

PRESENTATION

Introducing Large Language Models

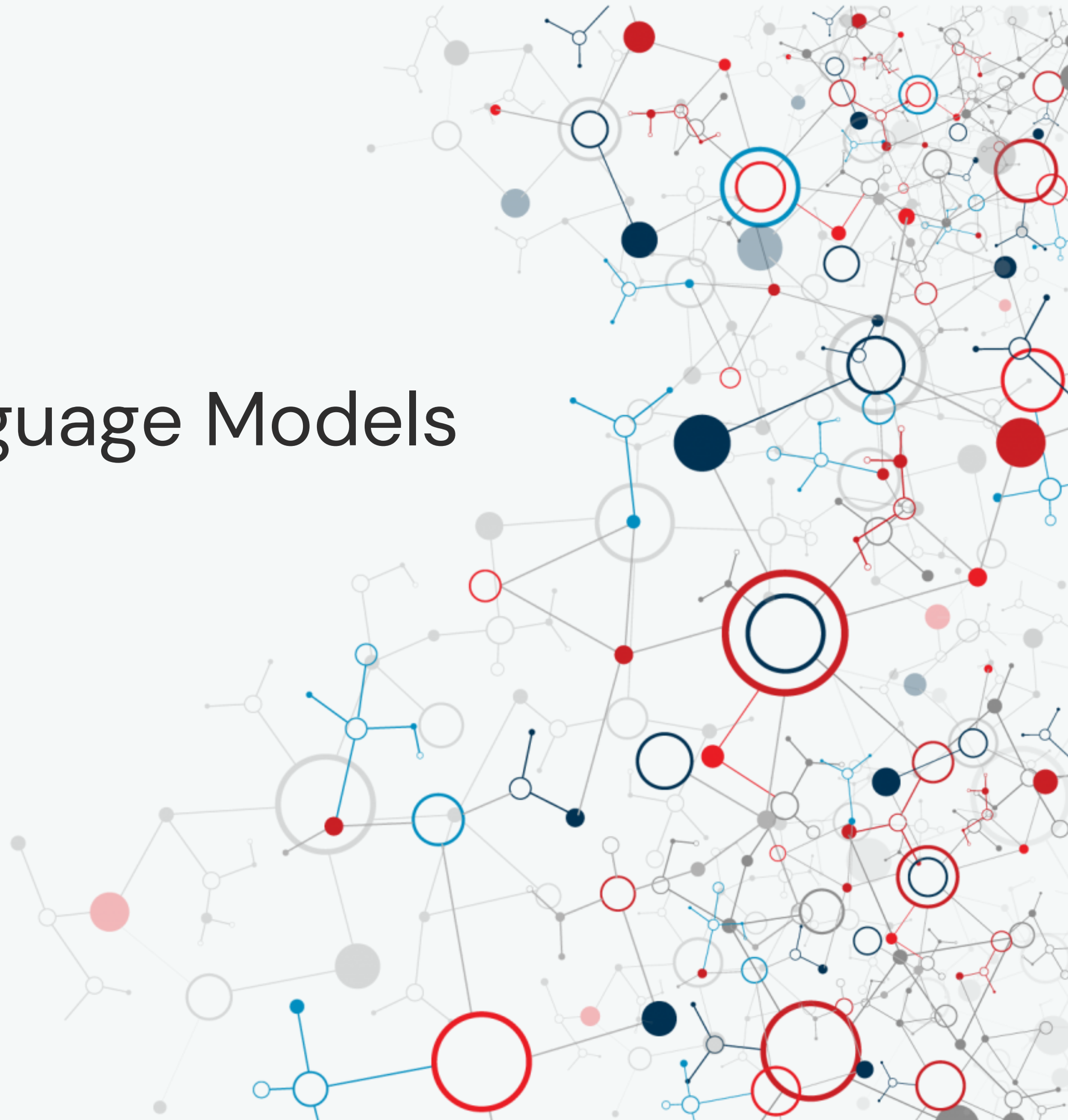
GPT-3

Codex

GitHub Copilot

GDSC

Łukasz Zalewski



TECH NEWS

What are large language models (LLMs), why have they become controversial?

(TECHNOLOGY) Large language models guide our AI training and recently, ethicists have pointed out serious flaws in LLMs (which cost some their jobs).



