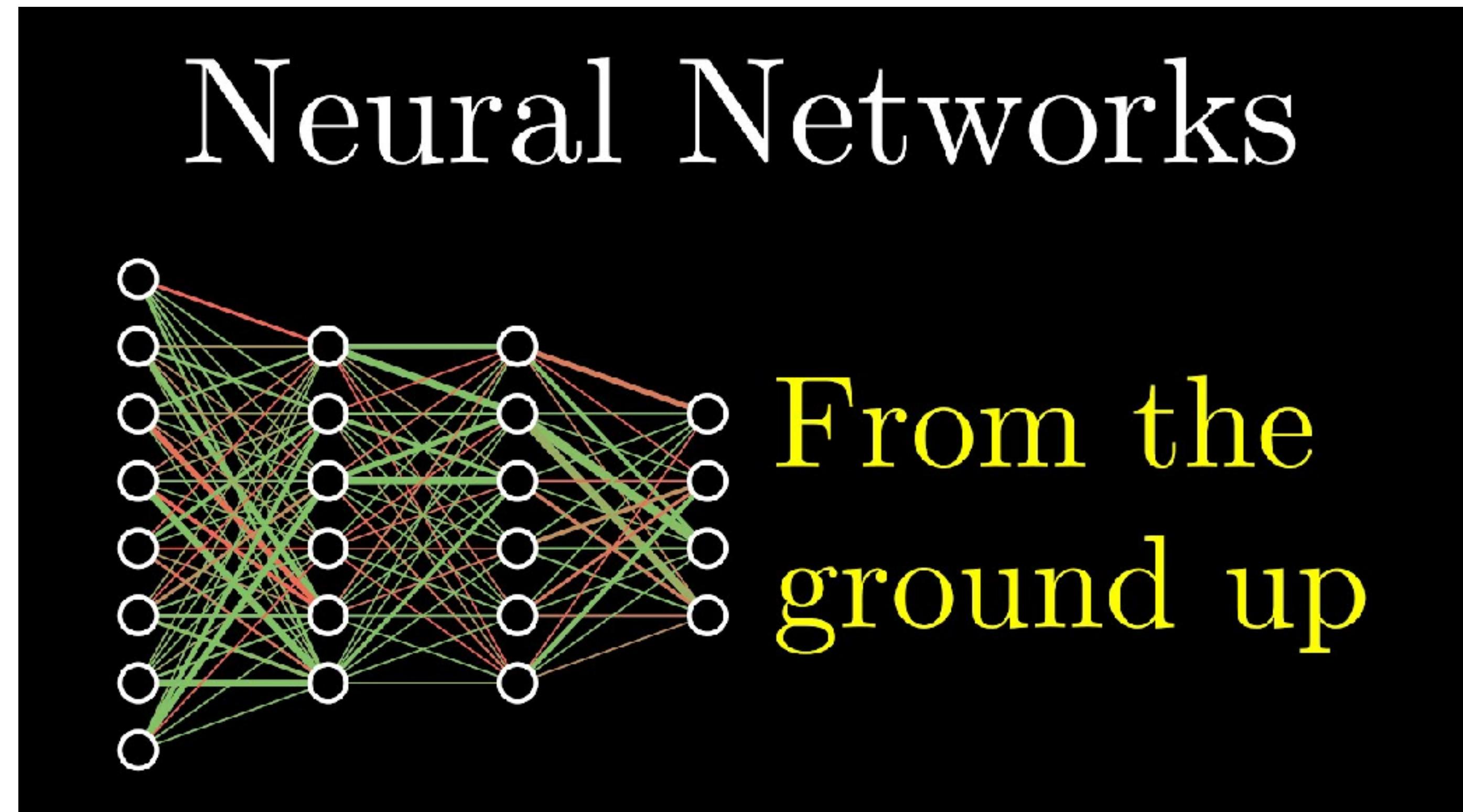
# Definition: Machine Learning

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 analyze and draw inferences from patterns in data.



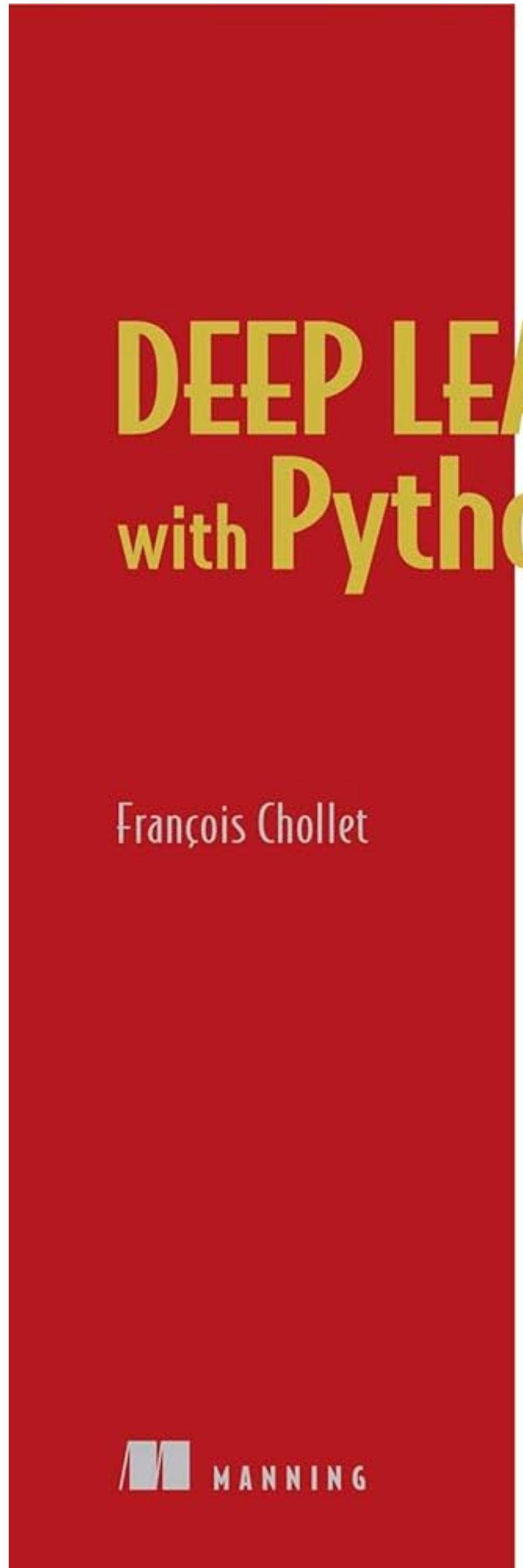
# Definition: Neural Networks

A machine learning (ML) technique that uses a network of interconnected layers of nodes to process data in a way that bears some resemblance to the human brain.



# Definition: Deep Learning

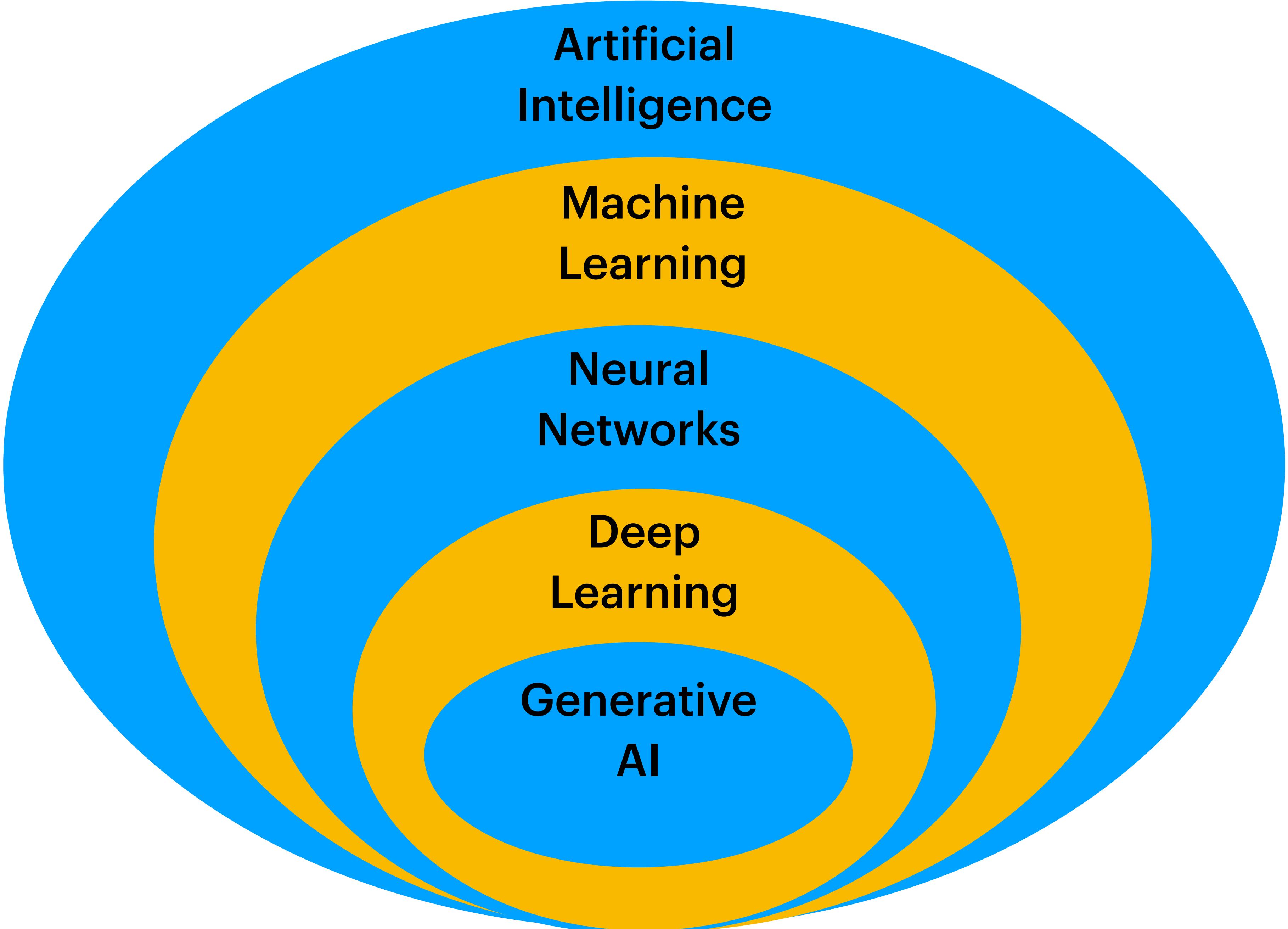
A type of machine learning that uses multi-layer neural networks to train computers to process data and make human-like decisions. Deep learning systems learn from large amounts of data, including images, text, audio, and video to recognize patterns, make predictions, and automate tasks.



# Definition: Generative AI

Deep-learning models  
that can generate high-  
quality text, images,  
video, and other  
content based on the  
data they were trained  
on.





**Artificial  
Intelligence**

**Machine  
Learning**

**Neural  
Networks**

**Deep  
Learning**

**Generative  
AI**

# Artificial Intelligence

Machine Learning

Deep Learning

1950's

1960's

1970's

1980's

1990's

2000's

2010's



# History

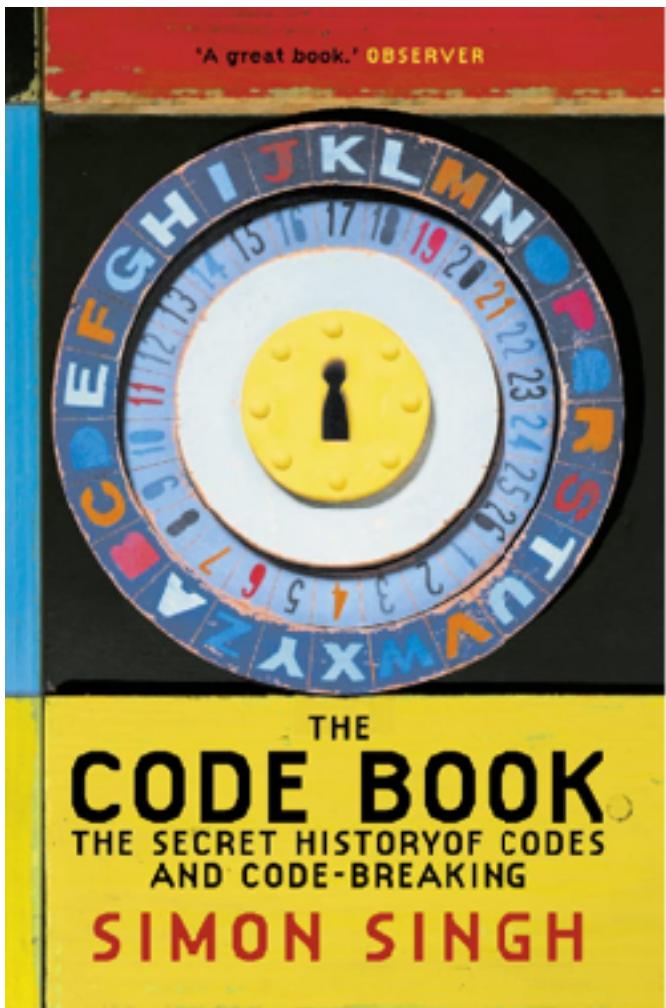
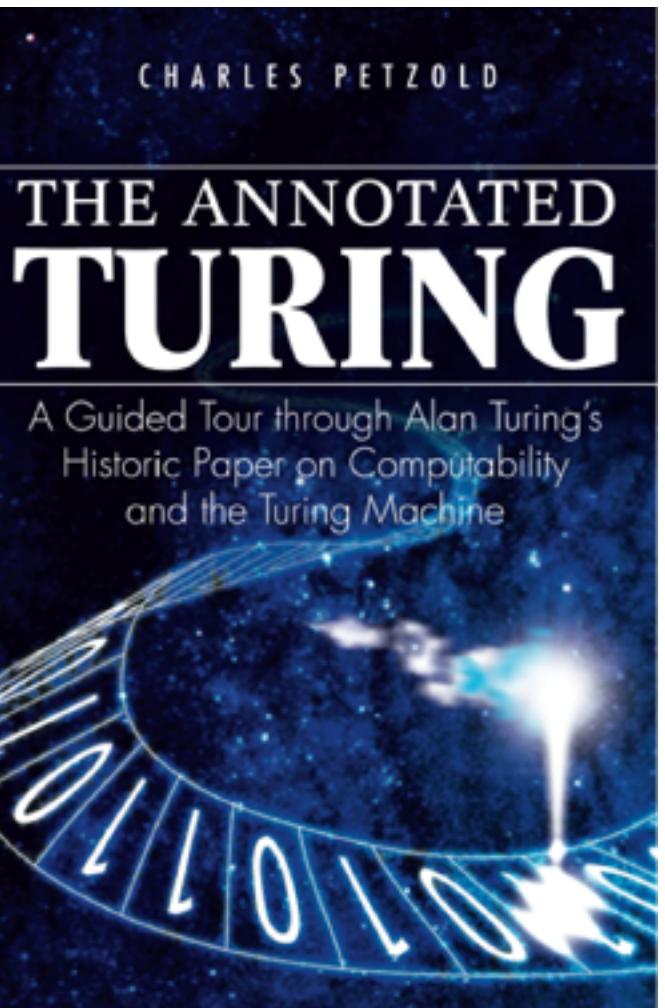
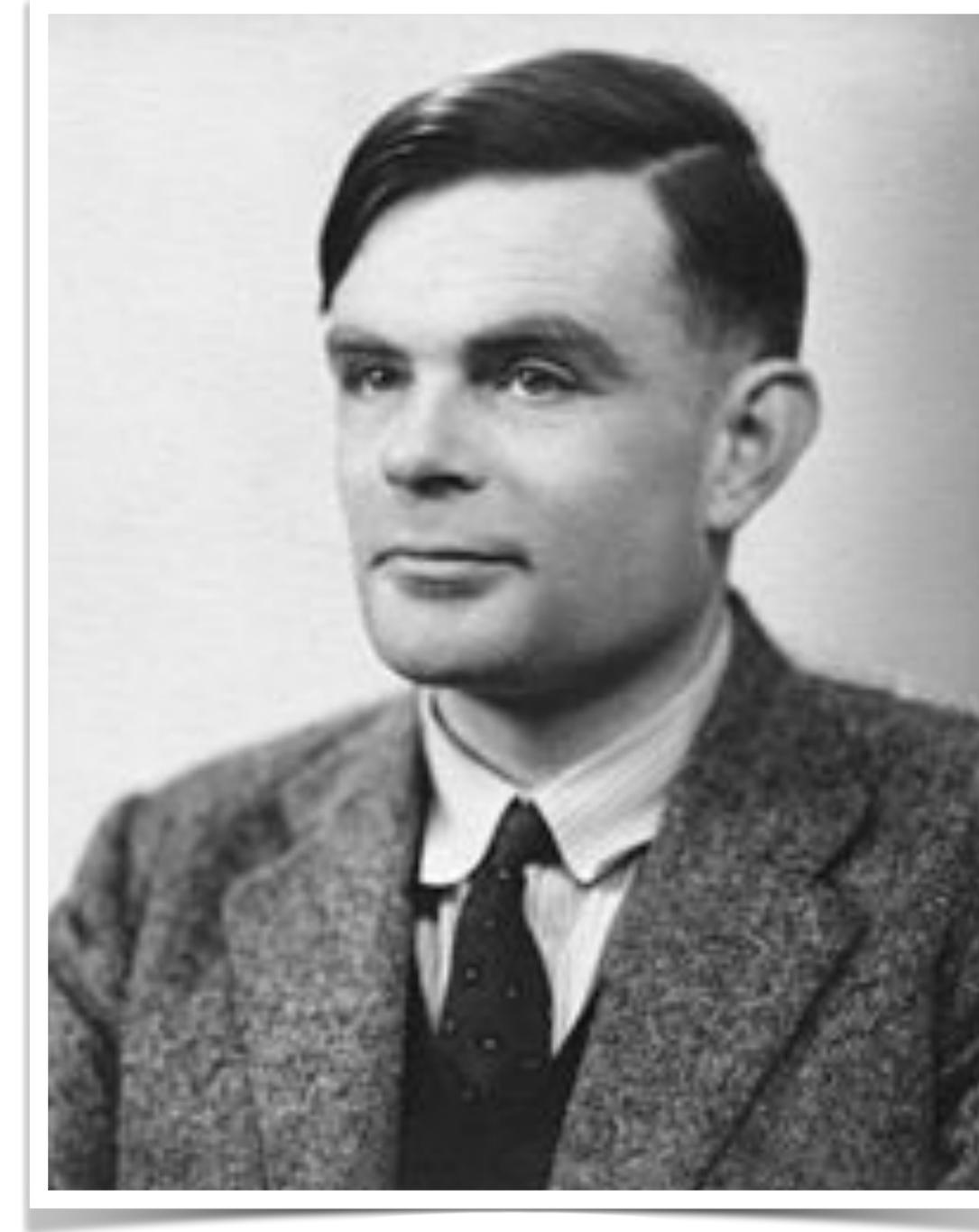
# How did we get here?

- Founders
- Timeline



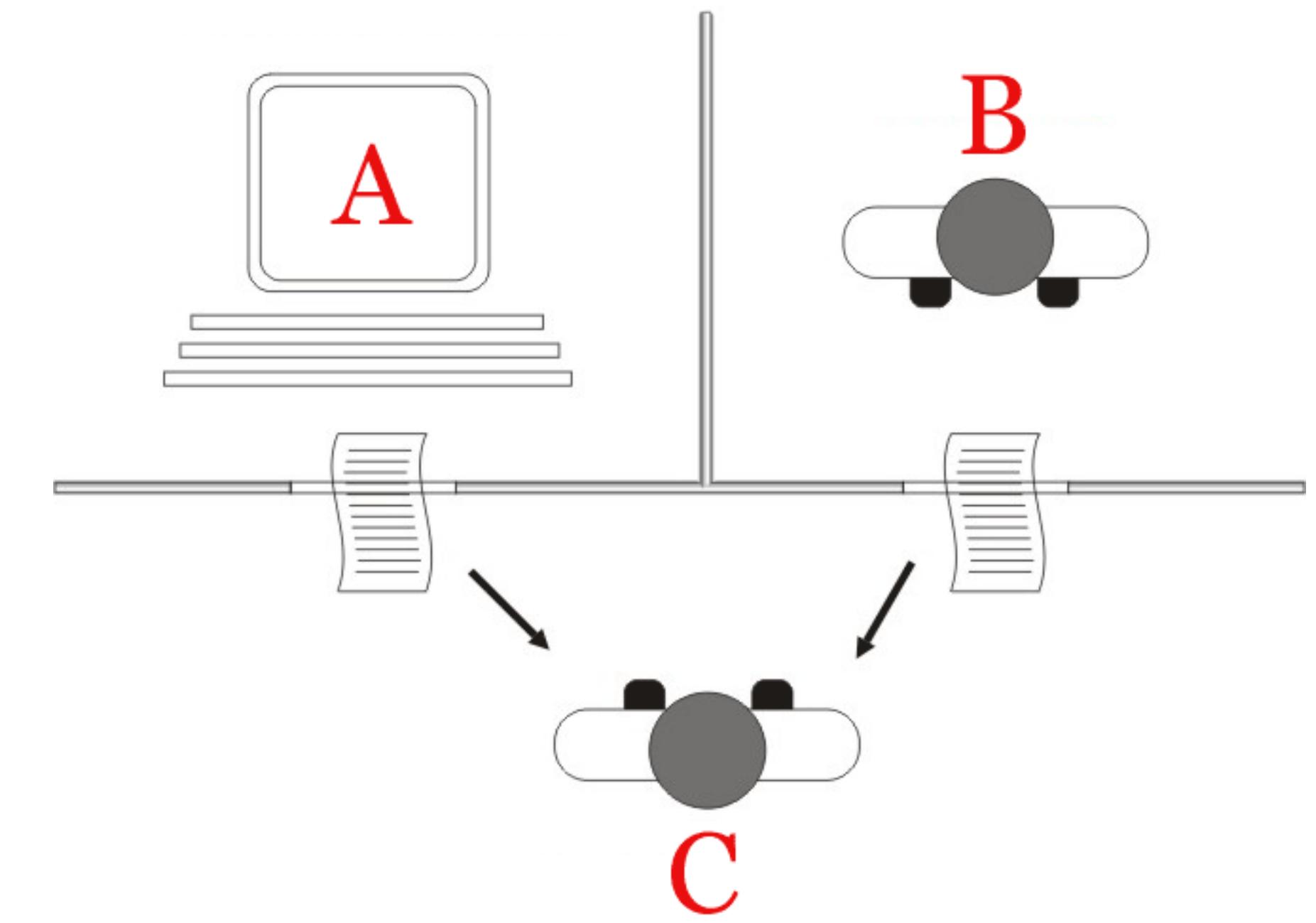
# Alan Turing

A Turing Machine is a theoretical construct that captures the essence of abstract symbol manipulation, i.e. computing. This invention inspired the founding of Computer Science and started the discussion about the possibility of thinking machines.



# The Turing Test (1950)

If a machine could carry on a conversation that was indistinguishable from a conversation with a human being, then it was reasonable to say that the machine was "thinking". This was the first serious proposal about how humanity might achieve artificial intelligence.



By Juan Alberto Sánchez Margallo - File:Test\_de\_Turing.jpg, CC BY 2.5

We'll conduct our own Turing Test later!

