GPT-3

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Language Models are Few-Shot Learners

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OpenAI

https://openai.com/

Q: What is Q life expectancy in the United States?
A: Q life expectancy in the United States is 78 years.

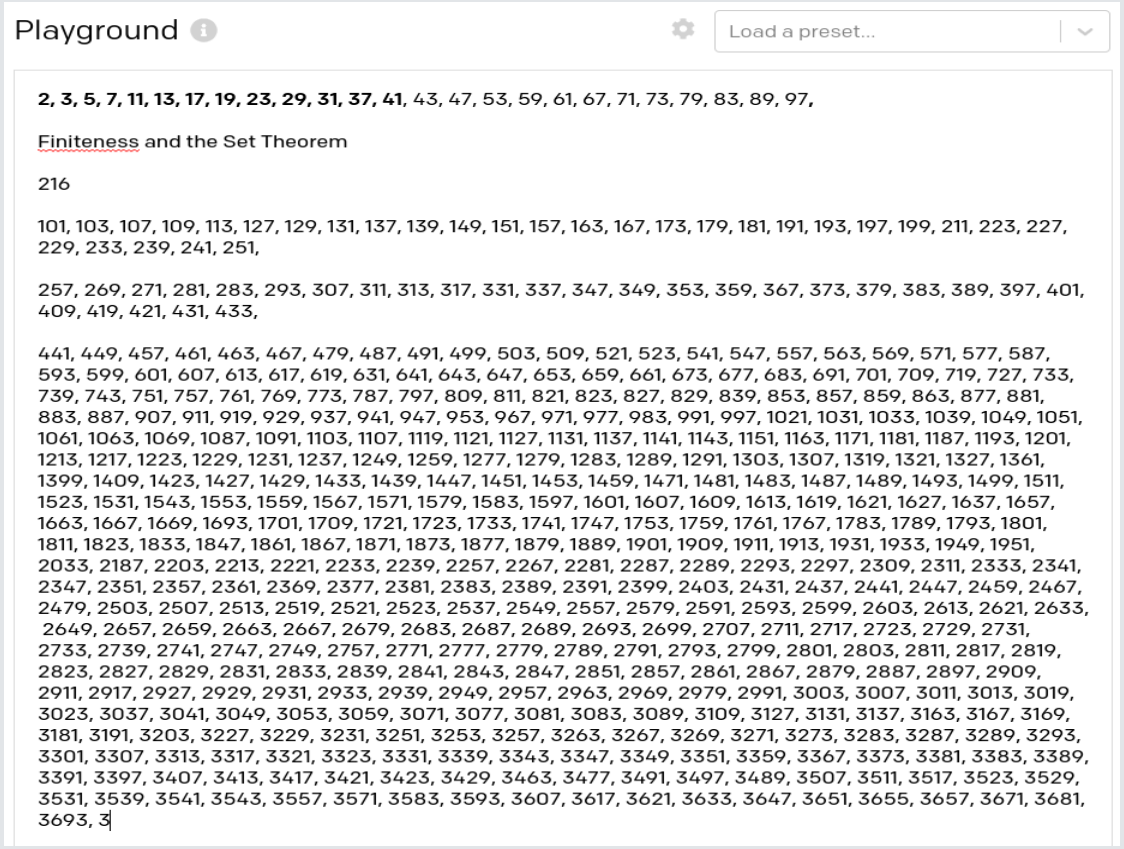
Q: Who was president of the United States in 1955?
A: Dwight D. Eisenhower was president of the United States in 1955.

Q: What party did he belong to?
A: He belonged to the Republican Party.

Q: Who was president of the United States before George W. Bush?
A: Bill Clinton was president of the United States before George W. Bush.

Q: Who won the World Series in 1995?
A: The Atlanta Braves won the World Series in 1995.