Published on August 30, 2021

By **Jack Lloyd**, Staff Writer

A GPT-3 bot posted comments on Reddit for a week and no one noticed

Under the username /u/thegentlemetre, the bot was interacting with people on /r/AskReddit, a popular forum for general chat with 30 million users.

A college student used GPT-3 to write fake blog posts and ended up at the top of Hacker News

He says he wanted to prove the AI could pass as a human writer

Agenda

1. What are Large Language Models
2. What is GPT-3
3. The art of prompt engineering
4. How can GPT-3 be useful for you
5. Fun with GPT-3 semantic search
6. What is Codex
7. Coding with GitHub Copilot



What Are **Large Language Models**

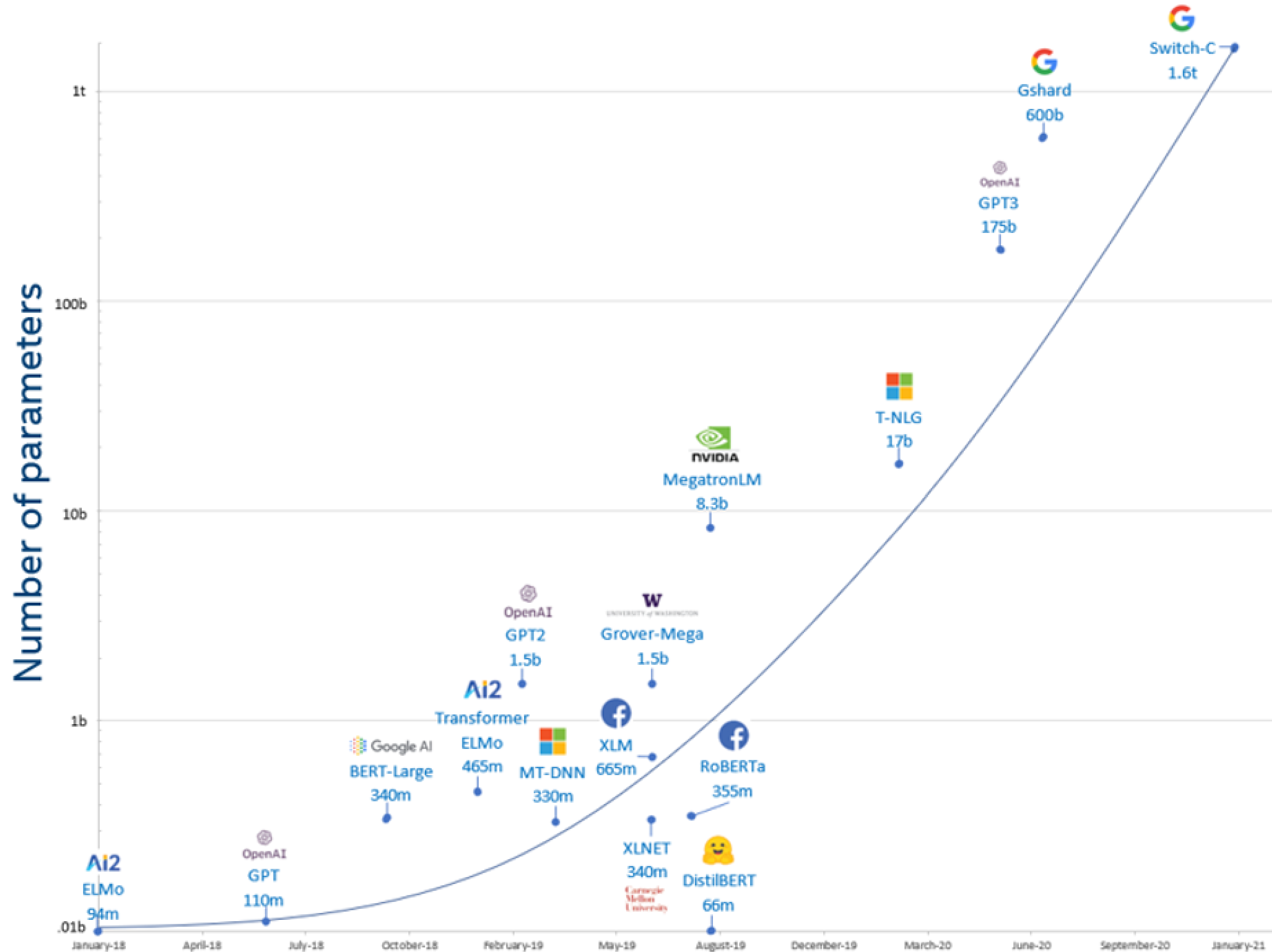
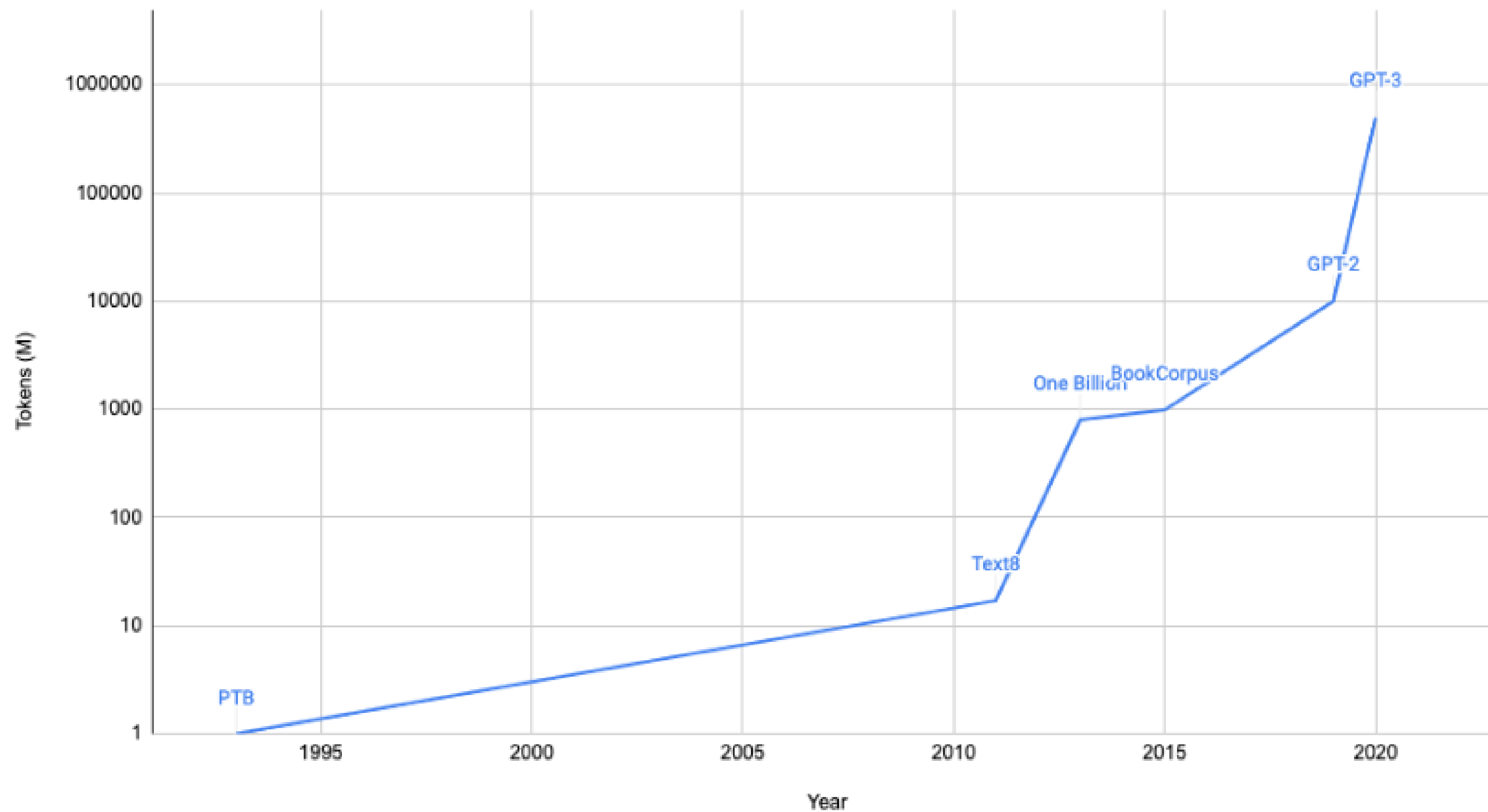


Figure 1: Exponential growth of number of parameters in DL models

Language model datasets over time (log scale)



GPT-3

Trained on ~45TB of internet text data.

Training on a single GPU would take ~300 years.

Has only one objective: predict the next word given previous words.