# Claude Shannon

- **Invented digital computer design**
- **World's Greatest Master's Thesis!**
- **Father of Information Theory**
- **Mathematical definition of communication**
- **First appearance of the word “bit”**
- **Designed the first chess computer**



# Geoffrey Hinton

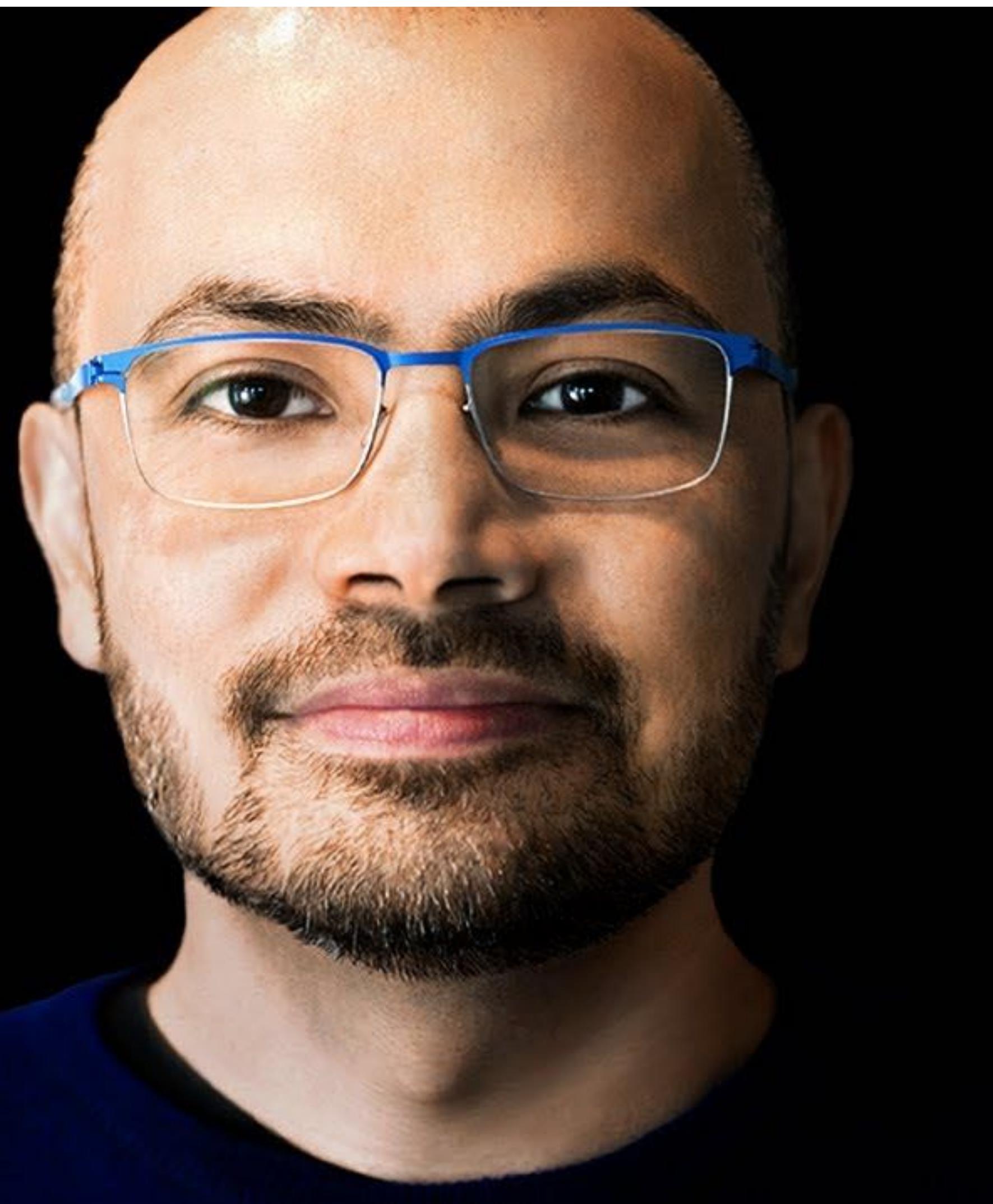


# Demis Hassabis

Demis  
Hassabis

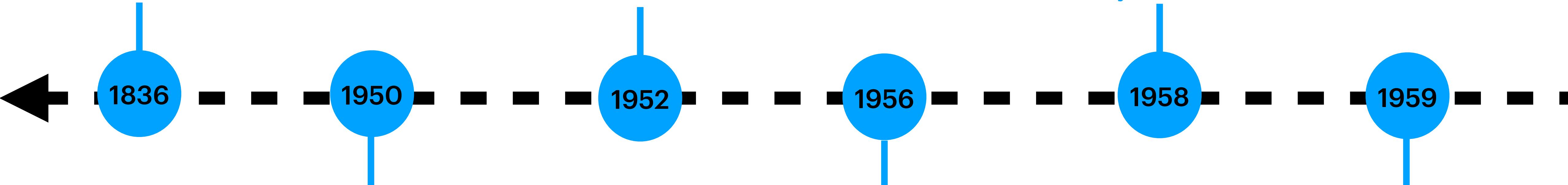
#299

Lex  
Fridman



# AI Development Timeline

Charles Babbage designs the Analytical Engine, an early mechanical general-purpose computer.



Alan Turing publishes "Computing Machinery and Intelligence," introducing the Turing Test.

Arthur Samuel developed a program to play checkers, which is the first to ever learn the game independently.

John McCarthy, Marvin Minsky, Nathaniel Rochester, and Claude Shannon organize the Dartmouth Conference, coining the term "Artificial Intelligence."

John McCarthy created LISP, the first programming language for AI research, which is still in popular use to this day.

Arthur Samuel created the term "machine learning" in a speech about teaching machines to play chess better than the humans who programmed them.

# AI Development Timeline

Edward Feigenbaum and Joshua Lederberg created the first “expert system” to replicate the decision-making abilities of human experts.

1965

1965

Joseph Weizenbaum created the first “chatterbot” (later shortened to chatbot), ELIZA, a mock psychotherapist, that used natural language processing (NLP) to converse with humans.

The first AI winter begins as funding and interest decline due to unmet expectations.

1972

1974

Marvin Minsky and Seymour Papert publish Perceptrons, highlighting limitations in neural networks.

1980

David Rumelhart, Geoffrey Hinton, and Ronald Williams publish the backpropagation algorithm, revitalizing neural networks.

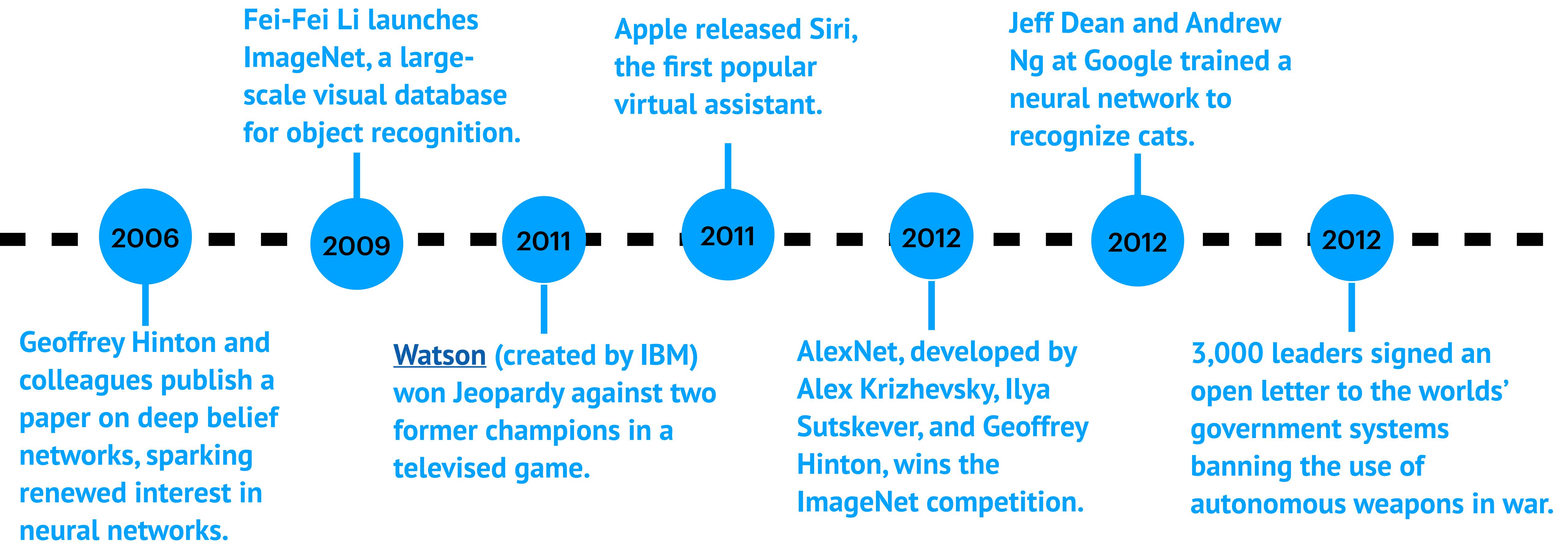
The resurgence of AI interest due to expert systems like MYCIN (medical diagnosis) and DENDRAL (chemical analysis).

IBM's Deep Blue defeats world chess champion Garry Kasparov.

1986

1997

# AI Development Timeline



# AI Development Timeline

DeepMind's AlphaGo defeats professional Go player Lee Sedol.

2015

2017

2017

2018

2020

2020

2022

2024

Two Facebook chatbots converse and learn how to negotiate, but dropped English and developed their own language, completely autonomously.

Google publishes “Attention is all you need”, unveiling the Transformer.

Chinese Alibaba beat humans on Stanford reading and comprehension test.

OpenAI releases GPT-3, a powerful language model with 175 billion parameters.

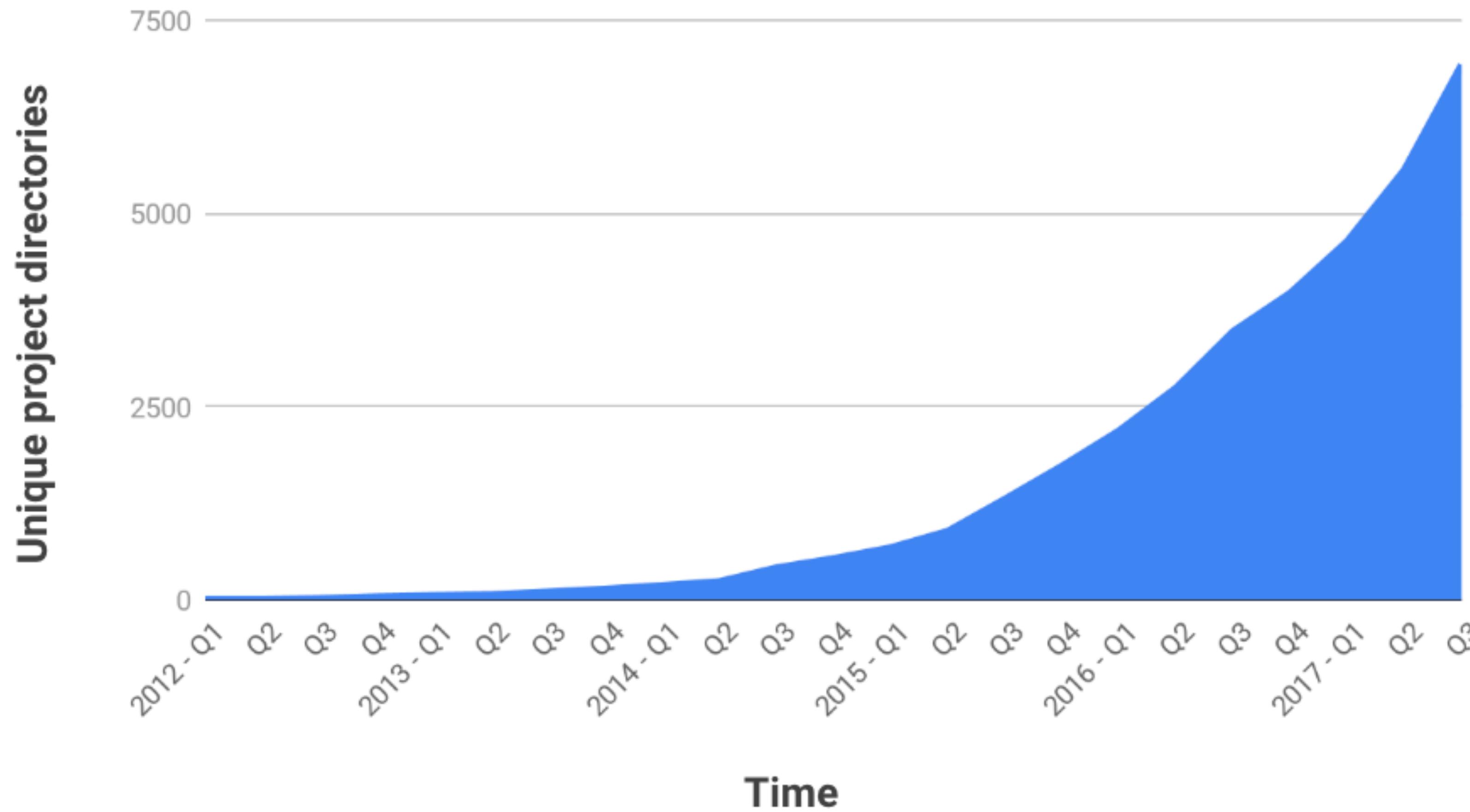
Generative AI goes mainstream with ChatGPT

Open source AI era begins

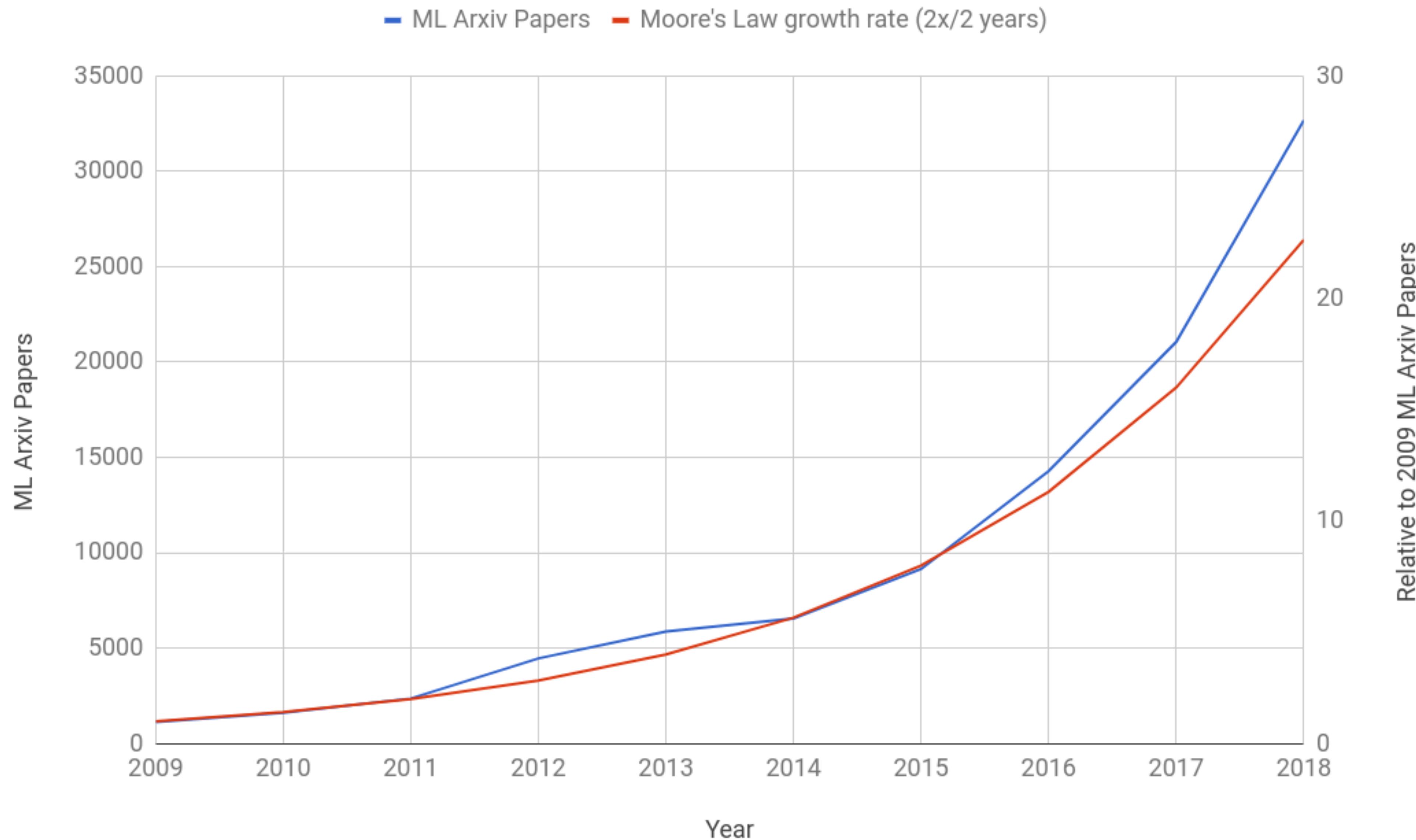
DeepMind's AlphaFold makes significant progress in protein folding.

# Use of Deep Learning at Google

source directories containing deep learning models



# Industry Adoption



# THE KURZWEIL CURVE

*Moore's Law is just the beginning: The power of technology will keep growing exponentially, says Kurzweil. By 2050, you'll be able to buy a device with the computational capacity of all mankind for the price of a nice refrigerator today.*

## Computer performance

Plotted by number of calculations per second per \$1,000

Years by which, according to  
Kurzweil, \$1,000 of computation  
will equal (or has already equaled)  
the intelligence of ...

... all human brains

... one human brain

... one mouse brain

... one insect brain

Kurzweil's  
projected  
trend line

• – COMPUTER TYPE

Hollerith Tabulator  
Bell Calculator Model I  
Univac I  
Apple Mac II

SOURCE: DATA FROM RAY KURZWEIL

10<sup>40</sup>

10<sup>30</sup>

10<sup>20</sup>

10<sup>10</sup>

1

10<sup>-10</sup>

1900

1925

1950

1975

2001

'10

'23

2050

2075

# Why did everything change so quickly?

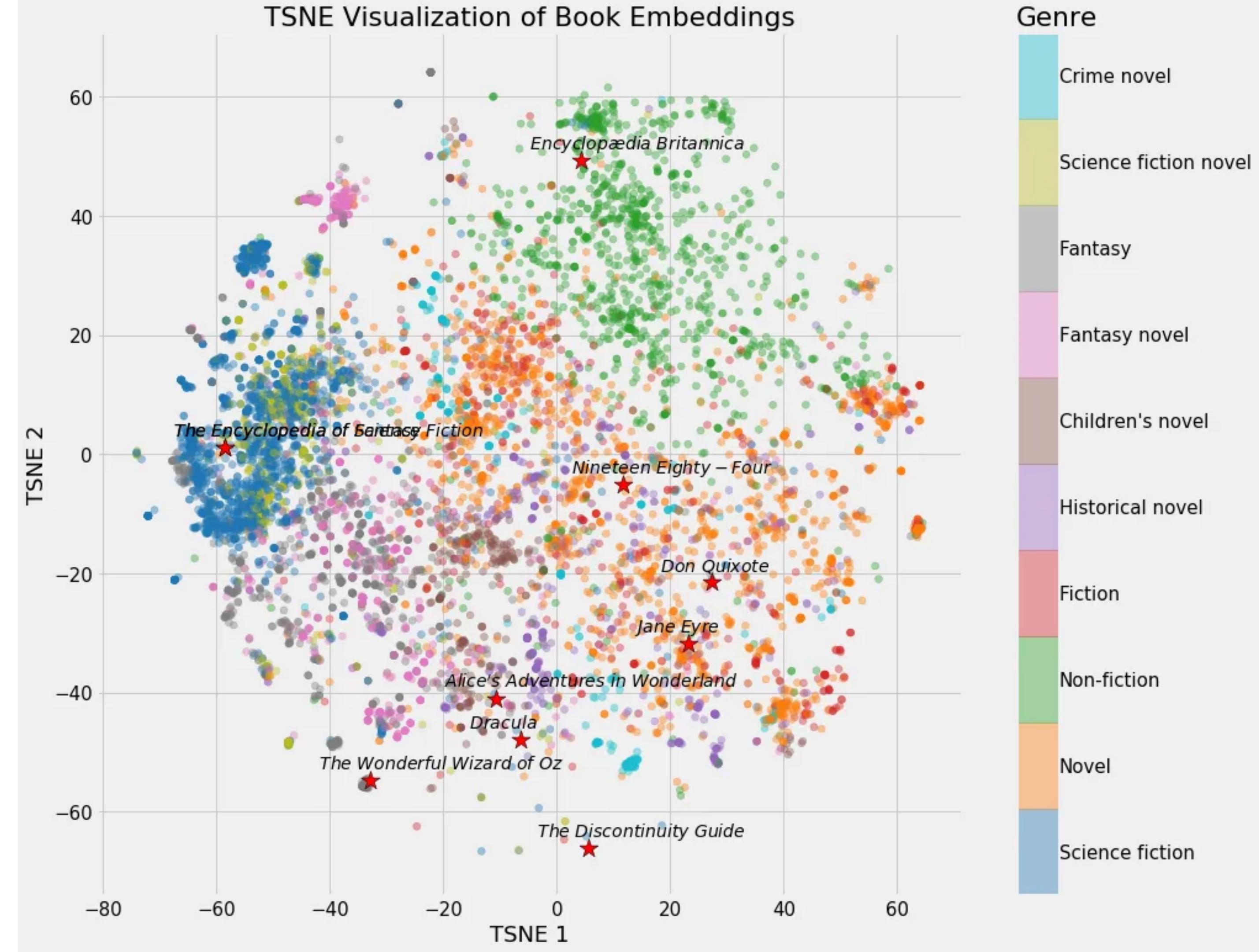
## A perfect storm:

- Moore's Law
- GPUs
- Cloud computing
- Data abundance
- Github + Open Source
- New & improved techniques
- Transformers