Q&A



Prime number generation

https://beta.openai.com/

Neural Machine Translation (NMT) Modeling

RNN

- Ability to remember the last output
- Can't remember long term
- Predict the next char of a word from last char

LSTM

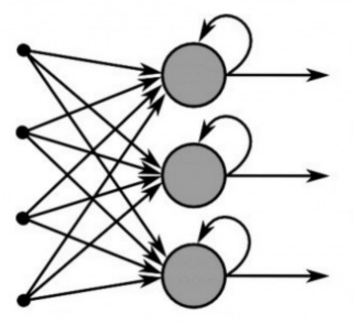
- Ability to forget/ reset
- Retain context by longer range
- Predict the next char of a word from last 2-3 chars

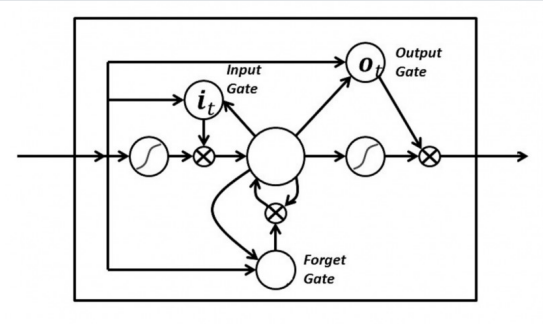
Transformer

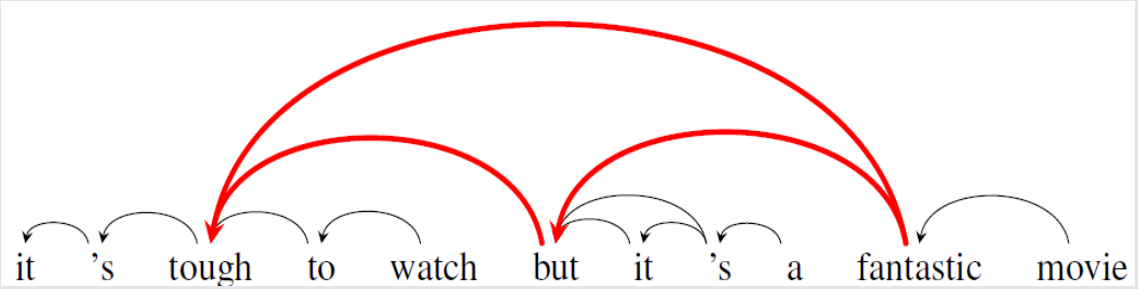
- Attention-based
- Encoder-Decoder model
- In-context learning using positional encoding