Used in 200+ production-ready software.

Model is cloused-source (but can be used by firing to the API).

Prompt

The following is a list of companies and the categories they fall into

Facebook: Social media, Technology

LinkedIn: Social media, Technology, Enterprise, Careers

Uber: Transportation, Technology, Marketplace

Unilever: Conglomerate, Consumer Goods

McDonalds: Food, Fast Food, Logistics, Restaurants

FedEx:

Sample response

Logistics, Transportation

**You can try solving any problem that can be
framed in a form of a text!**

Examples

Prompt

This is a tweet sentiment classifier

Tweet: "I loved the new Batman movie!"

Sentiment: Positive

###

Tweet: "I hate it when my phone battery dies."

Sentiment: Negative

###

Tweet: "My day has been 👍"

Sentiment: Positive

###

Tweet: "This is the link to the article"

Sentiment: Neutral

###

Tweet: "This new music video blew my mind"

Sentiment:

Sample response

Positive

Prompt

There are many fruits that were found on the recently discovered planet Gooocrux. There are neoskizzles that grow there, which are purple and taste like candy. There are also loheckles, which are a grayish blue fruit and are very tart, a little bit like a lemon. Pounits are a bright green color and are more savory than sweet. There are also plenty of loopnovas which are a neon pink flavor and taste like cotton candy. Finally, there are fruits called glowls, which have a very sour and bitter taste which is acidic and caustic, and a pale orange tinge to them.

Please make a table summarizing the fruits from Gooocrux

Fruit	Color	Flavor
Neoskizzles	Purple	Sweet
Loheckles	Grayish blue	Tart

Sample response

Pounits	Bright green	Savory
Loopnovas	Neon pink	Cotton candy
Glowls	Pale orange	Sour
Other		

Prompt

My second grader asked me what this passage means:

.....

Jupiter is the fifth planet from the Sun and the largest in the Solar System. It is a gas giant with a mass one-thousandth that of the Sun, but two-and-a-half times that of all the other planets in the Solar System combined. Jupiter is one of the brightest objects visible to the naked eye in the night sky, and has been known to ancient civilizations since before recorded history. It is named after the Roman god Jupiter. [19] When viewed from Earth, Jupiter can be bright enough for its reflected light to cast visible shadows,[20] and is on average the third-brightest natural object in the night sky after the Moon and Venus.

.....

I rephrased it for him, in plain language a second grader can understand:

.....

Sample response

Jupiter is a huge planet made of gas. It is the fifth planet from the sun. It is very big and bright. It is the third brightest object in the night sky after the moon and Venus. Jupiter has many moons. One of the moons is bigger than the planet Mercury.

Prompt

Convert my short hand into a first-hand account of the meeting:

Tom: Profits up 50%

Jane: New servers are online

Kjel: Need more time to fix software

Jane: Happy to help

Parkman: Beta testing almost done

Summary:

Sample response

Profits are up, Jane's new servers are online, Kjel needs more time to fix software, and Parkman's beta testing is almost done.

Prompt

Topic: Breakfast

Two-Sentence Horror Story: He always stops crying when I pour the milk on his cereal. I just have to remember not to let him see his face on the carton.

###

Topic: Wind

Two-Sentence Horror Story:

Sample response

I've never seen the wind before. I just know that it's out there, and it's coming for me.

There's a selection bias in the internet.

90% of the times it's not working. People only show when it does work.

Like all deep learning systems, GPT-3 looks for patterns in data.

It has been trained on a huge corpus of text that it's mined for statistical regularities.

These regularities are stored as billions of weighted connections between the different nodes in GPT-3's neural network.

What Is **Prompt Engineering**

Demo Time

<https://openai.com/api/>



How to Write a **Good Prompt**

The secret to writing good prompts is **understanding what GPT-3 knows about the world** and how to get it to use that information to generate a useful result.





Wrong Answer = **Wrong Question**

If you don't get the output you were expecting it's because GPT-3 thought you were asking it to predict something different.





Keep It **Simple!**

When you're trying to create a prompt to get GPT-3 to perform a task, think very clearly about what is the **minimum amount of information** you need to tell it about what it should do.



Task



Build a prompt, which will output a poem on...?

Task



Build a prompt, which can classify whether the sentences are logically correct or incorrect.

Use this in prompt:

Dogs are a type of plant.

Generally, a roof is above a floor.