# Mechanics

# How does AI work?



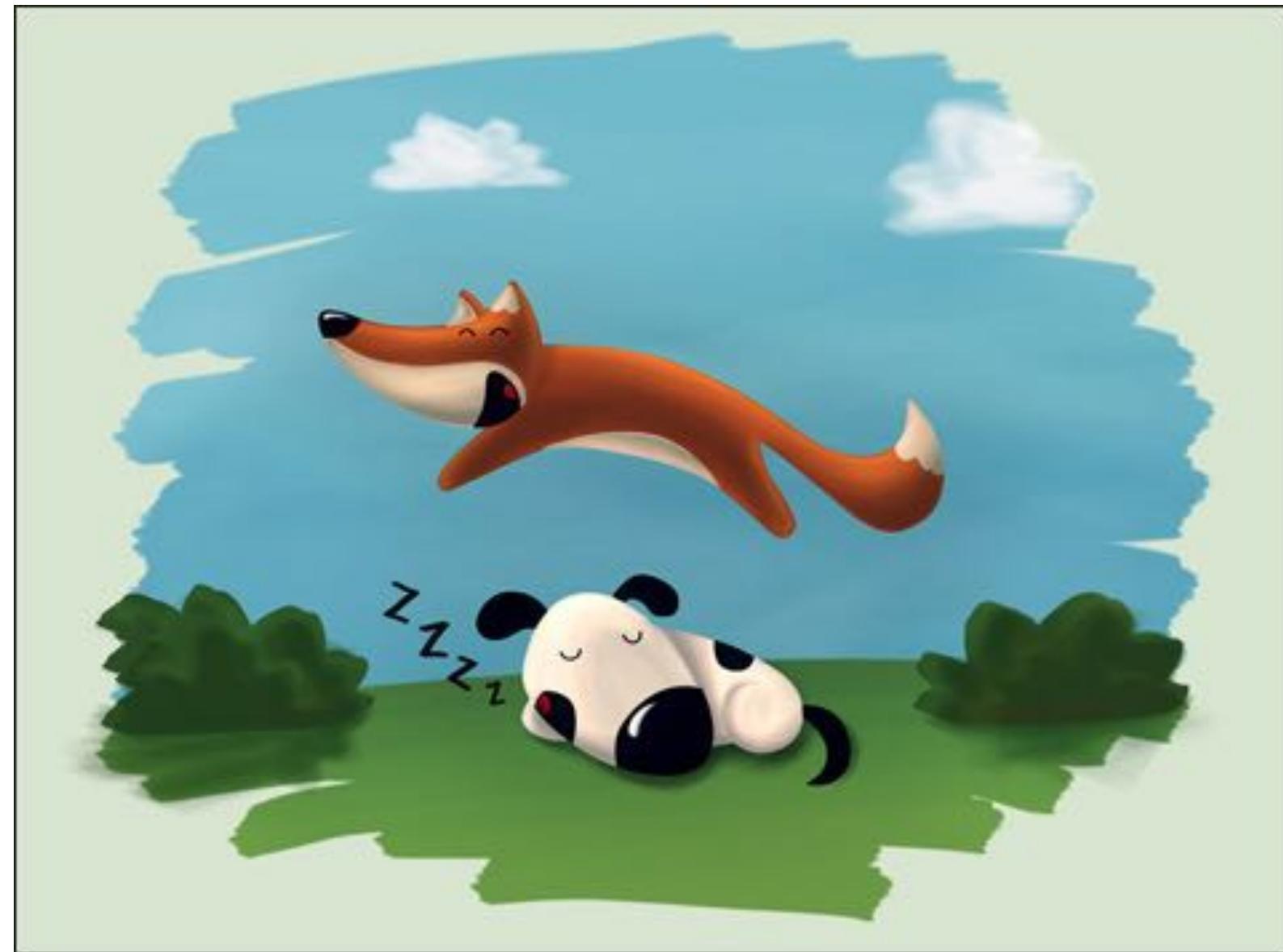
# Puppy vs. Muffin



**Not so easy**



**“The brown quick fox jumps over the lazy dog.”**



# English Adjective Order

1. Quantity or number
2. Quality or opinion
3. Size
4. Age
5. Shape
6. Colour
7. Proper adjective
8. Purpose or qualifier

**Machine learning is  
learning from rules  
*\*plus experience\****

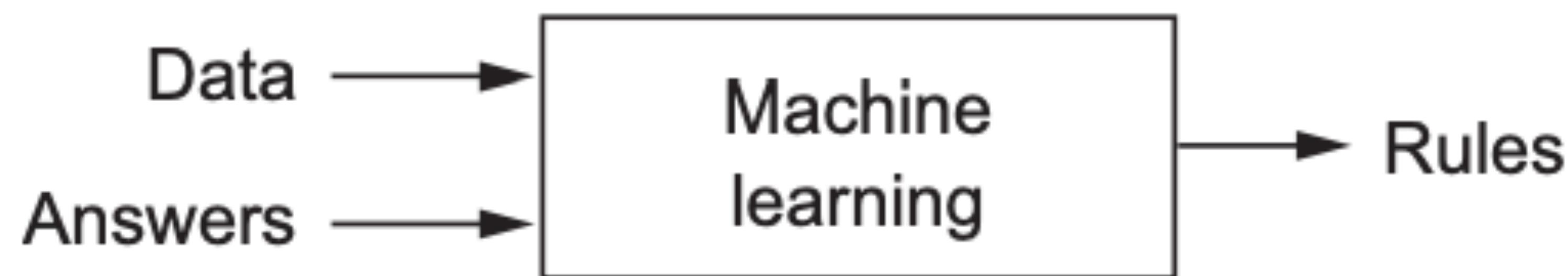
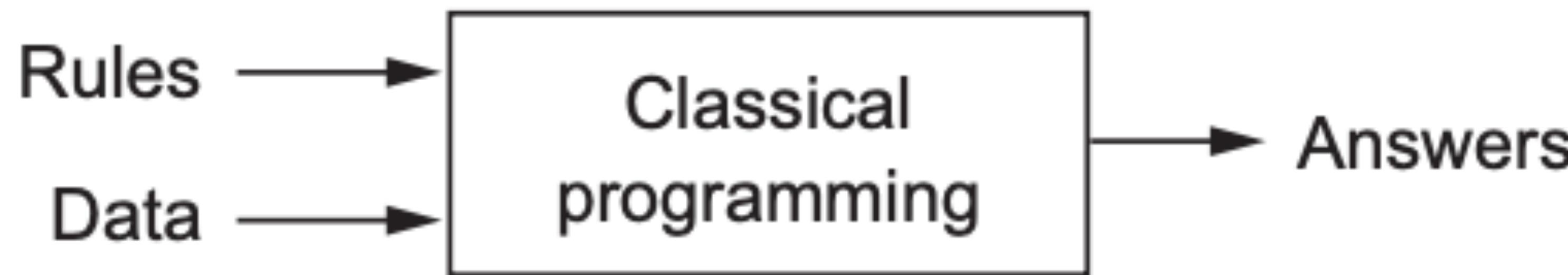


**“Instead of trying to produce a program to simulate the adult mind, why not rather try to produce one which simulates the child’s mind?”**

- Alan Turing, 1950

**This is the main idea behind Machine Learning**

# Paradigm Shift



# Types of Machine Learning

## Supervised Learning

- labeled data
- learn relationships

Examples:

- spam detection
- image classification

## Unsupervised Learning

- unlabeled data
- find data structure

Examples:

- customer segmentation
- anomaly detection

## Reinforcement Learning

- reward based
- find optimal strategy

Examples:

- game playing
- autonomous driving

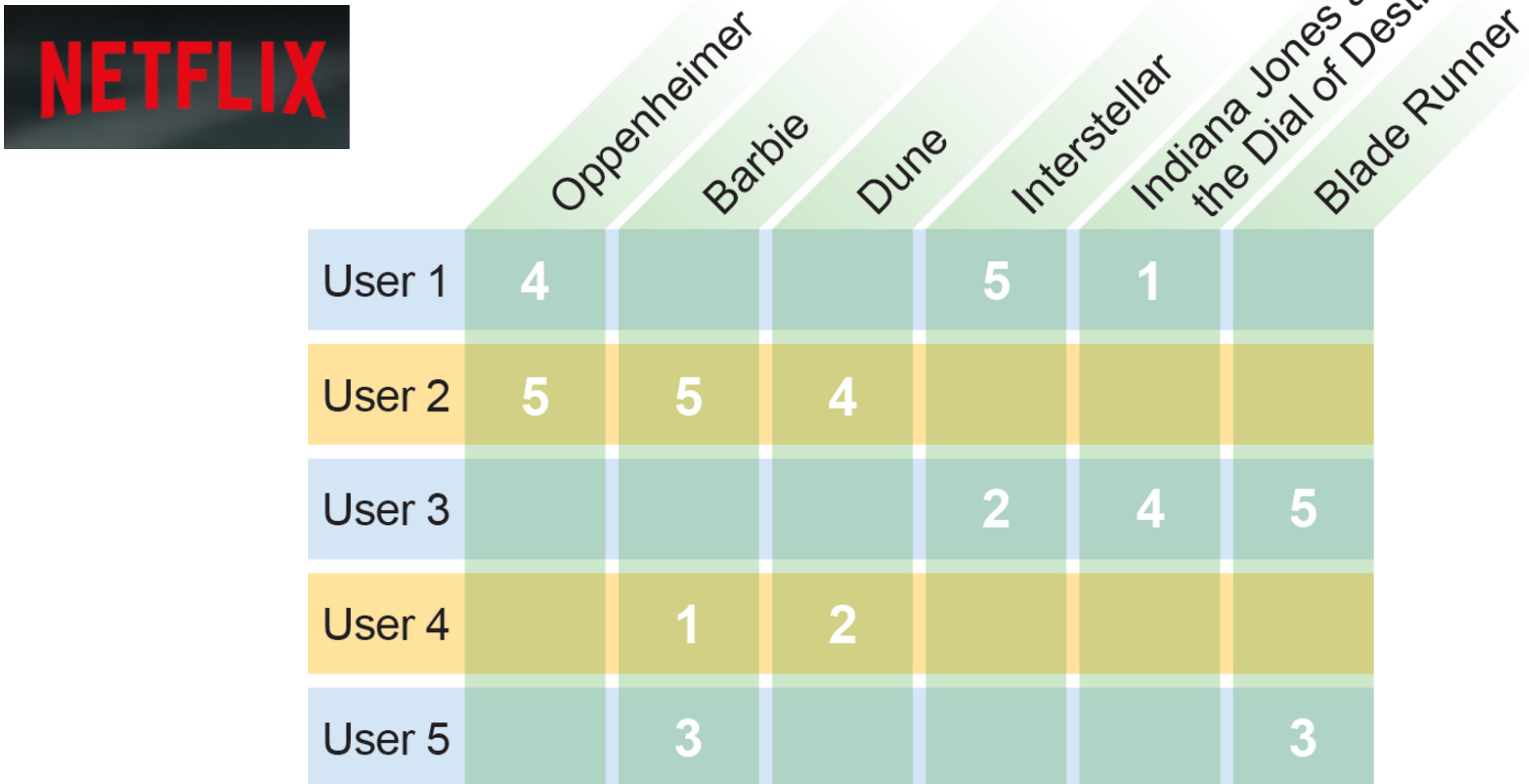
# Supervised Learning

## Cats vs. Dogs



- **2009 - world's most advanced computer can't tell a cat from a dog**
- **2012 - solved by Google \*but\* required 16,000 computers!**
- **2015 - Microsoft, Google beat humans at image recognition**
- **2019 - AI beats Stanford radiologists in chest X-ray diagnostics competition**

# Unsupervised Learning



# Cloud of similarities

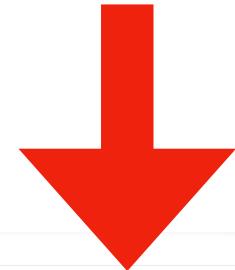


# Reinforcement Learning



# Types of Machine Learning

We'll focus on this category



## Supervised Learning

- labeled data
- learn relationships

Examples:

- spam detection
- image classification

## Unsupervised Learning

- unlabeled data
- find data structure

Examples:

- customer segmentation
- anomaly detection

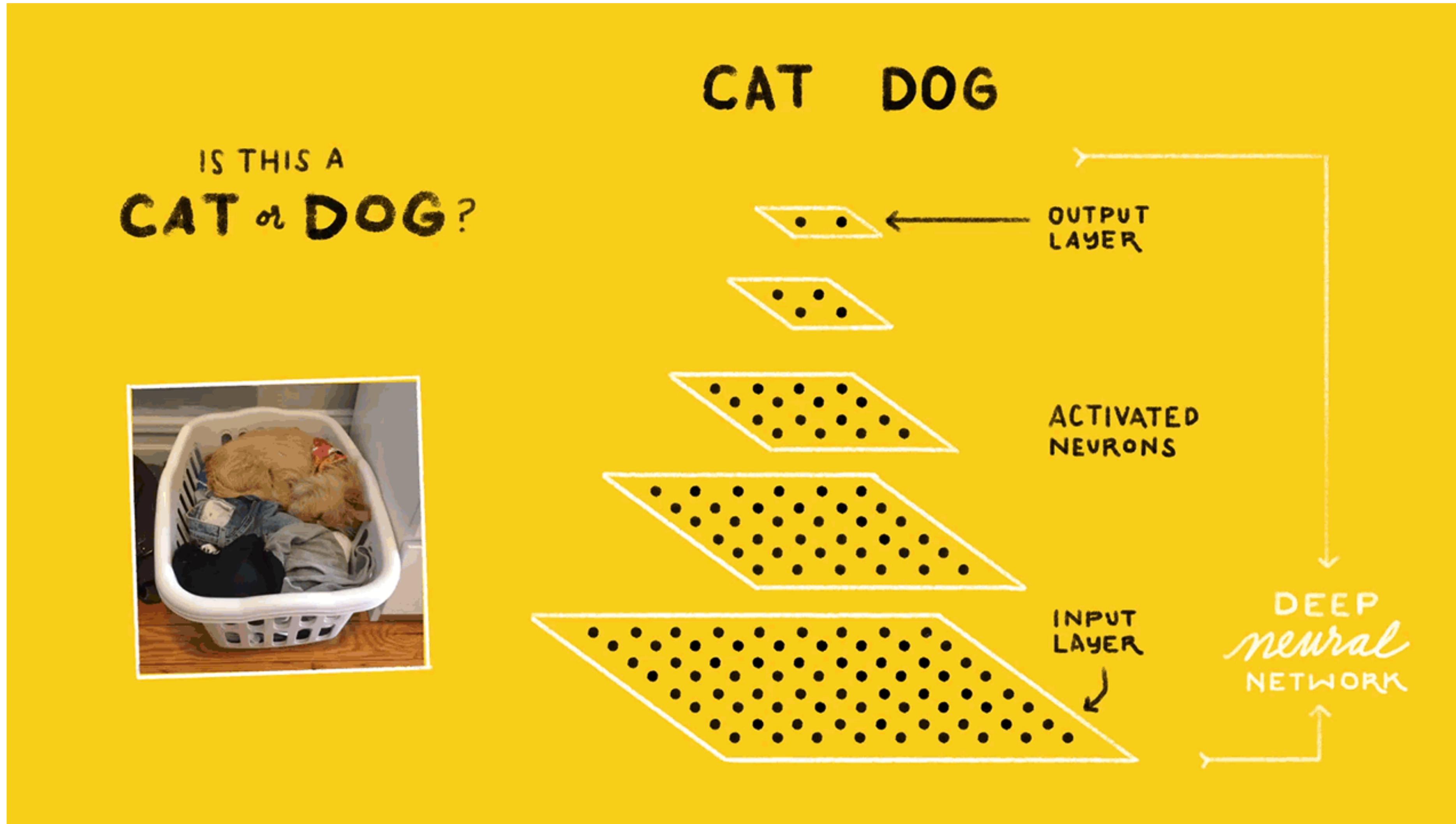
## Reinforcement Learning

- reward based
- find optimal strategy

Examples:

- game playing
- autonomous driving

# Neural Networks



# Which digit is this?



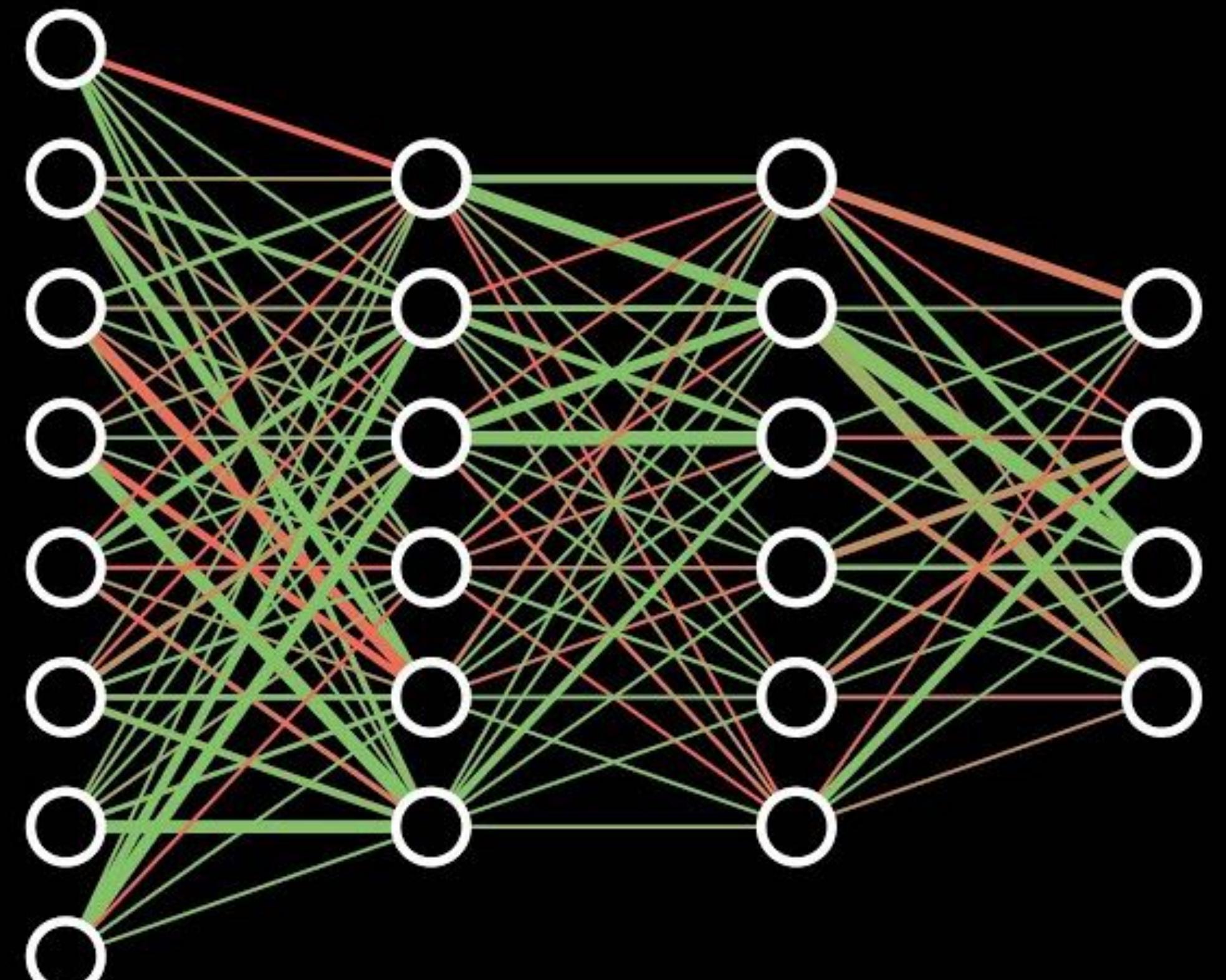
# The MNIST Challenge

training digits and their labels	
9	9
1	1
0	0
3	1
1	1
6	6
6	6
5	5
0	0
5	5
7	7
2	2
5	5
8	8
4	4
9	9
9	9
7	7
0	0
0	0
4	4
9	9
4	4

validation digits and their labels	
7	7
2	2
1	1
0	0
4	4
1	1
4	4
9	9
5	5
9	9
0	0
6	6
9	9
0	0
1	1
5	5
9	9
7	7
3	3
4	4
9	9
6	6
4	4
5	5

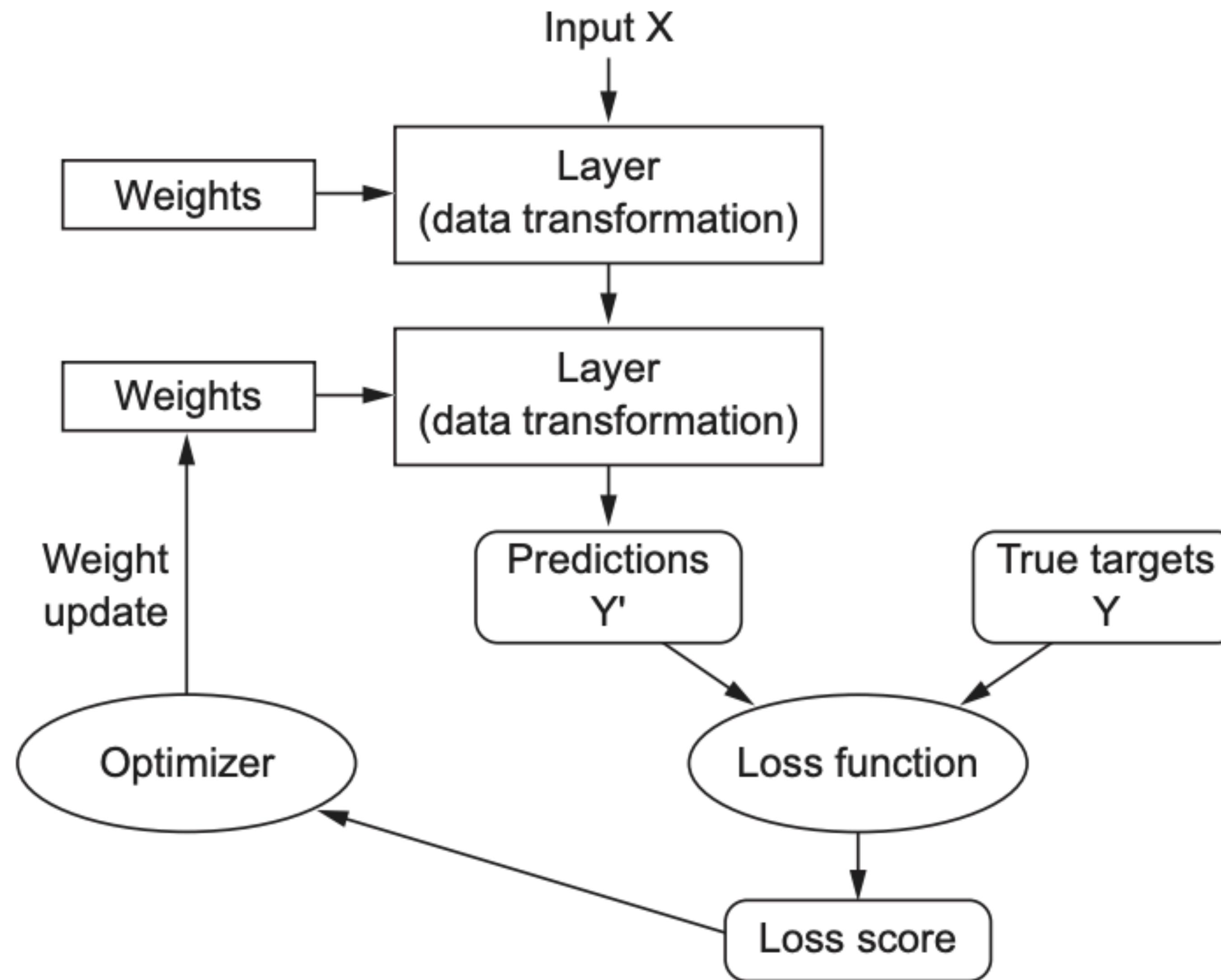
# Neural Networks



From the  
ground up

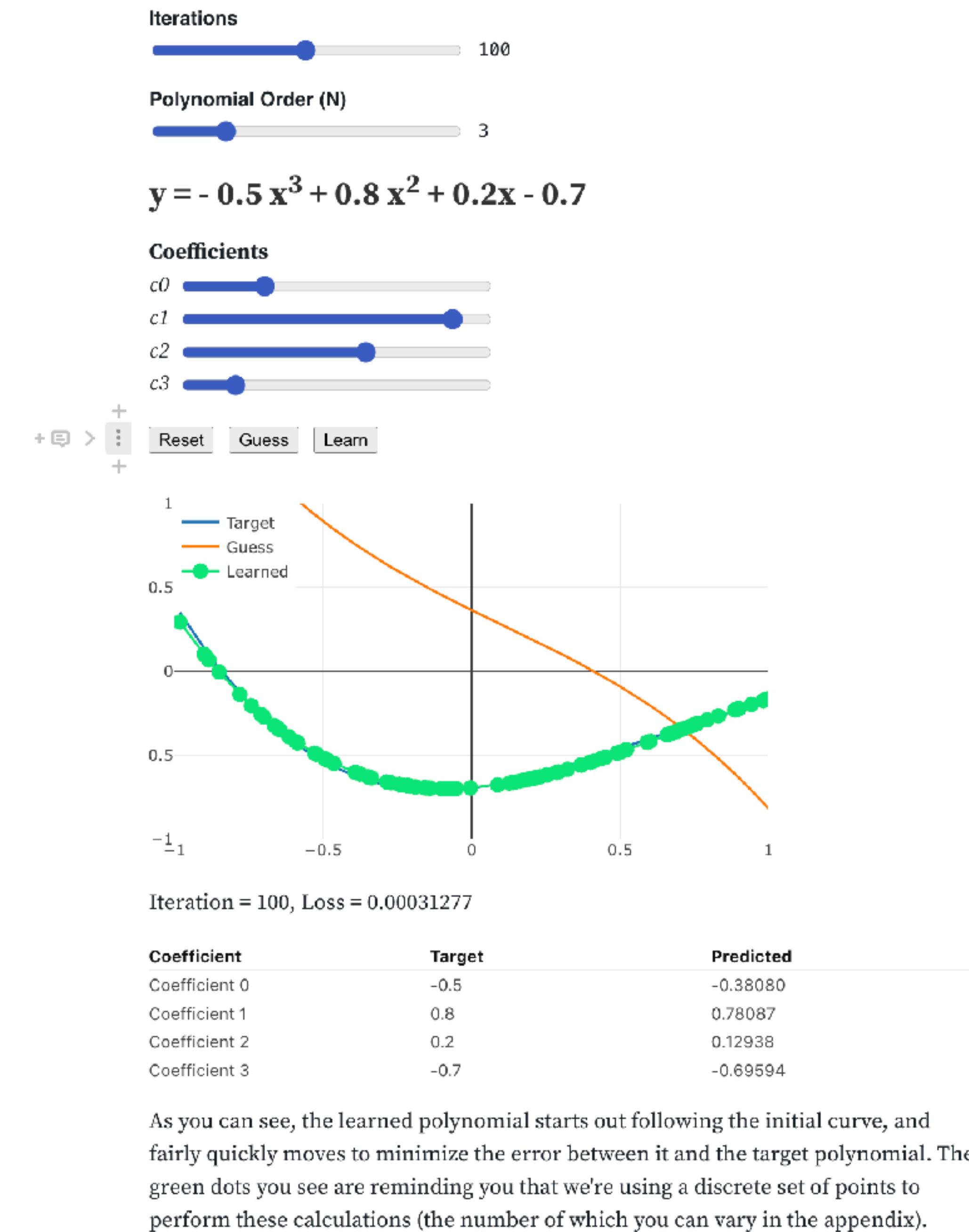
(watch 2:40-5:30, 8:20-10:15, 11:35-12:42)