GPT

- Task-agnostic
- Few shot learning

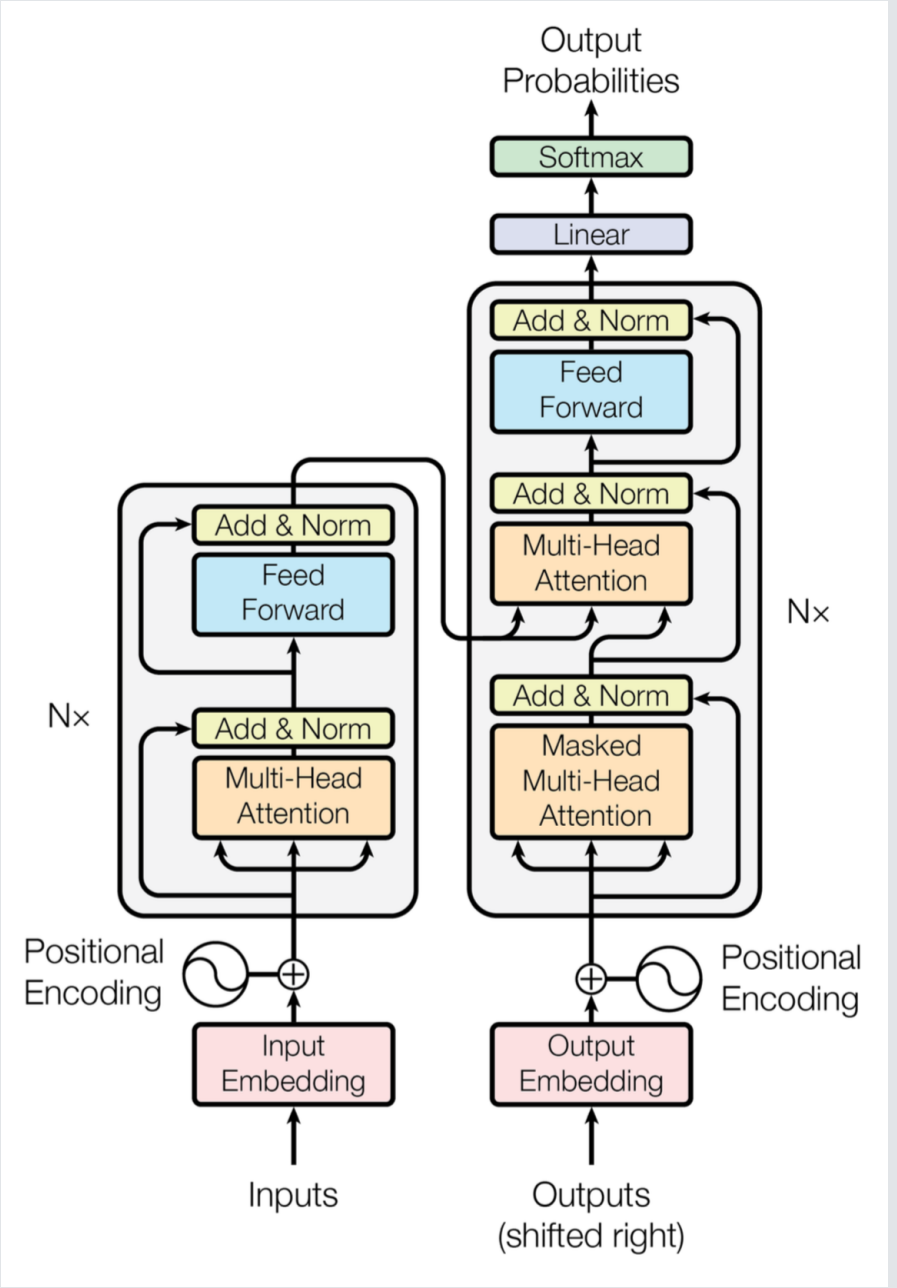