The sky on Earth is usually blue.

To classify this:

A chicken can fly across the whole ocean.

Elephants often swim in the sea.

A human hand typically has 5 fingers.

A human hand typically has 6 fingers.

Example Trick

Some people have some success forcing GPT to “think a bit more” by not only asking for an answer, but also asking it to justify its answer.

Classify each sentence as logically correct or incorrect.

Sentence: Dogs are a type of plant.

Analysis: Dogs are animals, not plants.

Result: Incorrect

Sentence: Generally, a roof is above a floor.

Analysis: Ignoring oddly-structured buildings, roofs go above floors.

Result: Correct

Sentence: The sky on Earth is blue.

Analysis: Due to Rayleigh scattering, the sky on Earth appears blue.

Result: Correct

Sentence: Some dogs are smaller than cats.

Analysis:

Software 1.0 – writing code that does things for us

Software 2.0 – training models that do things for us

Software 3.0 – querying large models to do things for us

GPT-3 Architecture Limit
Input + output < ~1500 words

You: "Neglect air resistance, and also neglect gravity. Pretend gravity doesn't exist. Suppose I shoot a bullet straight into the sky. Where does the bullet go?"

Hawking: "It keeps going up, and never comes back."

You: "Right. Let's think about a different version of the same problem. Neglect only air resistance, but include gravity in your reasoning. Suppose I shoot a bullet straight into the sky. Where does the bullet go?"

Hawking: "It falls to the ground."

You: "Why?"

Hawking: "Because... gravity... duh."



*Can it
reason?*

How can I use Large Language Models?

Examples

An addon that allows you to select a text and simplify it.

Automatic extraction of hashtags for posts on your website.

Simple search engine for your website that understands the queries.

A discord bot for your server!

Hundreds of products use OpenAI API, explore them here:

<https://gpt3demo.com/map>

Two Usage Approaches

~~0~~

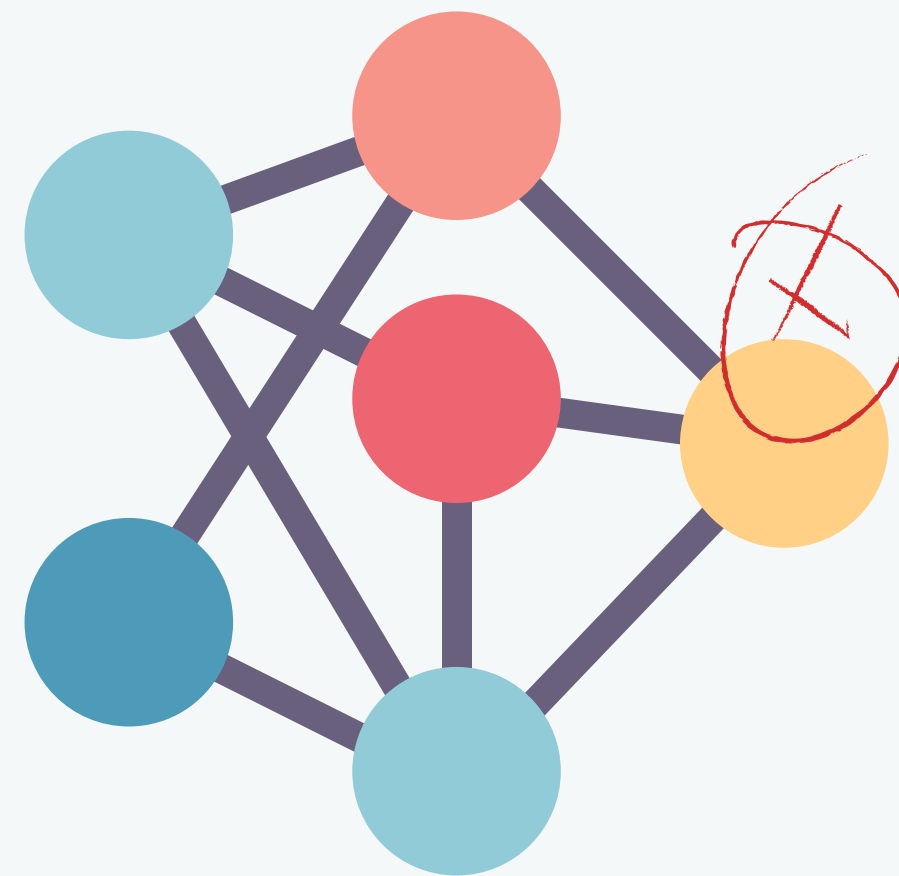
Through **Prompt Engineering**

Simply write a prompt.