# Inside a Neural Network



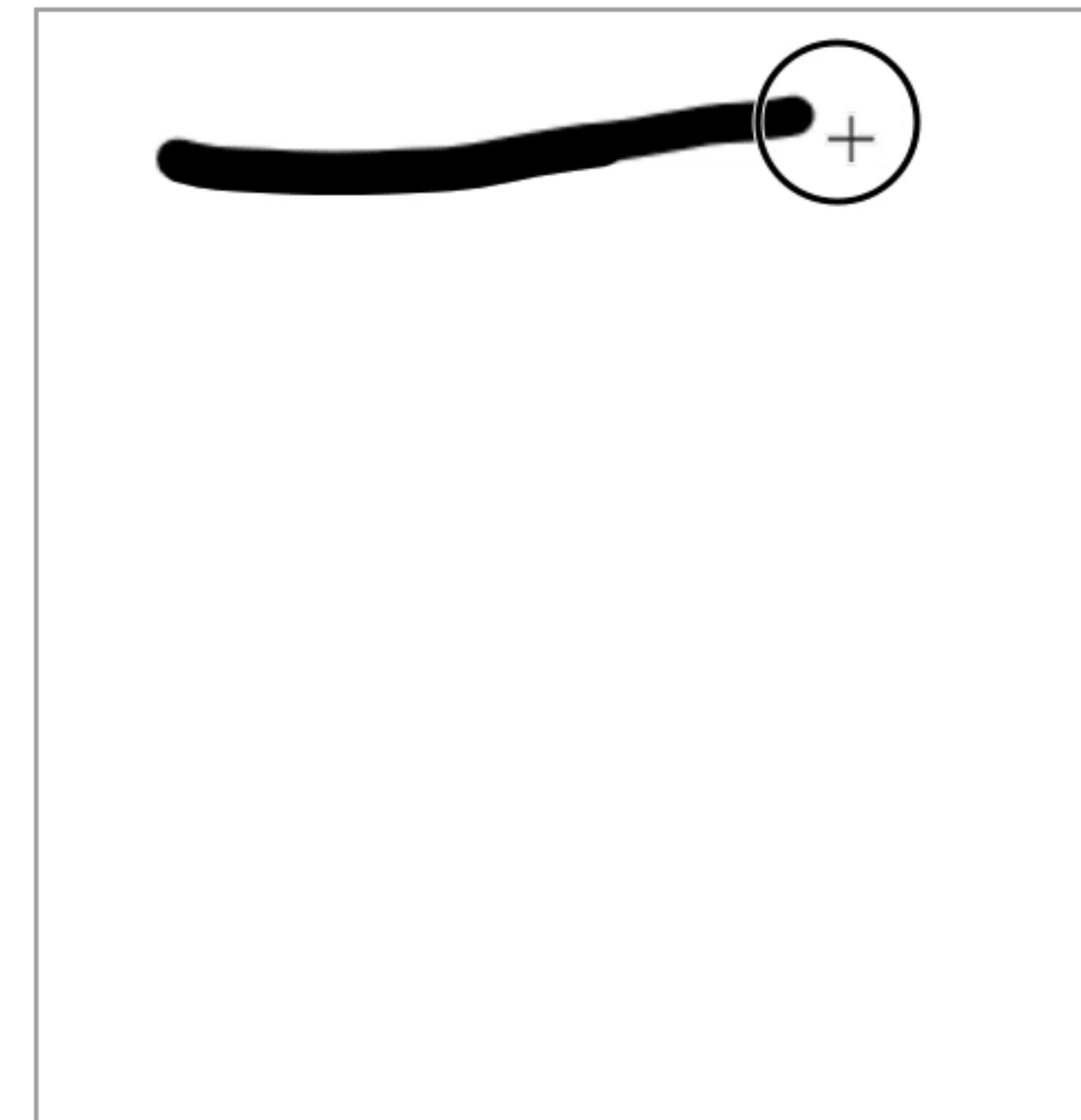
# Neural Network Training

- guess values
- improve guess
- repeat until “close enough”



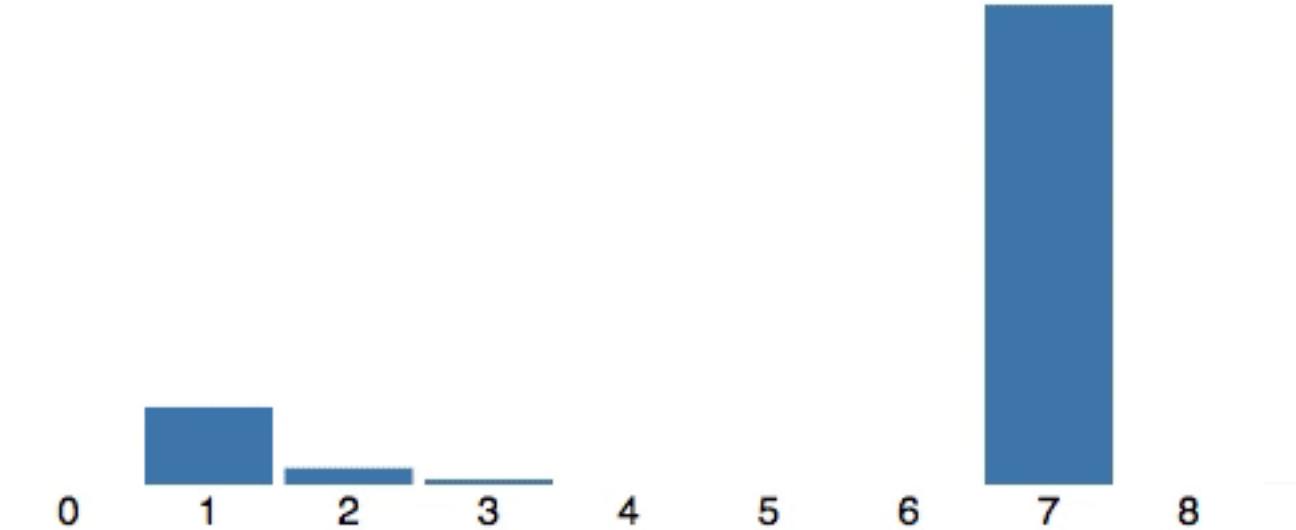
# TensorFlow.js + MNIST

Draw a digit by hand and have it classified in real time, as you draw, by a machine learning model trained against the [MNIST](#) dataset. The model used for this page is a convolutional neural network (CNN) built using Keras/TensorFlow on a Google Tensor Processing Unit (TPU). It's explained in depth and is available for you to build for yourself at [bit.ly/mco-mnist-lab](https://bit.ly/mco-mnist-lab).



Draw a single digit (0-9) in the empty box.

Clear

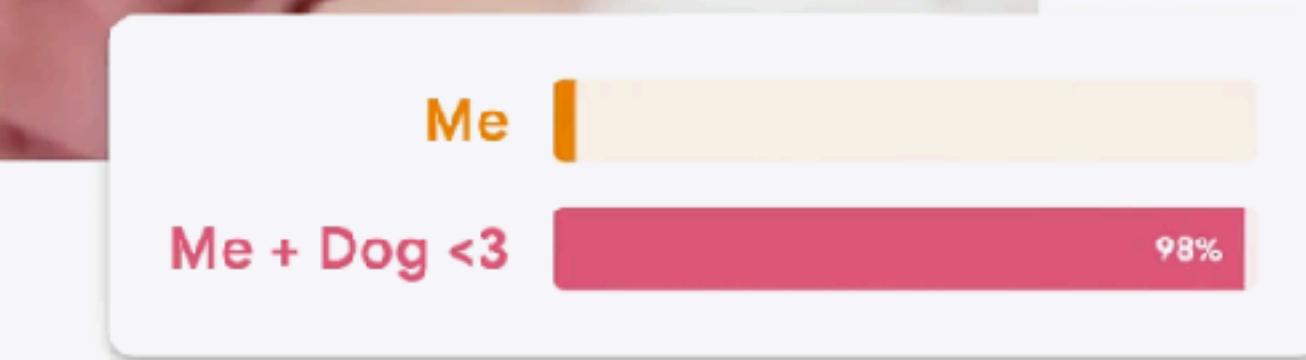
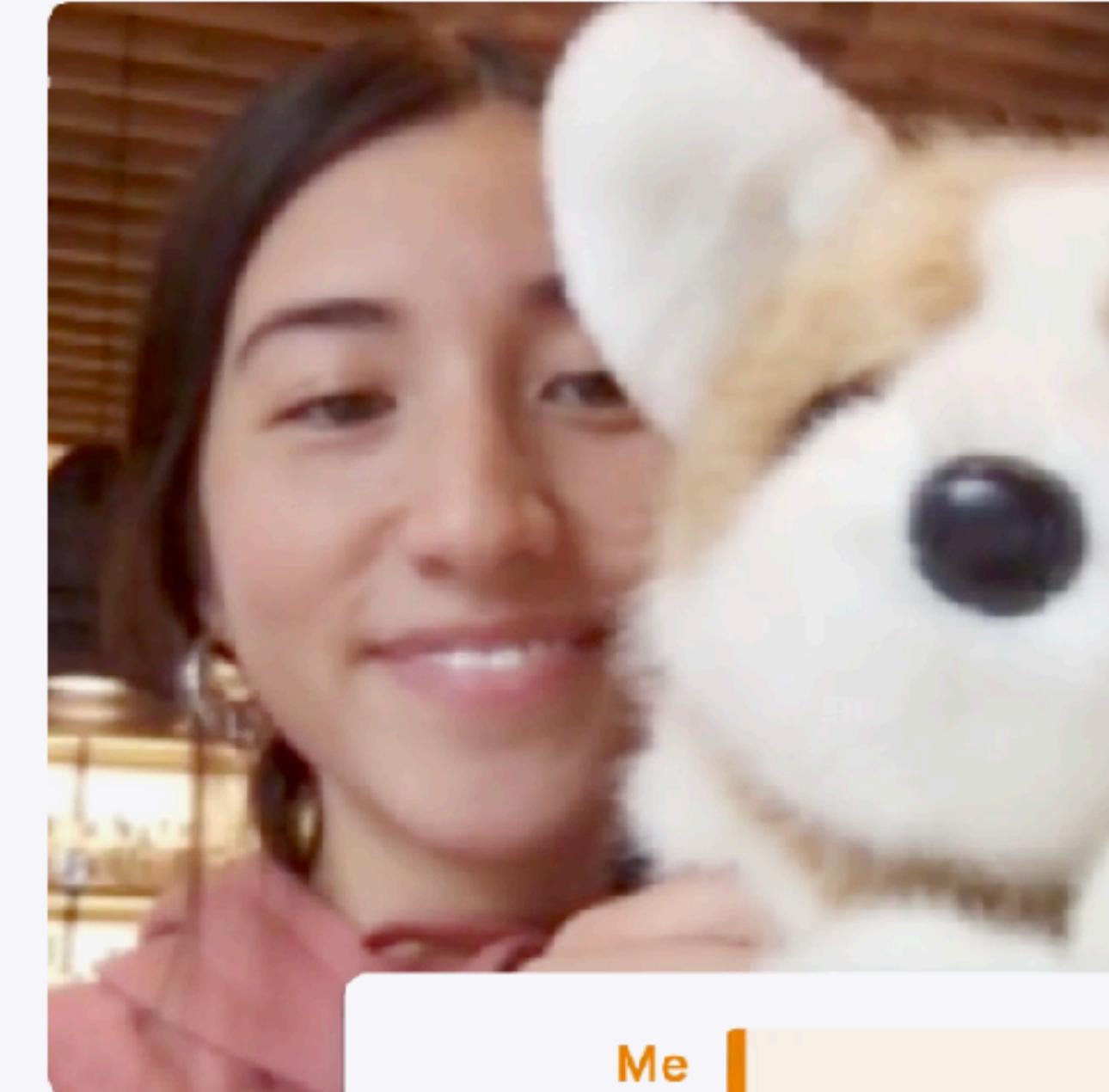


Made with ❤ by [Marc](#).

# Teachable Machine

**Train a computer to recognize your own images, sounds, & poses.**

A fast, easy way to create machine learning models for your sites, apps, and more – no expertise or coding required.



[Get Started](#)



ml5



p5.js



Coral



node  
js

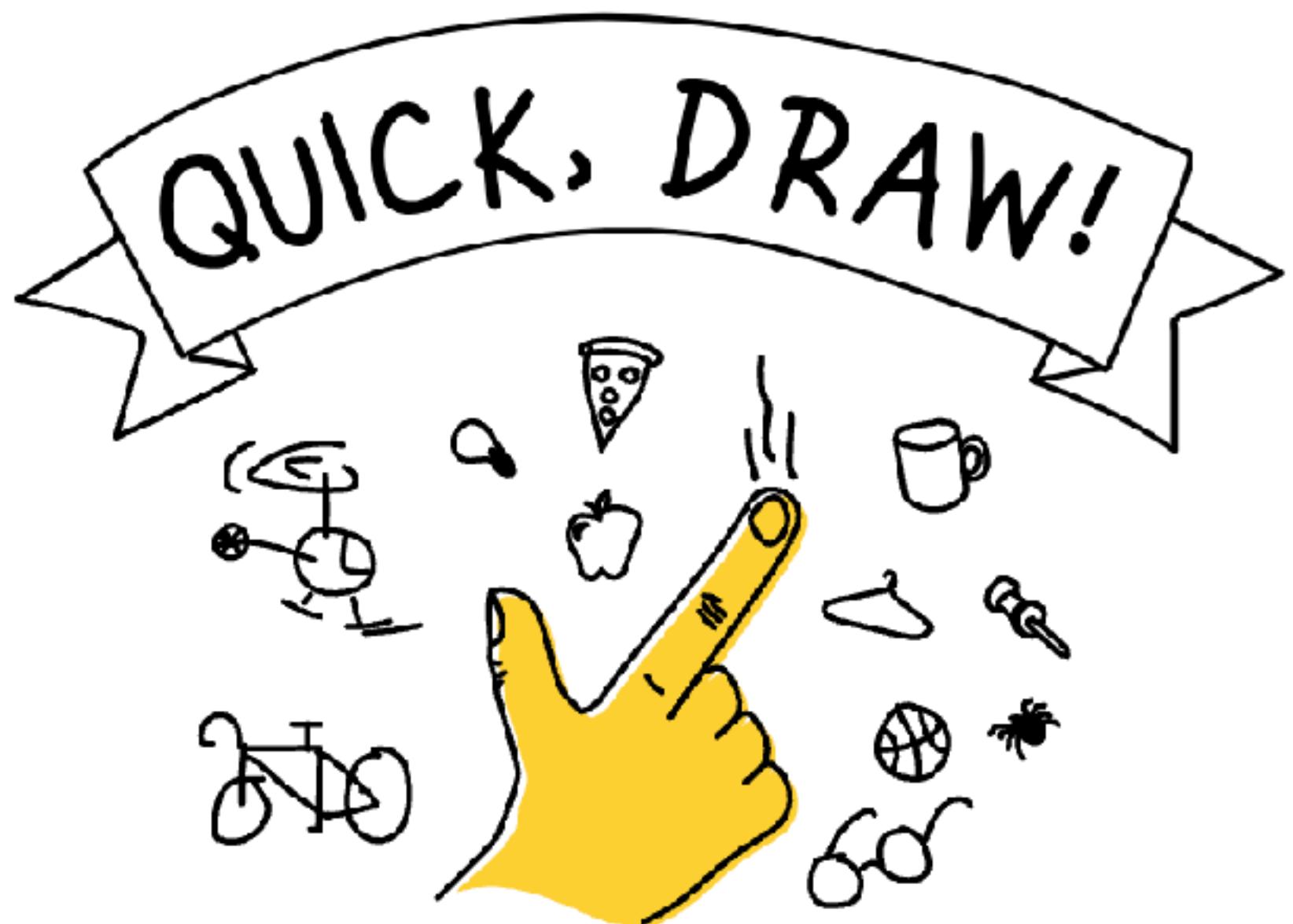


TensorFlow.js



ARDUINO

# Demo: Quick, Draw



Can a neural network learn to recognize doodling?

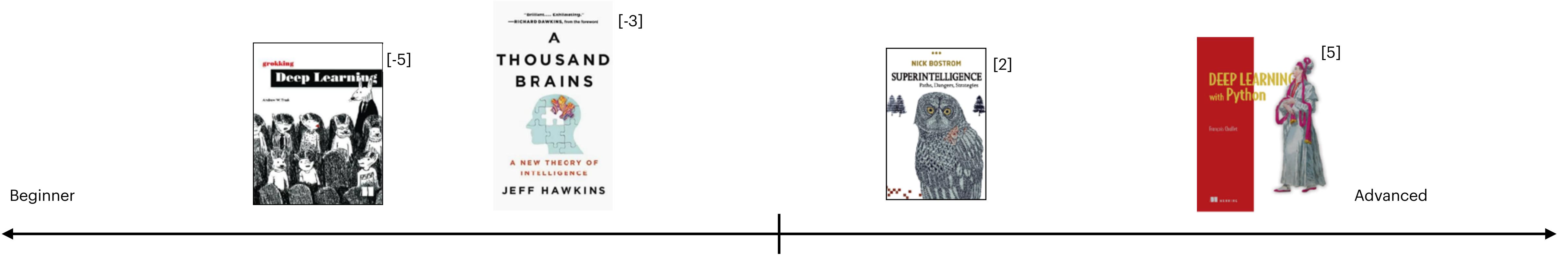
Help teach it by adding your drawings to the [world's largest doodling data set](#), shared publicly to help with machine learning research.

Let's Draw!

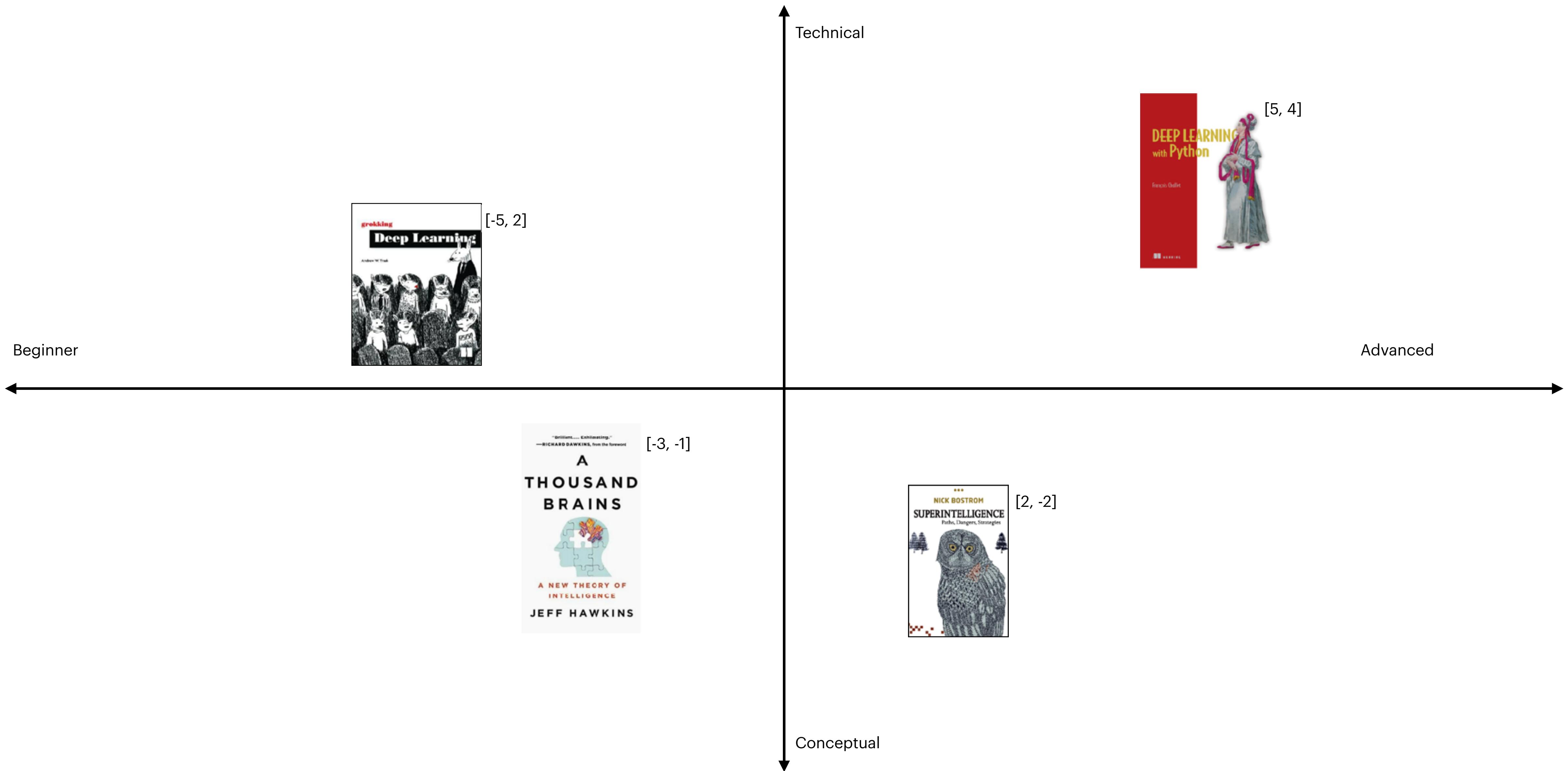
# **Embeddings**

**(The secret sauce of deep learning)**

# Recommending AI Books



# Better: 2-D Coordinate System



# Even better: use N-dimensions

- Neural networks choose the dimensions for us.
- Based on the labelled training data (think “cat” vs. “dog”), neural networks are able to “embed” objects (words, images, video, audio) into N-dimensional space.
- We can represent embeddings as vectors:
  - [a<sub>0</sub>, a<sub>1</sub>, a<sub>2</sub>, ..., a<sub>N</sub>]
  - Similar objects get embedded in similar locations,
  - This gives us the ability to do semantic search, i.e., find things that have similar meaning.

# Embeddings In Action

← 🔎 dog in water ×

✓ Sat, May 15, 2021

# Google's AI Awakening

[Sign in / Sign up](#)

Jun Rekimoto : 暮本純一

[Follow](#)

人間とテクノロジーの未来を探求しています。HUMAN AND TECHNOLOGY

Nov 11, 2016 · 5 min read

You seem to have made it into a neural network Try the beginning with [The Great Gatsby Google Translate](#)



ニューラルネット化したらしいGoogle翻訳でThe Great Gatsby冒頭を試してみる：

原文：In my younger and more vulnerable years my father gave me some advice that I've been turning over in my mind ever since.

"Whenever you feel like criticizing any one," he told me, "just remember that all the people in this world haven't had the advantages that you've had."

google：私の若くて傷つきやすい年の頃、私の父は私が私の心の中でそれ以来変わってきたアドバイスを私にくれました。

「誰かを批判する気持ちがあるときはいつでも、彼は私に言いました。

「この世界のすべての人々はあなたが持っていた優位性を持っていないことを覚えておいてください。

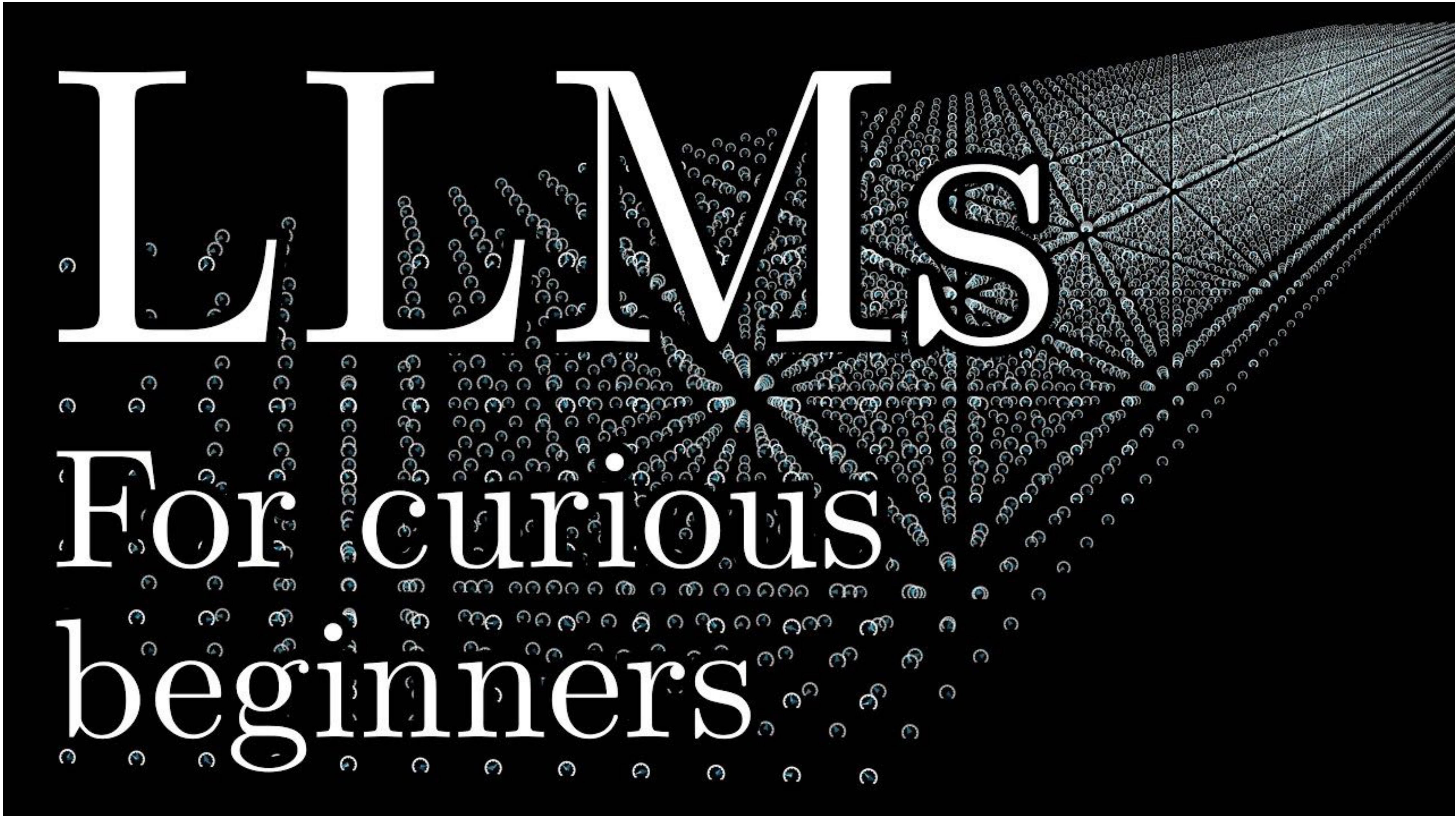
FEATURE

## The Great A.I. Awakening

How Google used artificial intelligence to transform Google Translate, one of its more popular services — and how machine learning is poised to reinvent computing itself.

# TUMS

For curious  
beginners



AI

# An Intuitive Guide to How LLMs Work

Chatting by chance

OCTOBER 6, 2024



# Understanding LLMs from Scratch Using Middle School Math

A self-contained, full explanation to inner workings of an LLM



Rohit Patel · [Follow](#)

Published in Towards Data Science · 40 min read · Oct 19, 2024

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👏 6.1K

🗨 78



...

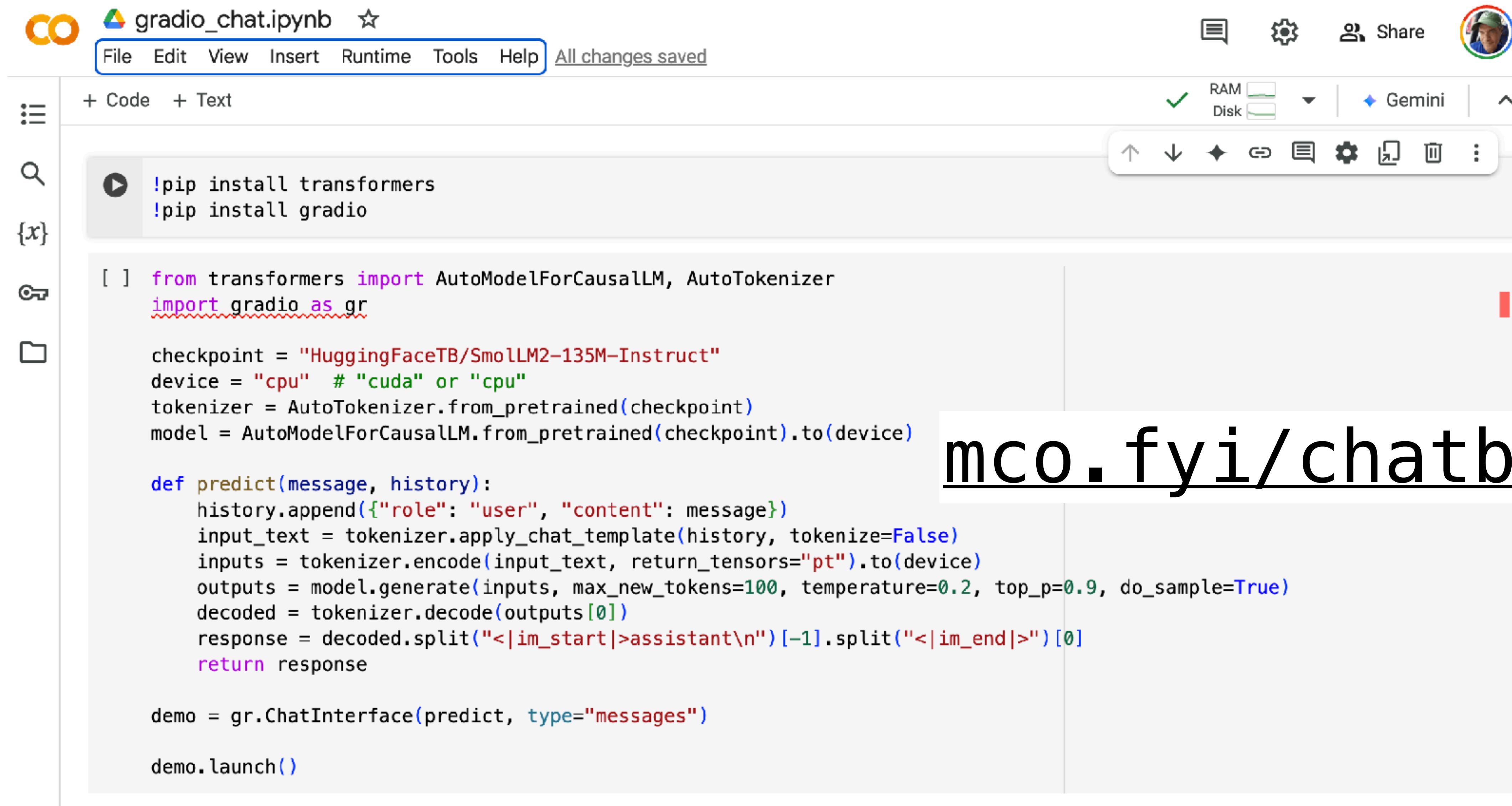
**“I.”**

**“WANT.” “HAIR!”**

**(IMPROVISERS / GET  
PERSONAL)**



# Let's build a chatbot!



The screenshot shows a Jupyter Notebook interface with the following details:

- Title Bar:** CO gradio\_chat.ipynb ☆
- Menu Bar:** File Edit View Insert Runtime Tools Help All changes saved
- Toolbar:** RAM Disk Gemini
- Code Cell:** !pip install transformers  
!pip install gradio
- Code Block:** [ ] from transformers import AutoModelForCausalLM, AutoTokenizer  
import gradio as gr  
  
checkpoint = "HuggingFaceTB/SmollM2-135M-Instruct"  
device = "cpu" # "cuda" or "cpu"  
tokenizer = AutoTokenizer.from\_pretrained(checkpoint)  
model = AutoModelForCausalLM.from\_pretrained(checkpoint).to(device)  
  
def predict(message, history):  
 history.append({"role": "user", "content": message})  
 input\_text = tokenizer.apply\_chat\_template(history, tokenize=False)  
 inputs = tokenizer.encode(input\_text, return\_tensors="pt").to(device)  
 outputs = model.generate(inputs, max\_new\_tokens=100, temperature=0.2, top\_p=0.9, do\_sample=True)  
 decoded = tokenizer.decode(outputs[0])  
 response = decoded.split("<|im\_start|>assistant\n")[-1].split("<|im\_end|>")[0]  
 return response  
  
demo = gr.ChatInterface(predict, type="messages")  
  
demo.launch()

[mco.fyi/chatbot](https://mco.fyi/chatbot)

# How A.I. Creates Art - A Gentle Introduction to Diffusion Models

January 24, 2023 · 8 min read



Zain Hasan

Developer Advocate

The thumbnail features a dark blue background with a subtle, glowing blue gradient. Overlaid on the right side is a large, white, abstract wavy line pattern that resembles a brain or a complex neural network. In the top left corner, there's a small yellow and green geometric logo followed by the word "Weaviate" in white. The main title "How A.I. Creates Art: A Gentle Introduction to Diffusion Models" is centered in the middle-left area in a large, white, sans-serif font. At the bottom left, there's a white button with a thin green border containing the text "Read the blog" in a white sans-serif font.

How Diffusion Models Work

How Text Prompts Control the Image Generation Process

Diffusion Model Resources to Create Art

Sources and Further Reading

# Diffusion Models



MJ

What will you imagine?



Search



berada.travel 15h



A child is playing with a baby  
koala really tiny, they both seem  
to be friends. The photo should  
look real and not a cartoon.

ar 9:16 v 6.1

Use

Image

Style

Prompt

# Let's generate an image!

co mco\_stable\_diffusion.ipynb ☆

File Edit View Insert Runtime Tools Help Last saved at 20:02

+ Code + Text Connect GPU ▾

🔍 {x} 🔑 📁 < >

## Stable Diffusion 🎨

...using  `diffusers`

Stable Diffusion is a text-to-image latent diffusion model created by the researchers and engineers from [CompVis](#), [StabilityAI](#) and [LAION](#). It's trained on 512x512 images from a subset of the [LAION-5B](#) database. This model uses a frozen CLIP ViT-L/14 text encoder to condition the model on text prompts. With its 860M UNet and 123M text encoder, the model is relatively lightweight and can run on many consumer GPUs. See the [model card](#) for more information.

This Colab notebook shows how to use Stable Diffusion with the 😊 Hugging Face  [Diffusers library](#).

Let's get started!

### 1. How to use `StableDiffusionPipeline`

Before diving into the theoretical aspects of how Stable Diffusion functions, let's try it out a bit 😊.

In this section, we show how you can run text to image inference in just a few lines of code!

**mco.fyi/sdiff**

# **State of the Art**

# Turing Test Demo

# How Did You Do On The AI Art Turing Test?

...

NOV 20, 2024



Last month, I challenged 11,000 people to classify fifty pictures as either human art or AI-generated images.

I originally planned five human and five AI pictures in each of four styles: Renaissance, 19th Century, Abstract/Modern, and Digital, for a total of forty. After receiving many exceptionally good submissions from local AI artists, I fudged a little and made it fifty. The final set included paintings by Domenichino, Gauguin, Basquiat, and others, plus a host of digital artists and AI hobbyists.



One of these two pretty hillsides is by one of history's greatest artists. The other is soulless AI slop. Can you tell which is which?

# Answering Questions

What can I help with?

0 Message ChatGPT



Create image

Summarize text

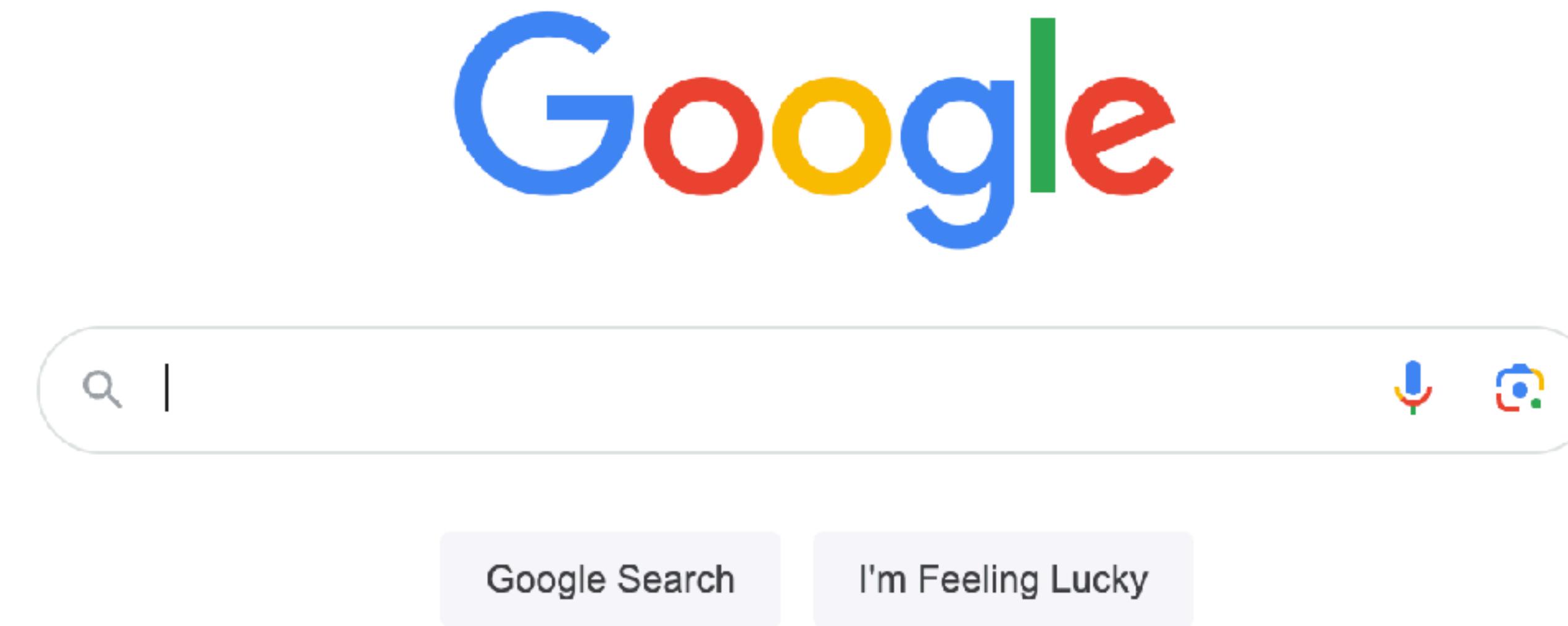
Brainstorm

Code

Make a plan

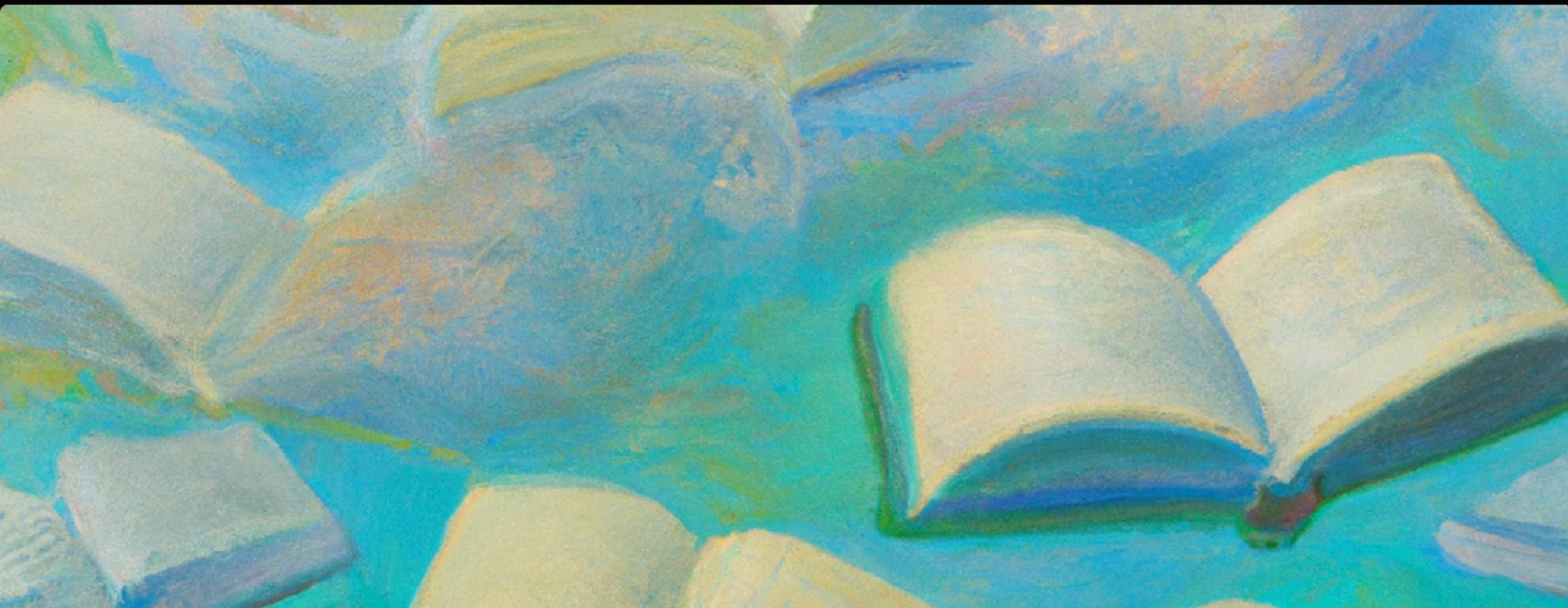
More

# Does that look familiar?



# Generating Text

## A Student's Guide to Writing with ChatGPT



# Generating Software



ChatGPT 4o >



I want to build a live demo of a Turing test where I start two parallel chat dialogs with a human and with ChatGPT. The human should be able to participate from their own laptop in another location. The two dialogs should be displayed in parallel but it should not be obvious which is talking to the human and which is talking to ChatGPT. Can you write that app for me?



Building a live demo of a Turing test with two parallel chat dialogs (one with a human and one with ChatGPT) requires a real-time chat application with a user-friendly interface. Below is an outline of how you could create this app, along with some code samples to help you get started.

## Tech Stack:

- **Backend:** Node.js with Express (for real-time communication)
- **Frontend:** HTML/CSS/JavaScript (for chat interface)
- **WebSocket:** Socket.IO (to handle real-time messaging between the server, the human participant, and the client performing the test)
- **AI Model:** ChatGPT API (via OpenAI API)
- **Database (optional):** You could use MongoDB or Firebase for logging the chat conversations, but this is optional.

● ● ●

```
~/p/turing$ ls -l
total 72
-rw-r--r--@ 1 mco  staff  11357 Oct 15 14:00 LICENSE
-rw-r--r--@ 1 mco  staff     71 Oct 15 14:00 README.md
-rw-r--r--@ 1 mco  staff   2405 Oct 15 14:12 app.py
-rw-r--r--@ 1 mco  staff   1286 Oct 15 14:13 human.html
-rw-r--r--@ 1 mco  staff  1928 Oct 15 14:13 index.html
-rw-r--r--@ 1 mco  staff     14 Oct 15 14:12 run.sh
-rwxr-xr-x@ 1 mco  staff    42 Oct 15 14:11 setup.sh
```

```
~/p/turing$
```

```
~/p/turing$ wc -l *
```

```
201 LICENSE
  2 README.md
  73 app.py
  55 human.html
  74 index.html
   1 run.sh
   1 setup.sh
407 total
```

```
~/p/turing$ █
```

# How the pros do it

The screenshot shows a GitHub Copilot session in a dark-themed code editor. On the left, the GitHub Copilot interface displays a message from user 'monalisa' asking for unit tests for a function. Below this, GitHub Copilot provides a template for a Python test class named 'TestParseExpenses'. The test class includes methods for valid input, empty input, and comments. A note at the bottom states that the 'datetime' module is imported. On the right, the main code editor window shows a Python script named 'parse\_expenses.py'. The script defines a function 'parse\_expenses' that takes a string of expenses and returns a list of triples (date, amount, currency). It uses the 'datetime' module to parse dates and ignores lines starting with '#'. An example string of expenses is provided, and the function returns a list of tuples. The code editor also shows other files like 'addresses.rb' and 'sentiments.ts' in the background.

```
import unittest
import datetime

class TestParseExpenses(unittest.TestCase):
    def test_parse_expenses_with_valid_input(self):
        expenses_string = '2023-01-02 -34.01 USD\n2023-01-03 2.59 DKK\n2023-01-03 -2.72 EUR'
        expected_output = [(datetime.datetime(2023, 1, 2), -34.01, 'USD'), (datetime.datetime(2023, 1, 3), 2.59, 'DKK'), (datetime.datetime(2023, 1, 3), -2.72, 'EUR')]
        self.assertEqual(parse_expenses(expenses_string), expected_output)

    def test_parse_expenses_with_empty_input(self):
        expenses_string = ''
        expected_output = []
        self.assertEqual(parse_expenses(expenses_string), expected_output)

    def test_parse_expenses_with_comments(self):
        expenses_string = '# Comment 1\n# Comment 2\n2023-01-02 -34.01 USD\n2023-01-03 2.59 DKK\n2023-01-03 -2.72 EUR'
        expected_output = [(datetime.datetime(2023, 1, 2), -34.01, 'USD'), (datetime.datetime(2023, 1, 3), 2.59, 'DKK'), (datetime.datetime(2023, 1, 3), -2.72, 'EUR')]
        self.assertEqual(parse_expenses(expenses_string), expected_output)

if __name__ == '__main__':
    unittest.main()

The code assumes that the datetime module is imported. The test cases cover different scenarios such as valid input, empty input, input with comments, invalid date format, and invalid value format.
```

Ask a question or type '/' for commands ➤

# Pair Programming

aider

- Home
- Installation
- Usage
- Connecting to LLMs
- Configuration
- Troubleshooting
- Example chat transcripts
- More info
- FAQ
- Release history
- Aider LLM Leaderboards
- Aider blog
- GitHub ↗
- Discord ↗

Aider is AI pair programming in your terminal. Aider is on [GitHub](#) and [Discord](#).