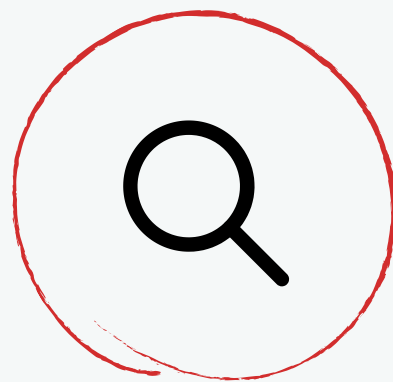


Through **Fine-tuning**

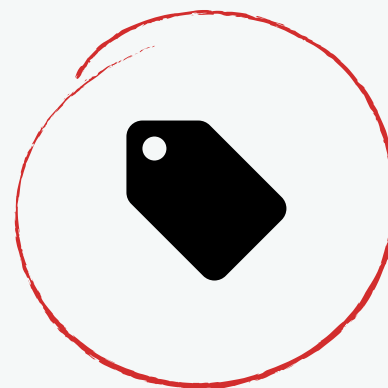
Train GPT on small-scale dataset.



OpenAI API Endpoints



Semantic Search



Text Classification



Question Answering



Semantic Search

Query
This can be any text!



Code Generation

CODEx & GITHUB COPILOT

What is **Codex**?

Basically GPT-3, but model is smaller and trained on code.

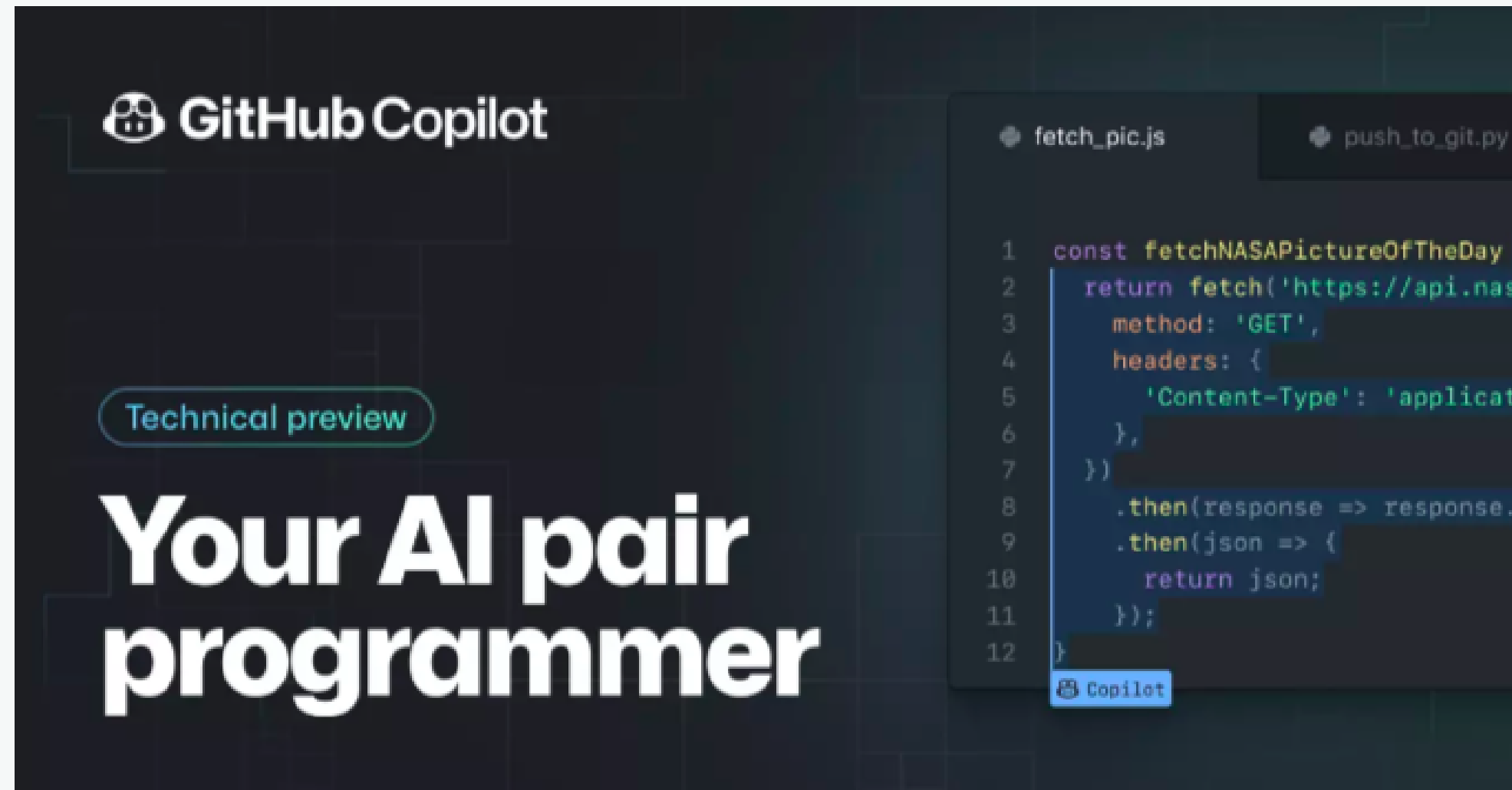
<https://beta.openai.com/codex-waitlist>