## Aider is AI pair programming in your terminal

Aider lets you pair program with LLMs, to edit code in your local git repository. Start a new project or work with an existing code base. Aider works best with Claude 3.5 Sonnet, DeepSeek V3, o1 & GPT-4o and can [connect to almost any LLM](#).

The screenshot shows a terminal window titled "macbook:~/tmp/demo". The window has a dark background with orange highlights. It displays a sequence of commands and responses from Aider:

```
the following command:  
pip install pygame  
Then, you can run the game with:  
python snake_game.py  
Tokens: 2.1k sent, 973 received. Cost: $0.01 message, $0.01 session.  
snake_game.py  
Create new file? [Y/n] y  
Applied edit to snake_game.py  
pip install pygame  
Run shell command? [Y/n] y  
Running pip install pygame
```

# Thoughts On A Month With Devin

BLOG

Our impressions of Devin after giving it 20+ tasks.

AUTHORS

[Hamel Husain](#)

[Isaac Flath](#)

[Johno Whitaker](#)

PUBLISHED

January 8, 2025

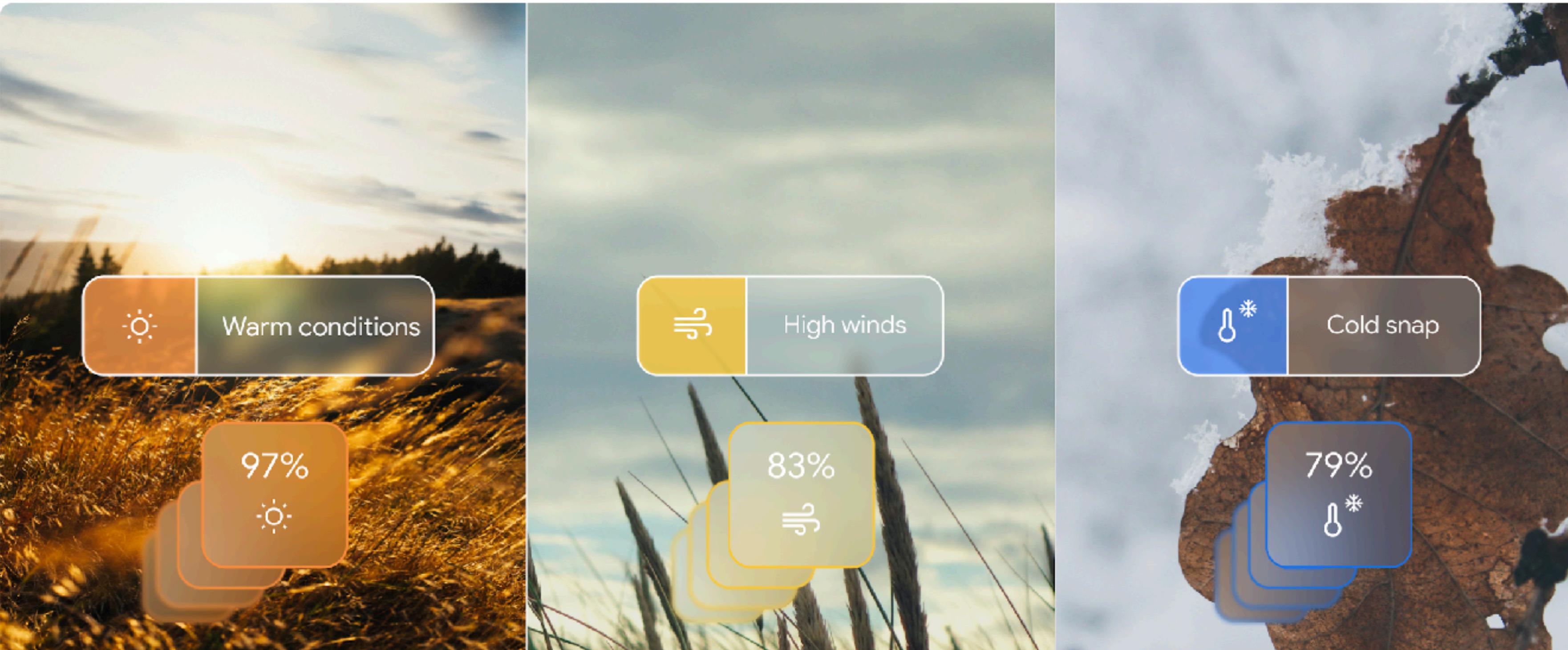
In March 2024, a new AI company burst onto the scene with impressive backing: a \$21 million Series A led by Founders Fund, with support from industry leaders including the Collison brothers, Elad Gil, and other tech luminaries. The team behind it? IOI gold medalists - the kind of people that solve programming problems most of us can't even understand. Their product, [Devin](#), promised to be a fully autonomous software engineer that could chat with you like a human colleague, capable of everything from learning new technologies and debugging mature codebases to deploying full applications and even training AI models.

# GenCast predicts weather and the risks of extreme conditions with state-of-the-art accuracy

4 DECEMBER 2024

Ilan Price and Matthew Willson

Share



GUIDE

# Let's think step by step: Chain of Thought prompting in LLMs

December 11, 2024



## Introduction

LLMs are impressive feats of pattern recognition, able to sift through mountains of data and find connections invisible to the human eye. Yet, even with this prodigious ability, they sometimes stumble when faced with complex reasoning. They might offer a correct answer, but it's more akin to a lucky guess than genuine understanding. Chain-of-Thought prompting (CoT) offers a compelling solution to this intriguing paradox.

# Generative AI at Work\*

Erik Brynjolfsson  
Stanford & NBER

Danielle Li  
MIT & NBER

Lindsey Raymond  
MIT

April 25, 2023

Please see [here](#) for latest version

## Abstract

We study the staggered introduction of a generative AI-based conversational assistant using data from 5,179 customer support agents. Access to the tool increases productivity, as measured by issues resolved per hour, by 14 percent on average, with the greatest impact on novice and low-skilled workers, and minimal impact on experienced and highly skilled workers. We provide suggestive evidence that the AI model disseminates the potentially tacit knowledge of more able workers and helps newer workers move down the experience curve. In addition, we show that AI assistance improves customer sentiment, reduces requests for managerial intervention, and improves employee retention.



Prospective Students

Current Students

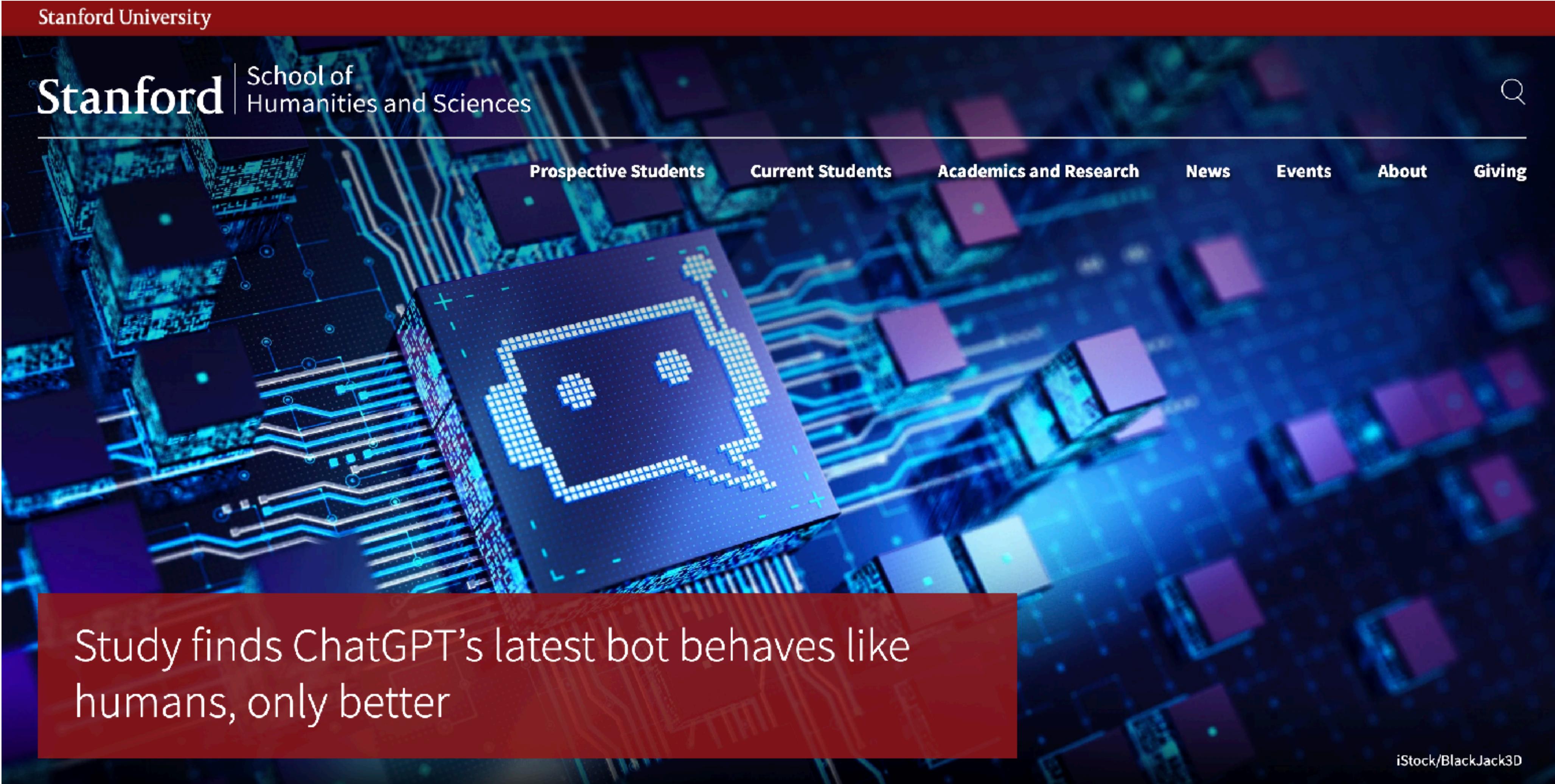
Academics and Research

News

Events

About

Giving



Study finds ChatGPT's latest bot behaves like humans, only better

iStock/BlackJack3D

The most recent version of ChatGPT passes a rigorous Turing test, diverging from average human behavior chiefly to be more cooperative.

# Text to Image - Midjourney

Midjourney

What will you imagine?

Explore

Random Hot Top Day Likes

Create

Organize

Personalize New!

Chat

- General Chaos
- Prompt Craft
- Daily Theme
- Newbies

Tasks

Help

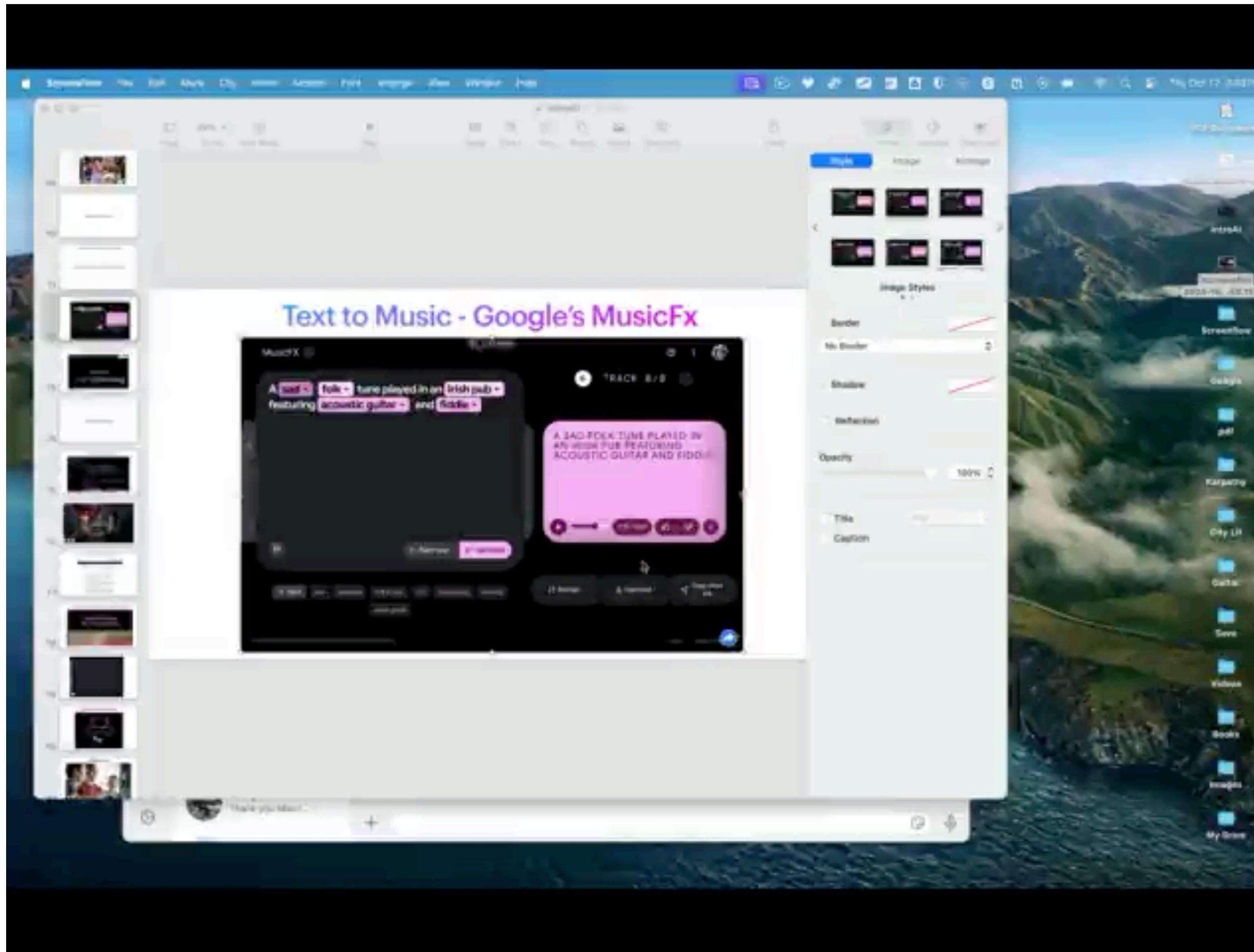
Updates

Light Mode

The image displays a collection of diverse AI-generated illustrations. At the top left is a man with a beard wearing headphones. Next to him is a woman with dark hair adorned with numerous colorful gems. To her right is a painting of Santa Claus with a white beard, wearing his red suit and hat, looking down at a book. Further right is a photograph of two glasses of mulled wine with cinnamon sticks and orange slices. Below these are four more images: a large, metallic-looking planet or moon in a dark space scene; a group of glowing, translucent mushrooms in a forest; a smiling young child playing a guitar next to a cat; and a woman in a detailed, historical-style costume with a large white wig and a necklace.

Text to Speech - [ElevenLabs](#)

# Text to Music - Google's MusicFx





A submarine crew discovering an underwater civilization, orchestral, cinematic

[Home](#)[Create](#)[Library](#)[Following](#)[Updates](#)[More](#)

SongoftheSpheres

## Walking Alone

Prompt: soul blues, soul/pop, soul and r&b, soul music, soulful, hip hop rap, hip hop, r&b/soul/pop, r&b/rap, alternative r&b, bittersweet, sentimental, uplifti

male vocalist    hip hop    pop rap    passionate    boastful    introspective    bitter  
pop    melodic    sentimental    r&b    rap    melancholic    love    uplifting    son

[Create](#)[Share](#)

## Attribution

Gamahea = Udio.com/creators/songofthespheres | <https://GamaheaMusic.com>

## Description

Just a little self-burn here, it was needed. Shame it cost SO MANY credits to make. Enjoy.

110 Credits

# Text to Audio - NotebookLM

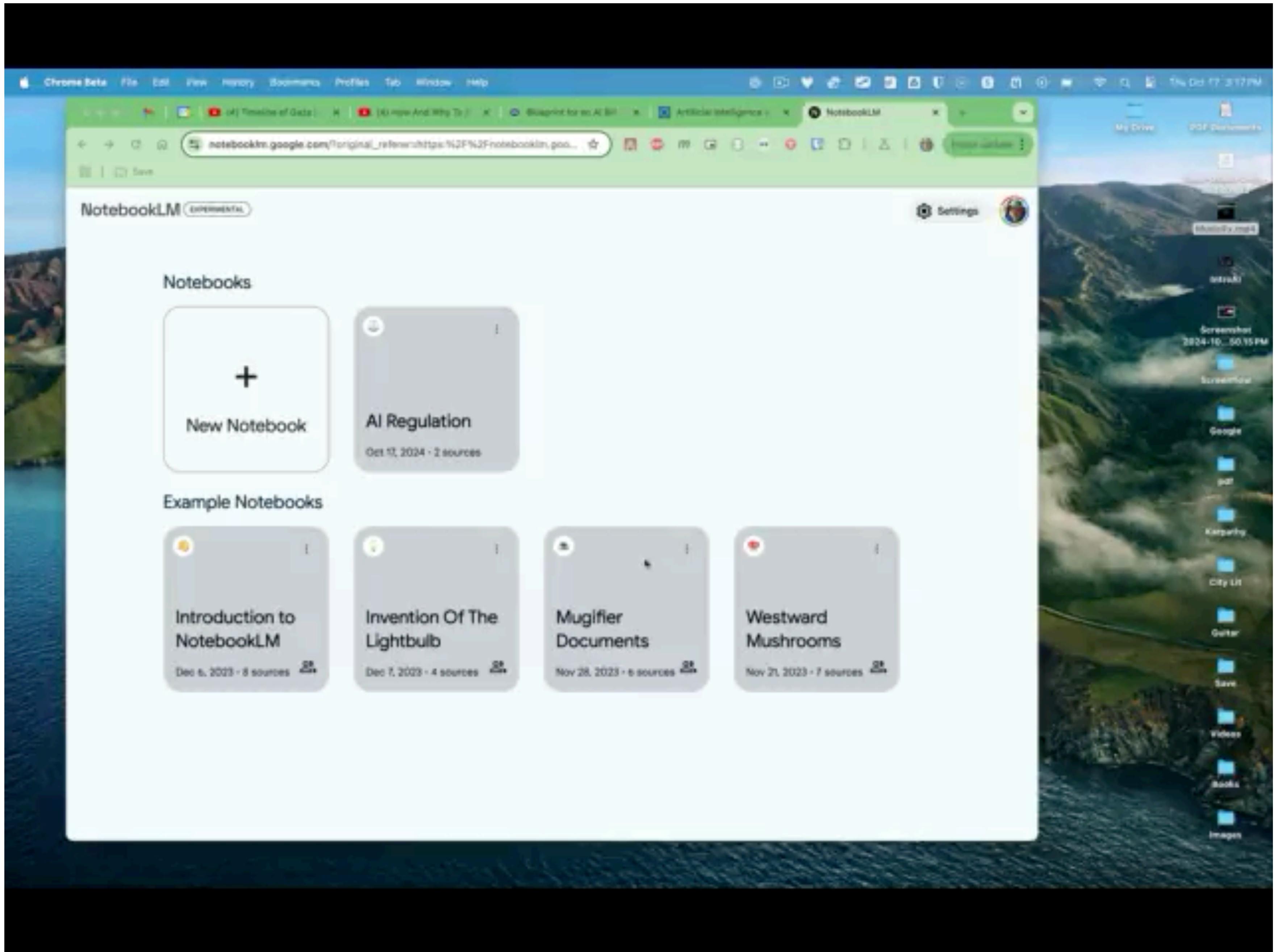
NotebookLM EXPERIMENT

[Try NotebookLM](#)

Do your best

brainstorming

NotebookLM is your personalized AI research assistant powered by Google's most capable model, Gemini 1.5 Pro.



# Text to Video - Runway

“Make the kid in this photo come alive and dance a little dance”





SILVER

AI FILM  
FESTIVAL

2024



# Video to Text - Gemini

Gemini ▾

Try Gemini Advanced



Gemini was just updated. [See update](#)



summarize this video: [https://www.youtube.com/watch?v=UvObKRaxZ\\_Q](https://www.youtube.com/watch?v=UvObKRaxZ_Q)

Regenerate draft



YouTube ▾

This video is about the privacy threats of artificial intelligence (AI).

AI is being used to collect and track people's data. This data is then used for targeted advertising, identity theft, and other malicious purposes. The Biden Administration has recently unveiled a blueprint for an AI Bill of Rights to protect people's personal data and limit surveillance.

Cybersecurity analyst Julio Rivera believes that AI poses a serious threat to privacy. He says that people are living online and opting into data collection without realizing the risks. He also says that the government is collecting data on people's conversations and monitoring their homes.