- Same architecture as GPT
- Currently biggest version has 12 billions parameters (GPT-3 has 175 billions)
- First trained on internet text (just like GPT)
- After being trained on text, it was additionally trained on github code
- Has more rich vocabulary which encodes whitespaces better
- Currently supports 12 programming languages

Demo Time

<https://beta.openai.com/codex-javascript-sandbox>

<https://copilot.github.com>



GitHub Copilot • Your AI pair programmer

GitHub Copilot works alongside you directly in your editor, suggesting whole lines or entire functions for you.

 GitHub Copilot

NEWS

Will AI Replace Developers? GitHub Copilot Revives Existential Threat Angst

f in t

DEVELOPMENT / MACHINE LEARNING

GitHub Copilot: A Powerful, Controversial Autocomplete for Developers

1 Jul 2021 9:54am, by Darryl K. Taft

Technical preview

Your AI pair programmer

Prompt

```
# Python 3
def remove_common_prefix(x, prefix, ws_prefix):
    x["completion"] = x["completion"].str[len(prefix) :]
    if ws_prefix:
        # keep the single whitespace as prefix
        x["completion"] = " " + x["completion"]
    return x

# Explanation of what the code does

#
```

Sample response

The code above is a function that takes a dataframe and a prefix as input and returns a dataframe with the prefix removed from the completion column.

Prompt

Create a SQL request to find all users who live in California and have over 1000 credits:

SELECT

Sample response

* FROM users WHERE state = 'CA' AND credits > 1000



Natural language to OpenAI API

Create code to call to the OpenAI API usin...



Natural language to Stripe API

Create code to call the Stripe API using nat...



SQL translate

Translate natural language to SQL queries.



Python to natural language

Explain a piece of Python code in human un...



Calculate Time Complexity

Find the time complexity of a function.



Translate programming languages

Translate from one programming language ...



Explain code

Explain a complicated piece of code.



Python bug fixer

Find and fix bugs in source code.



JavaScript helper chatbot

Message-style bot that answers JavaScript ...



JavaScript to Python

Convert simple JavaScript expressions into ...



Write a Python docstring

An example of how to create a docstring for ...



JavaScript one line function

Turn a JavaScript function into a one liner.

When are Codex & Copilot useful?

- Basic boilerplate code
- Writing tests
- Using standard libraries
- Writing simple things which there are lots of examples on the internet (e.g. there's lots of examples of 2D games in javascript on github, so it's not surprising the model is good at it)
- It's good at boring parts of the code! (like creating all SQL statements for a particular datamodel or getters and setters in java)
- Terminal commands in natural language

Image2text & Text2image

CLIP

television studio (90.2%) Ranked 1 out of 397



✓ a photo of a **television studio**.

✗ a photo of a **podium indoor**.

✗ a photo of a **conference room**.

✗ a photo of a **lecture room**.

✗ a photo of a **control room**.

DALLE

TEXT PROMPT

an armchair in the shape of an avocado. . . .

AI-GENERATED
IMAGES



[Edit prompt or view more images ↓](#)

TEXT PROMPT

a store front that has the word 'openai' written on it. . . .

AI-GENERATED
IMAGES