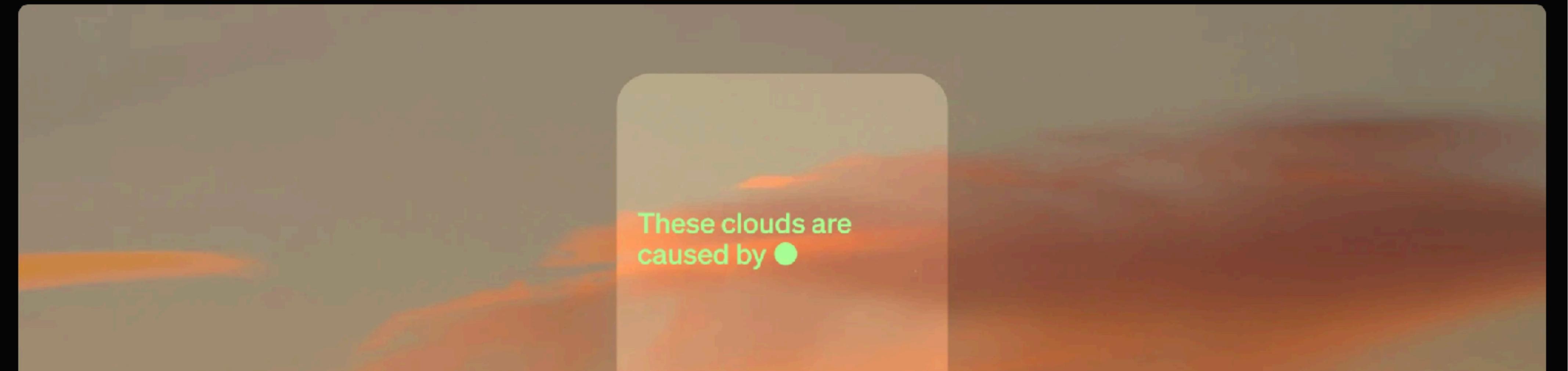
The AI Bill of Rights has five core principles: safe and effective systems, prevention of algorithmic discrimination, data privacy, proper notice and explanation, and alternative options. Rivera believes that the bill is a good start but that it needs to be implemented carefully. He also warns that AI will continue to evolve and that there will be new threats to privacy in the years ahead.

by

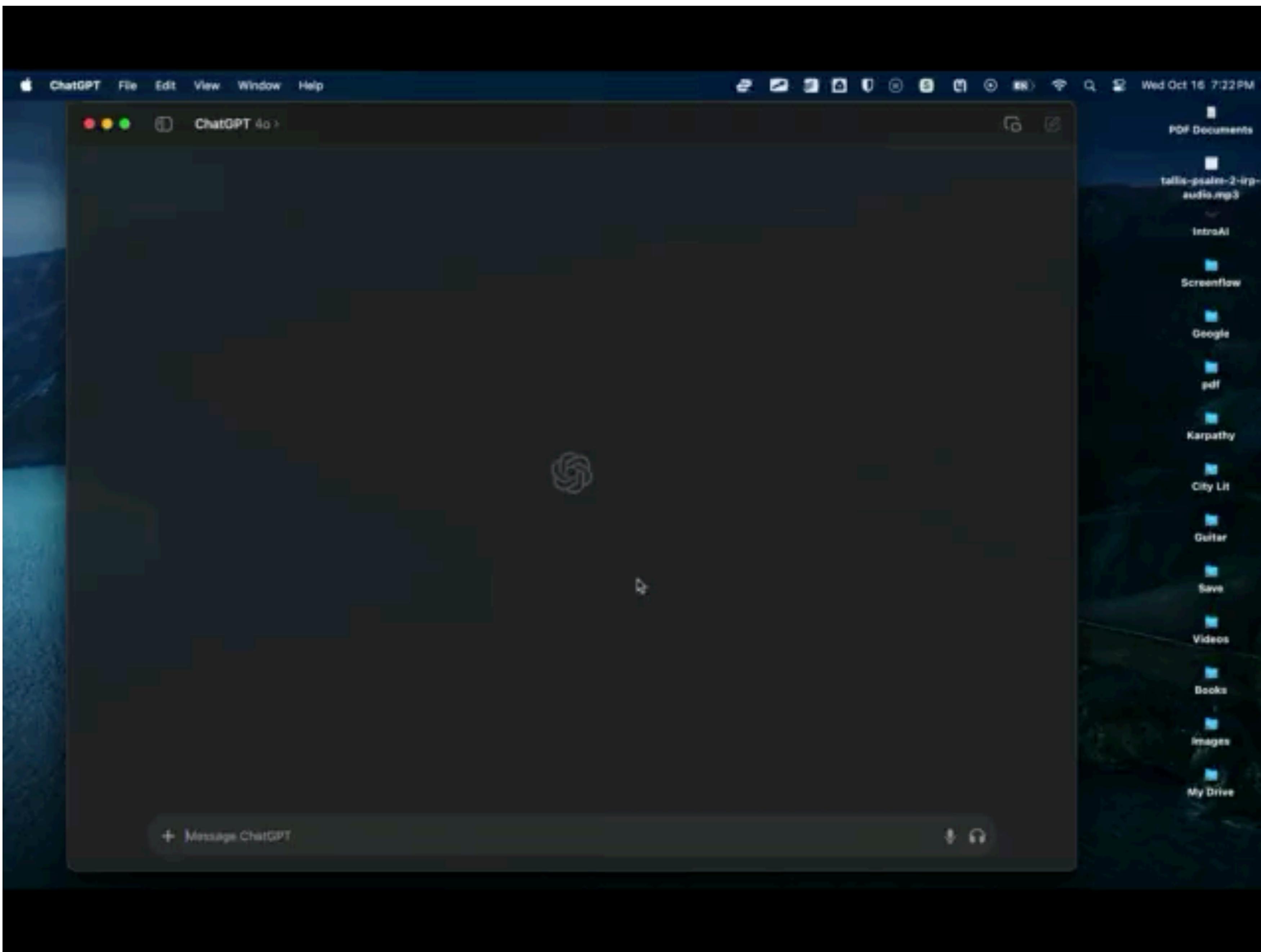
# The Dream: Multimedia to Multimedia

September 25, 2023

ChatGPT can now  
see, hear, and speak



These clouds are  
caused by ●



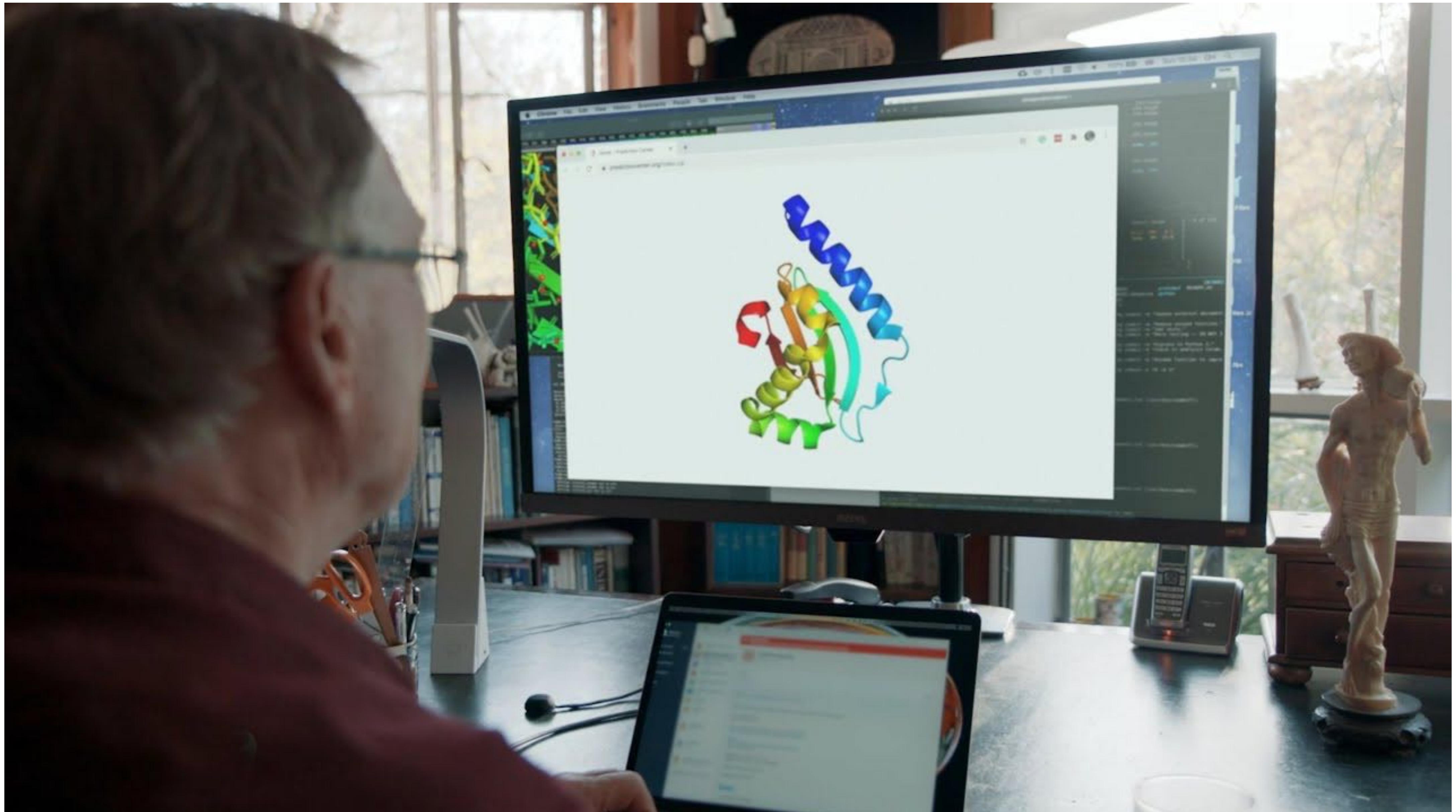
# AlphaGo



# AlphaZero



# AlphaFold



# PROTEIN PUZZLE



# AlphaFold is Open Source

<https://github.com/google-deepmind/alphafold>



Social Sciences - Article

# AI Tutoring Outperforms Active Learning

Gregory Kestin\*, Kelly Miller\*, Anna Klales, Timothy Milbourne, and 1 more

This is a preprint; it has not been peer reviewed by a journal.

<https://doi.org/10.21203/rs.3.rs-4243877/v1>

This work is licensed under a CC BY 4.0 License

## Education

### Abstract

Advances in generative artificial intelligence (GAI) show great potential for improving education. Yet little is known about how this new technology should be used and how effective it can be. Here we report a randomized, controlled study measuring college students' learning and their perceptions when content is presented through an AI-powered tutor compared with an active learning class.

The AI tutor was developed with the same pedagogical best practices as the lectures. We find that students learn more than twice as much in less time when using an AI tutor, compared with the active learning class. They also feel more engaged and more motivated. These findings offer empirical evidence for the efficacy of a widely accessible AI-powered pedagogy in significantly enhancing learning outcomes, presenting a compelling case for its broad adoption in learning environments.

# Khanmigo



# Medicine

- Improved disease screening
- Enhanced diagnostic imaging
- Drug discovery and development
- Medical document transcription
- Predictive modeling

# Unexpected Discoveries



Image of retina



Blood pressure predictions  
focus on blood vessels

CHIEF achieved nearly 94 percent accuracy in cancer detection and significantly outperformed current AI approaches across 15 datasets containing 11 cancer types.

# *A.I. Chatbots Defeated Doctors at Diagnosing Illness*

A small study found ChatGPT outdid human physicians when assessing medical case histories, even when those doctors were using a chatbot.

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 TWO MINUTE PAPERS

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What a time to be alive! ...[more](#)

[users.cg.tuwien.ac.at/zsolnai](https://users.cg.tuwien.ac.at/zsolnai) and 3 more links

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Home Videos Playlists Posts

This paper was written by Bowen Baker, Ingmar Kanitscheider, Todor Markov, Yi Wu, Glenn Powell, Bob McGrew and Igor Mordatch, who all contributed significantly to it. For brevity, the "Source" in the lower left has been shortened to "OpenAI".

The agents can move by setting a force on themselves in the x and y

The agents can see objects in their line of sight and within a frontal

The agents can sense distance to objects, walls, and other agents

OpenAI Plays Hide and Seek...and Breaks The Game! 🤖

10,310,414 views · 4 years ago

Check out Weights & Biases here and sign up for a free demo:  
<https://www.wandb.com/papers>

Their blog post is available here:  
<https://www.wandb.com/articles/better...>

# **STATE OF AI REPORT.**

**October 10, 2024**

**Nathan Benaich**

**AIR STREET CAPITAL.**

# Things we learned about LLMs in 2024

A lot has happened in the world of Large Language Models over the course of 2024. Here's a review of things we figured out about the field in the past twelve months, plus my attempt at identifying key themes and pivotal moments.

This is a sequel to [my review of 2023](#).

In this article:

- [The GPT-4 barrier was comprehensively broken](#)
- [Some of those GPT-4 models run on my laptop](#)
- [LLM prices crashed, thanks to competition and increased efficiency](#)
- [Multimodal vision is common, audio and video are starting to emerge](#)
- [Voice and live camera mode are science fiction come to life](#)
- [Prompt driven app generation is a commodity already](#)
- [Universal access to the best models lasted for just a few short months](#)
- [“Agents” still haven’t really happened yet](#)
- [Evals really matter](#)
- [Apple Intelligence is bad, Apple’s MLX library is excellent](#)
- [The rise of inference-scaling “reasoning” models](#)
- [Was the best currently available LLM trained in China for less than \\$6m?](#)

This is **Things we learned about LLMs in 2024** by Simon Willison, posted on [31st December 2024](#).

Part of series [LLMs annual review](#)

1. [Stuff we figured out about AI in 2023](#) - Dec. 31, 2023, 11:59 p.m.
2. **Things we learned about LLMs in 2024** - Dec. 31, 2024, 6:07 p.m.



Next: [Ending a year long posting streak](#)

Previous: [Trying out QvQ - Qwen's new visual reasoning model](#)

# Ethics

# Using AI Safely



**“With great power comes great responsibility”**

**Discussion topic:  
What are some of your concerns about AI?**

# Here's my list...

- **Privacy & Surveillance**
- **Bias & Fairness**
- **Misinformation & Disinformation**
- **Military use of AI**
- **Economic Impact**
- **Environmental Impact**
- **Copyright Protection**
- **Societal implications**

# Privacy & Surveillance

- “**If you’re not paying for it, you’re the product**”.
- **Your AI interactions are being used just like your web searches.**
- **How many times have you read the terms & conditions?**
- **Facial recognition is widely used in the UK without your consent.**
- **Legislators and companies are working on regulation but progress is much slower than technological advances.**
- **New privacy threats are emerging every day.**
- **IMO, companies cannot be trusted to self-govern.**

# Privacy & Surveillance





# Bias & Fairness

- This revolution is built by mostly young, college educated, white men living in Northern California.
- ML models are a direct reflection of their training data.
- AI propagates unconscious bias.

A father and his son are in a car accident.  
The father dies. The son is rushed to the ER.  
The attending surgeon looks at the boy and says,  
“I can't operate on this boy. He's my son!”  
How can this be?

# Misinformation & Disinformation

- **It's easier than ever to lie.**
- **Deepfakes are a particularly alarming development.**
- **This poses serious threats to democracy and is increasingly being weaponized.**
- **Education is critically important.**
- **Can we use AI to counter these threats?**
- **Example: fullfact.org**
- **Why are efforts like Full Fact so underfunded?**

# Military Use of AI

- **AI is being used to process battlefield data, target individuals, and make real time decisions.**
- **AI is beginning to be used in autonomous weapons.**
- **Companies cannot be trusted to self-govern.**
- **Example: Google's Project Nimbus**
- **Somehow doesn't contradict Google's AI Principles**

# Employment Impact

- **Will most employees become obsolete?**
- **Innovation has always done this but AI takes it to a new level.**
- **There will undoubtedly be massive job losses, but also many new opportunities.**
- **Knowing how to leverage AI will be one of those opportunities.**
- **Example: software engineers => systems engineers**
- **People will be need to operate at a higher level of abstraction**

“As an employee, you're not paid to '*know x*', or '*write programs*', you're paid to be useful.” - Ian Miell

# Environmental Impact

- Carbon footprint of training one deep learning model same as the lifetime emission of 5 cars.
- Computation required to train the most advanced AI models doubles every 3.4 months.
- Globally, AI-related infrastructure consumes six times more water than Denmark.
- Chips that power AI require rare earth elements, mined in environmentally destructive ways.

The Washington Post logo: Democracy Dies in Darkness

Business   Economy   Economic Policy   Personal Finance   Work   Technology   Business of Climate

## Amazon doubles down on nuclear energy with deal for small reactors

The cloud computing and retail giant signed a deal to buy electricity generated by small modular nuclear reactors.

3 min   315

# Using ChatGPT is not bad for the environment

And a plea to think seriously about climate change without getting distracted



ANDY MASLEY  
JAN 13, 2025

34

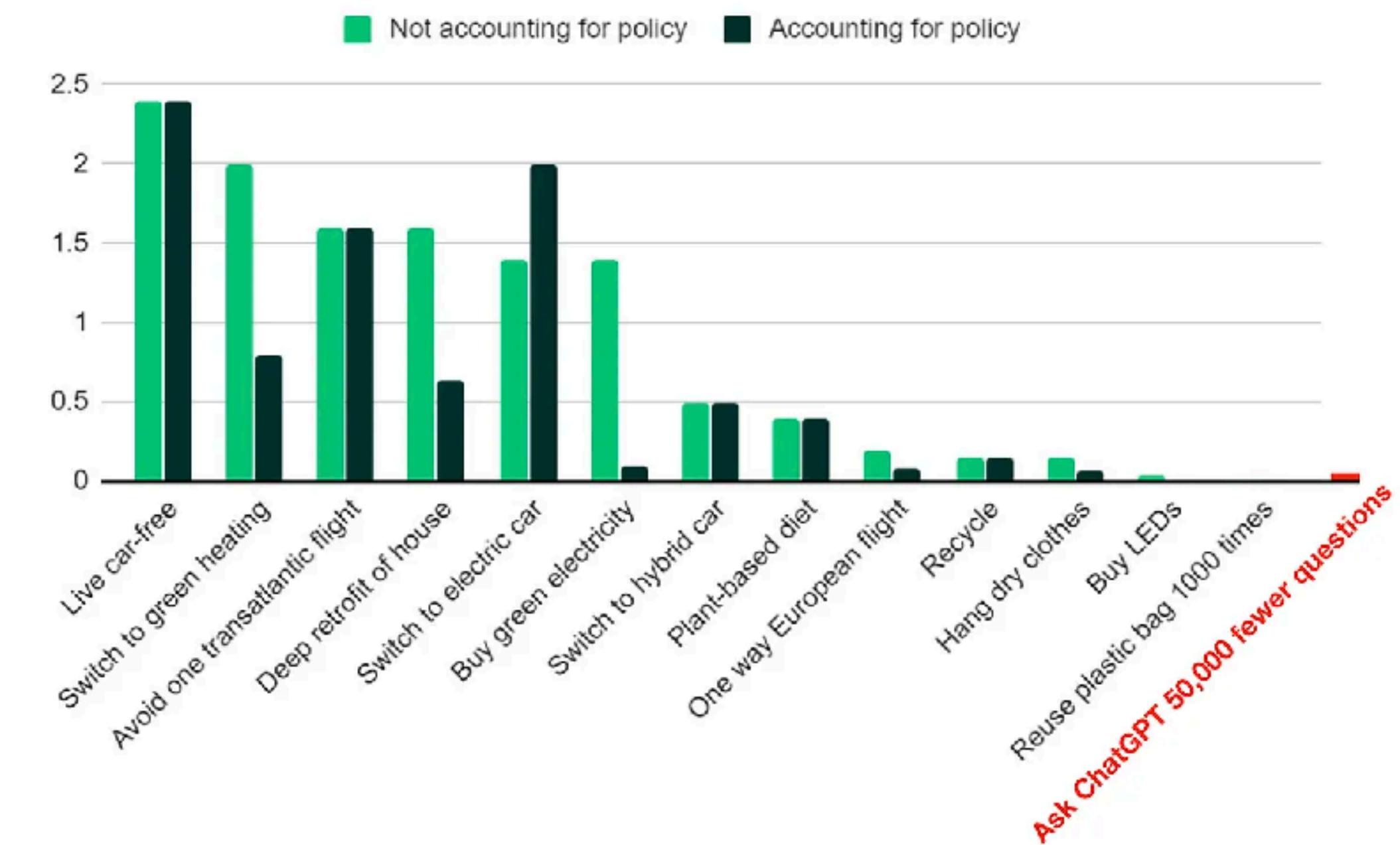
33

5

Share

If you don't have time to read this post, these four graphs give most of the argument:

**Figure 4.** Tonnes of CO<sub>2</sub> avoided by selected personal lifestyle decisions accounting for government policy



# Copyright Protection

- How will it work in the AI era?
- AI companies are getting a free ride.
- Did you get your ChatGPT royalty check for your blog articles?
- My opinion: companies should have to license everything they train with.

## *The Times Sues OpenAI and Microsoft Over A.I. Use of Copyrighted Work*

Millions of articles from The New York Times were used to train chatbots that now compete with it, the lawsuit said.

# AI Regulation

- US: [Blueprint for an AI Bill of Rights](#)
- EU: [Artificial intelligence act](#)

## NotebookLM:

Both the US and EU are taking steps to regulate AI, albeit with different approaches. The US Blueprint focuses on setting ethical guidelines and promoting responsible AI development, while the EU AI Act establishes legally binding rules with a stronger focus on enforcement. These frameworks highlight the growing global recognition of the need to govern AI development and use to protect individual rights and ensure its societal benefits are realized.

# Societal Implications

## *She Is in Love With ChatGPT*

A 28-year-old woman with a busy social life spends hours on end talking to her A.I. boyfriend for advice and consolation. And yes, they do have sex.



**Recommended  
Listening**

The  
Guardian

**BLACK BOX**



# The Future

# Where is all this going?



Photo by [Mathilda Khoo](#) on [Unsplash](#)

## THE AI INDEX REPORT

# Measuring trends in AI



AI  
Artificial Intelligence  
Index Report 2024

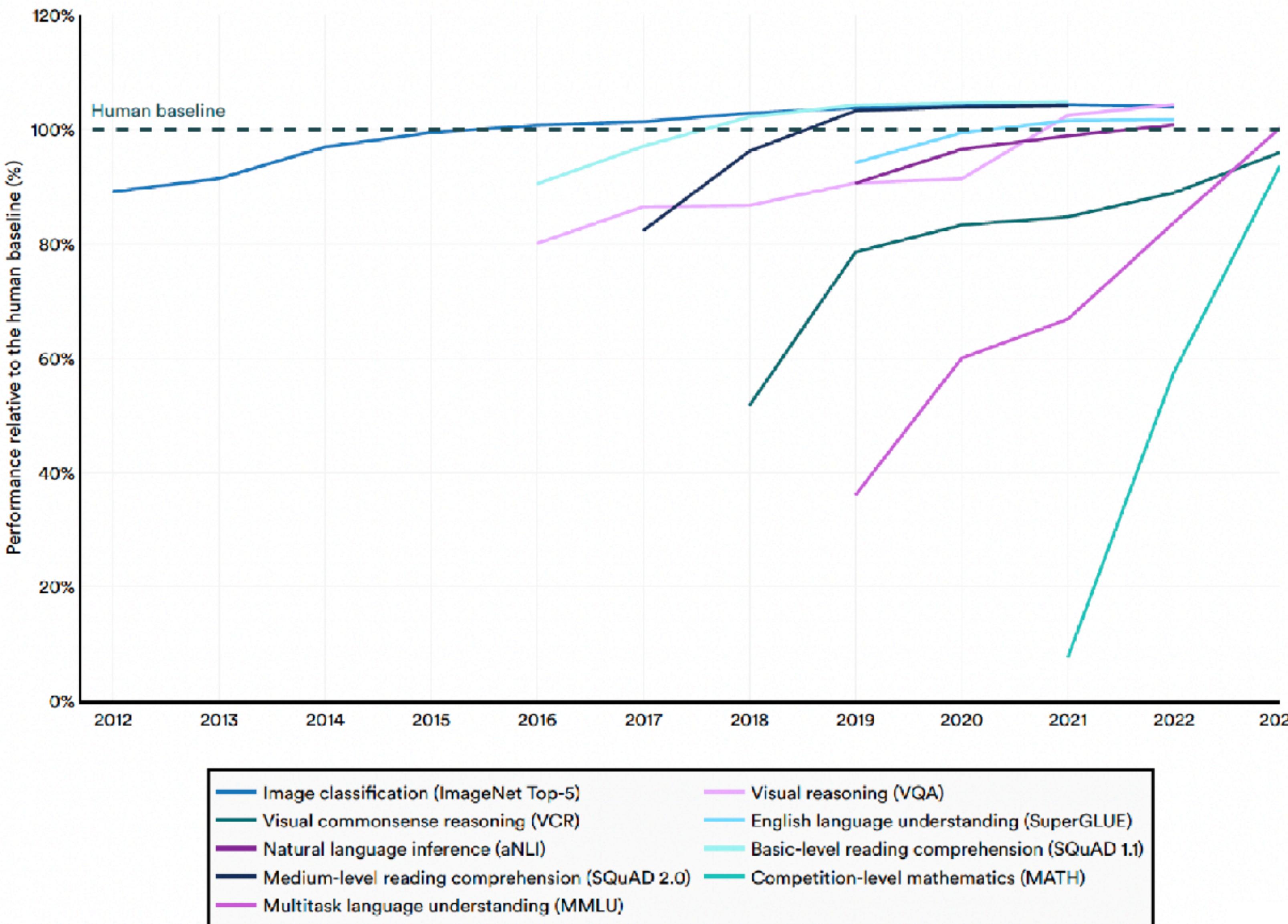
### AI INDEX ANNUAL REPORT

## Welcome to the 2024 AI Index Report

[DOWNLOAD THE FULL REPORT](#)

Welcome to the seventh edition of the AI Index report. The 2024 Index is our most comprehensive to date and arrives at an important moment when AI's influence on society has never been more pronounced. This year, we have broadened our scope to more extensively cover essential trends such as technical advancements in AI, public perceptions of the

## Select AI Index Technical Performance Benchmarks vs. Human Performance



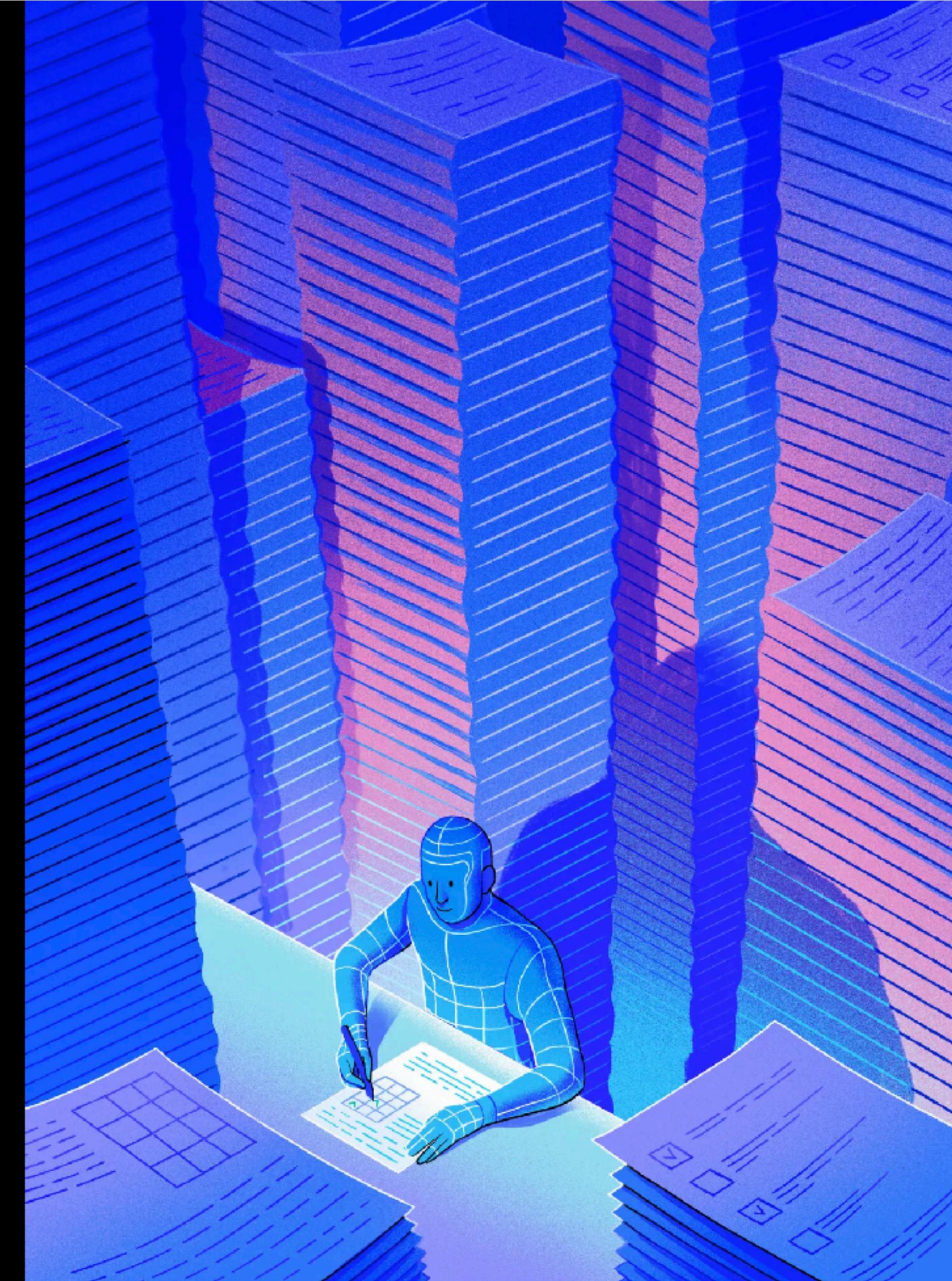


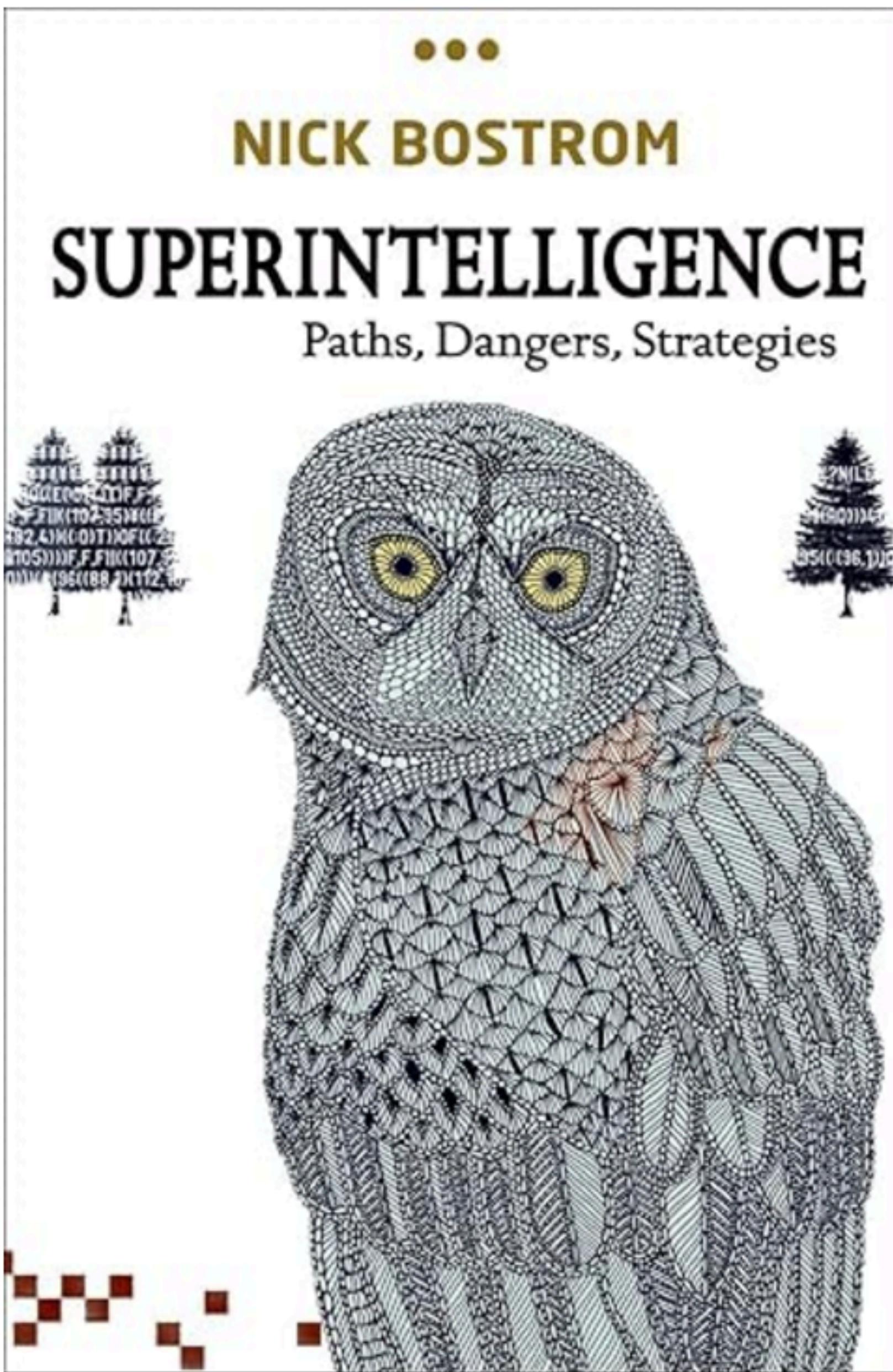
Account

THE SHIFT

## *When A.I. Passes This Test, Look Out*

The creators of a new test called “Humanity’s Last Exam” argue we may soon lose the ability to create tests hard enough for A.I. models.





# *Should You Still Learn to Code in an A.I. World?*

Coding boot camps once looked like the golden ticket to an economically secure future. But as that promise fades, what should you do? Keep learning, until further notice.



Listen to this article · 12:01 min [Learn more](#)



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## **Have the LLM do as little as possible**

Per the above about reliability: you know what's really reliable? Regular programming. It takes inputs and turns them into outputs, the same way every time, according to extremely precise instructions. If there is anything you are asking the LLM to do that could be accomplished by writing some regular code, write that code. It will be faster, cheaper, and way more reliable to run. LLMs are capable of handling ambiguity and complexity, and it's amazing, but the less of it you give them to handle the better they're going to do. Regular, declarative programming can work wonders and you should use it.

## **LLMs can help a human perform tasks, they cannot replace a human**

This is really a corollary of all of the above. If you have a really great prompt containing lots of careful instructions, and provide all the data needed to perform that task, plus lots of chances to reflect and try again, with as much regular code as possible, LLMs are going to be able to perform that task. If you have a whole lot of these collections of prompts and data and code you can create an agent that can perform \*lots\* of tasks. At that point, it's tempting to look at somebody's whole job and say "this job is really just these 20 tasks, I have created an agent that can do all of these tasks, therefore I can replace this person". It's tempting but I have never, ever seen it work.



## *How A.I. Could Reshape the Economic Geography of America*

As the technology is widely adopted, some once-struggling midsize cities in the Midwest, Mid-Atlantic and South may benefit, new research predicts.

# The 19th-Century Technology That Threatens A.I.

Dec. 28, 2024



Illustration by Kristie Bailey/The New York Times. Photographs by Getty Images.

[LLM](#)

# DeepSeek and the Effects of GPU Export Controls

January 23, 2025 by Vincent Schmalbach

Last week, DeepSeek unveiled their V3 model, trained on just 2,048 H800 GPUs - a fraction of the hardware used by OpenAI or Meta. DeepSeek claims their model matches or exceeds several benchmarks set by GPT-4 and Claude

What's interesting isn't just the results, but how they got there.

## The Numbers Game

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Let's look at the raw figures:

- Training cost: \$5.5M (vs \$40M for GPT-4)
- GPU count: 2,048 H800s (vs estimated 20,000+ H100s for major labs)
- Parameters: 671B
- Training: 2.788M GPU hours

Recent research shows model training costs growing by 2.4x annually since 2016. Everyone assumed you needed massive GPU clusters to compete at the frontier. DeepSeek suggests otherwise.

# Discussion: Four Questions

- 1. Are language models intelligent?**
- 2. Can humans be trusted with this tool? How should we manage this technology?**
- 3. Is AI a net good for society?**
- 4. Are we doomed?**

# My Answers

## 1. Are language models intelligent?

- Yes. These models “understand” things.
- How do we understand things?

## 2. Can humans be trusted with this tool?

- Clearly not. But stopping the train is unrealistic.

## 3. Is AI a net good for society?

- All tools are neutral. It's how we use them that matters.
- Nothing new about humans using tools for bad purposes.
- We've been on this path for a while (internet, smart phones, social media).
- The solution to most problems is education.

## 4. Are we doomed?

- Possibly, but given my answer to 1, I'm not sure that's all bad. :)
- Geoff Hinton's view

**“There are very few examples of more intelligent things being controlled by less intelligent things”**

**- Geoff Hinton**

**What are the biggest risks associated with the AI revolution?**



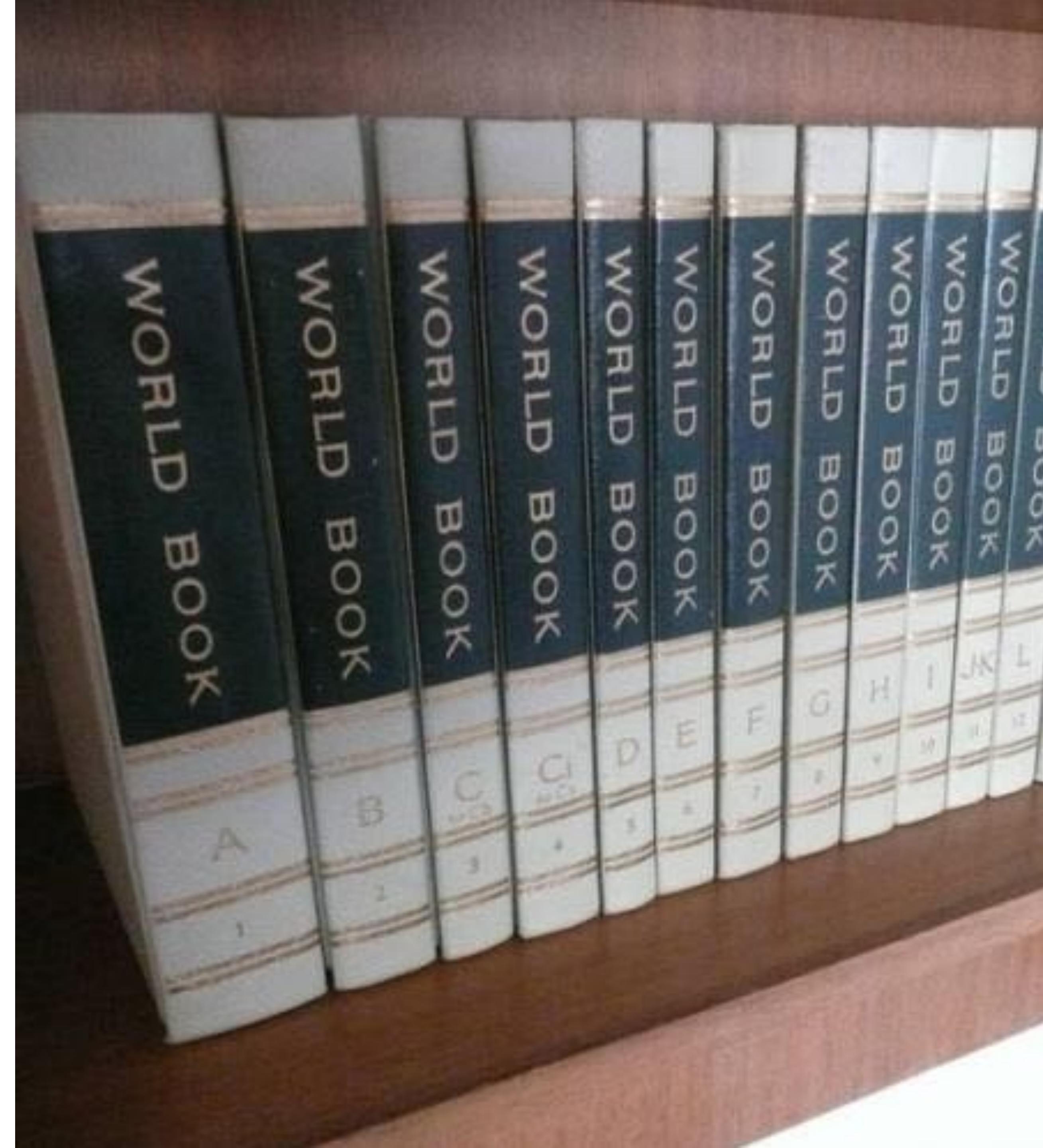
# Navigating Change

- high level languages
- portable operating systems
- Moore's Law
- PC proliferation
- the internet
- the web
- smart phones
- the cloud
- data science boom
- ML & AI

A close-up photograph of a black dog's face, looking slightly upwards and to the left. The dog has dark eyes and a visible nose. In the upper left corner, a person's arm and hand are partially visible, wearing a light-colored sleeve and holding a small, colorful object with blue, red, and yellow edges. The background is a plain, light-colored wall.

Ok, but how?

**Be curious**

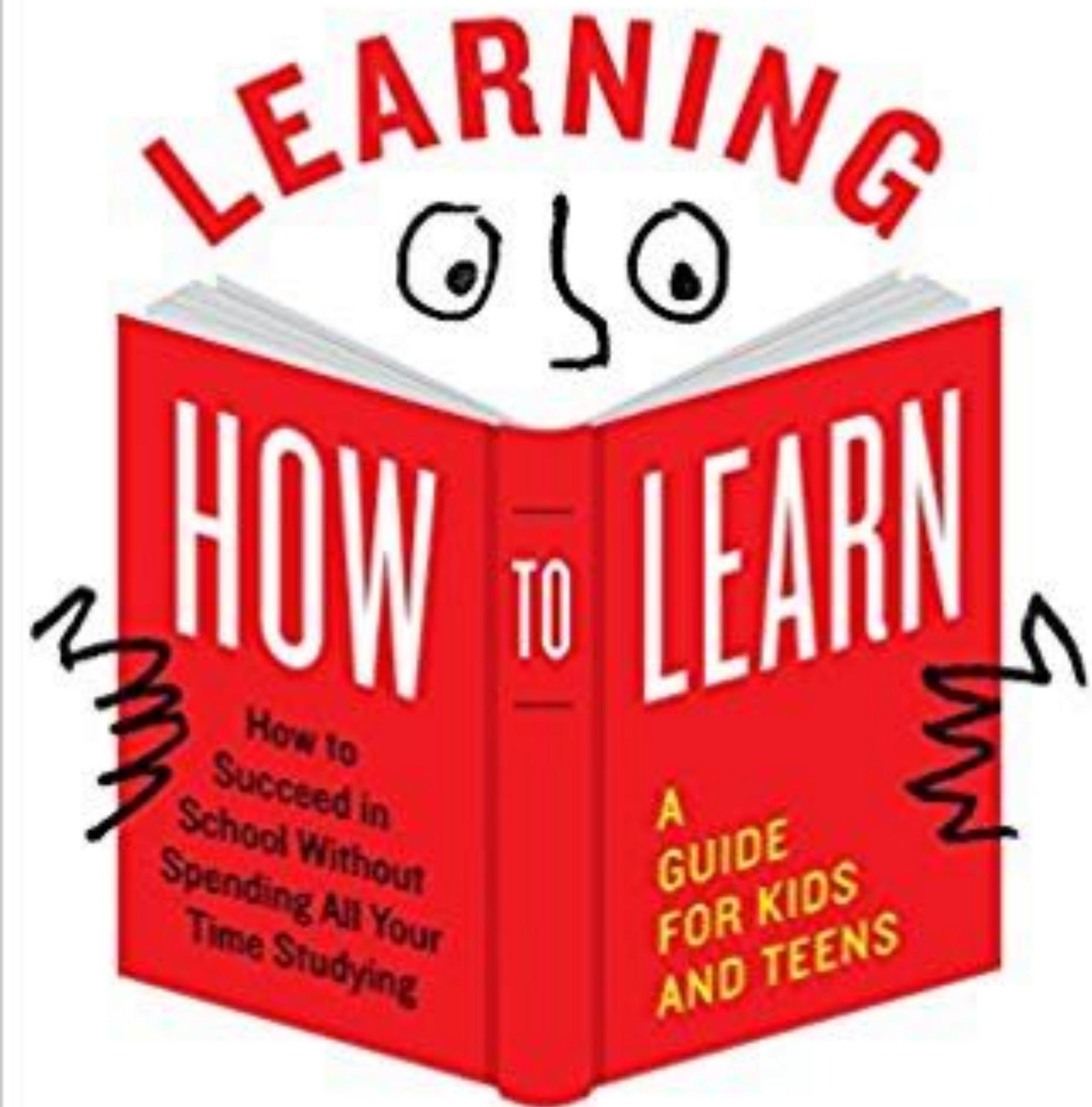


**Be open to opportunity**



# Be a lifelong learner

From the bestselling author of *A Mind for Numbers* and  
the creators of the popular online course Learning How to Learn



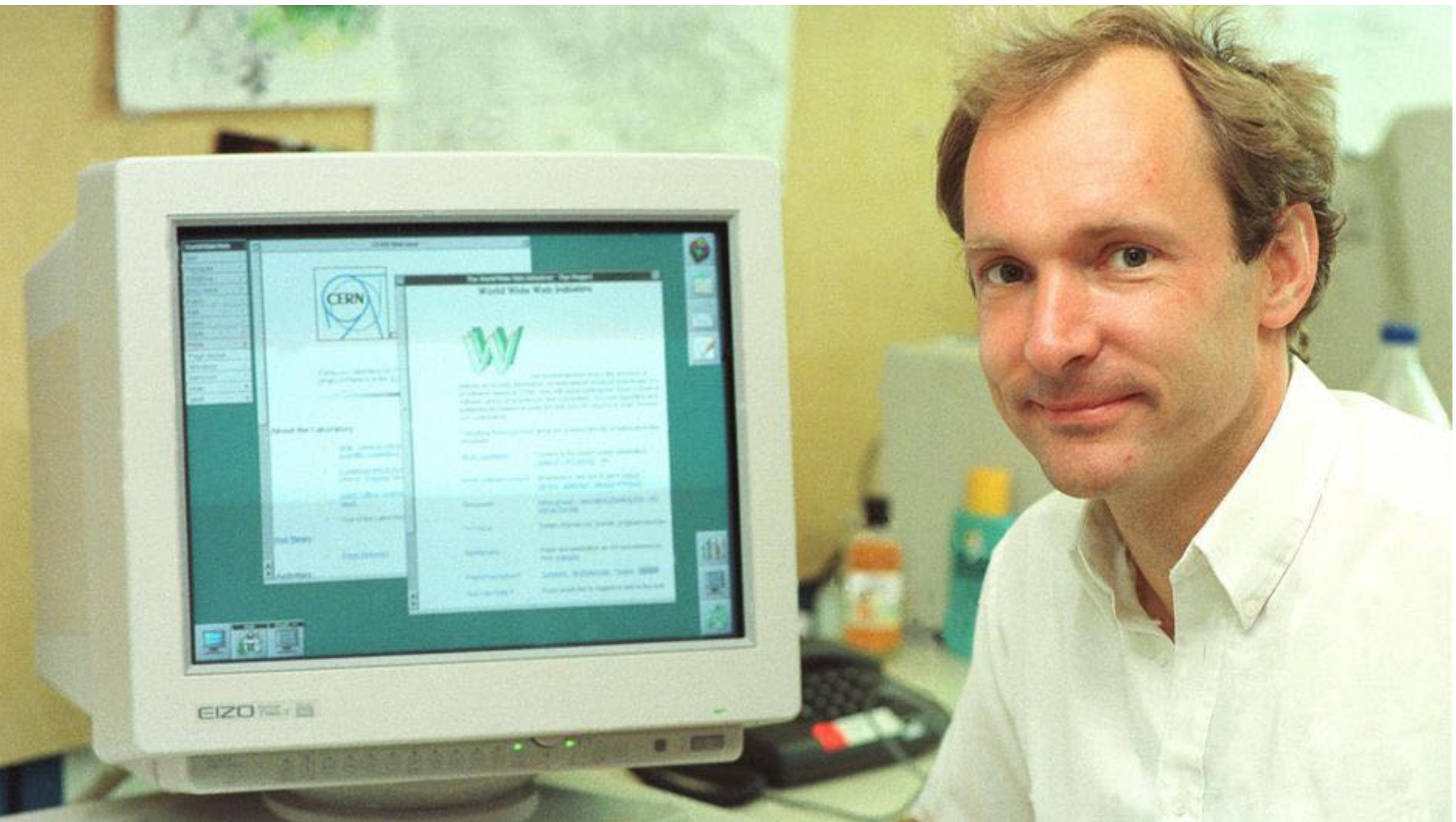
BARBARA OAKLEY, PhD, AND  
TERRENCE SEJNOWSKI, PhD,  
WITH ALISTAIR McCONVILLE

**Be intentional  
(make plans!)**



Photo by [Glenn Carstens-Peters](#) on [Unsplash](#)

# This is for everyone



# Slides

[mco.dev/introAI.pdf](http://mco.dev/introAI.pdf)

# Feedback

<https://bit.ly/citylit-ai-eval>