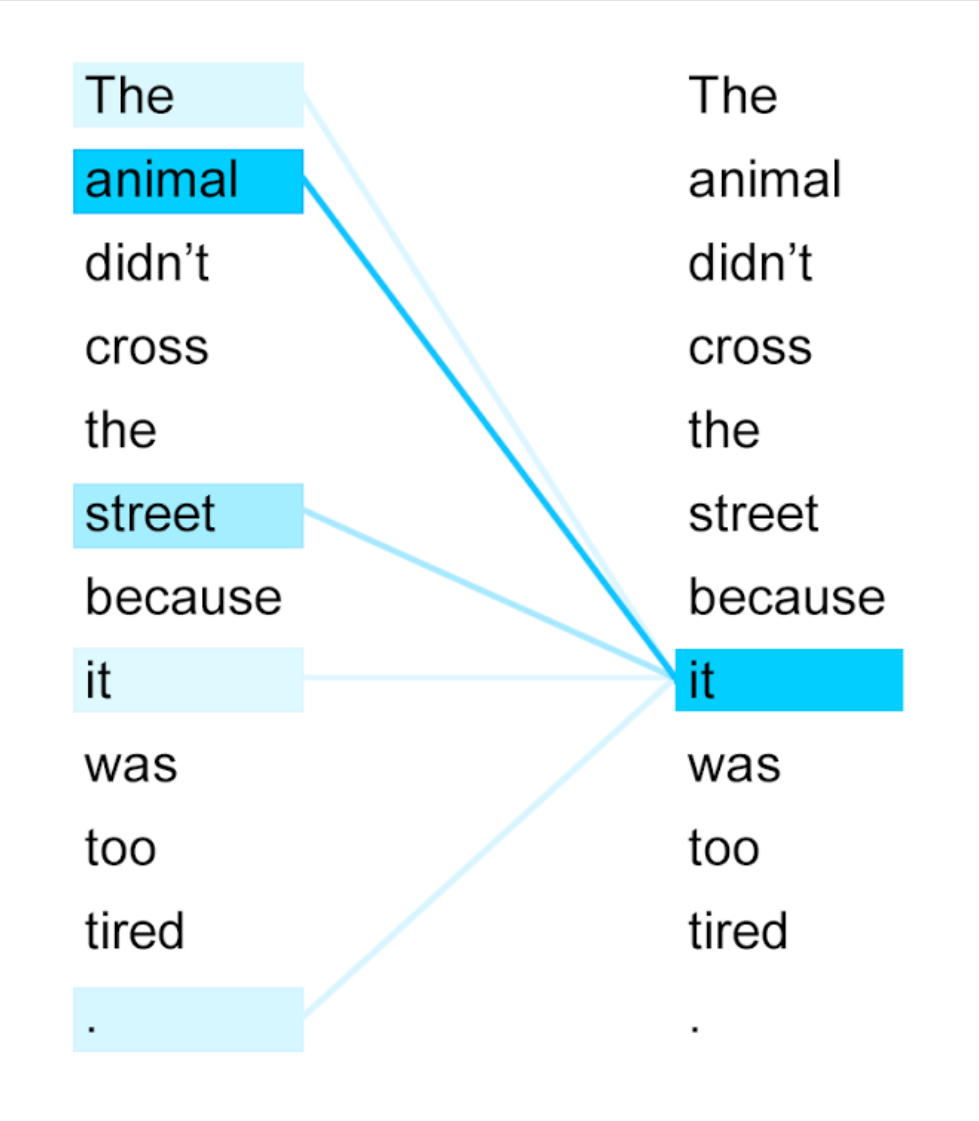


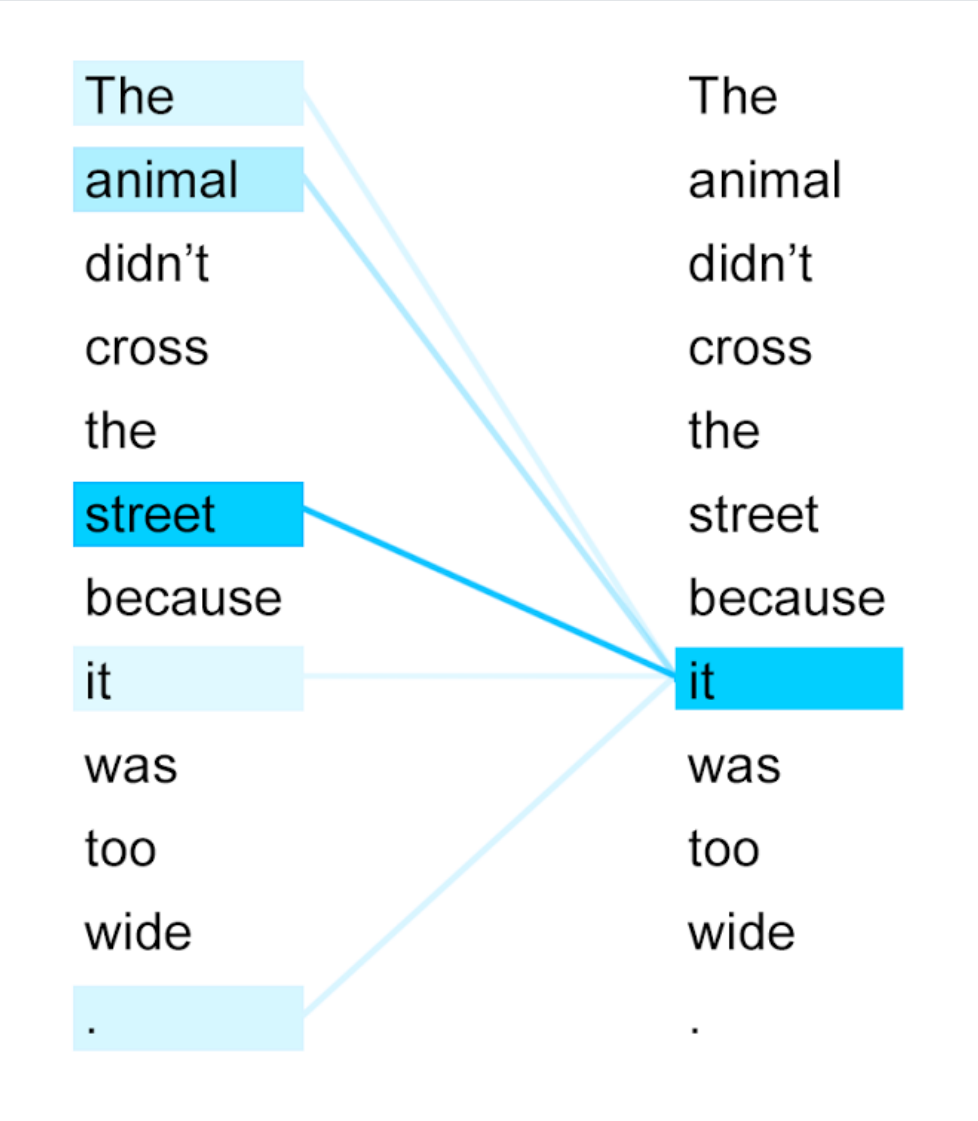
Transformer

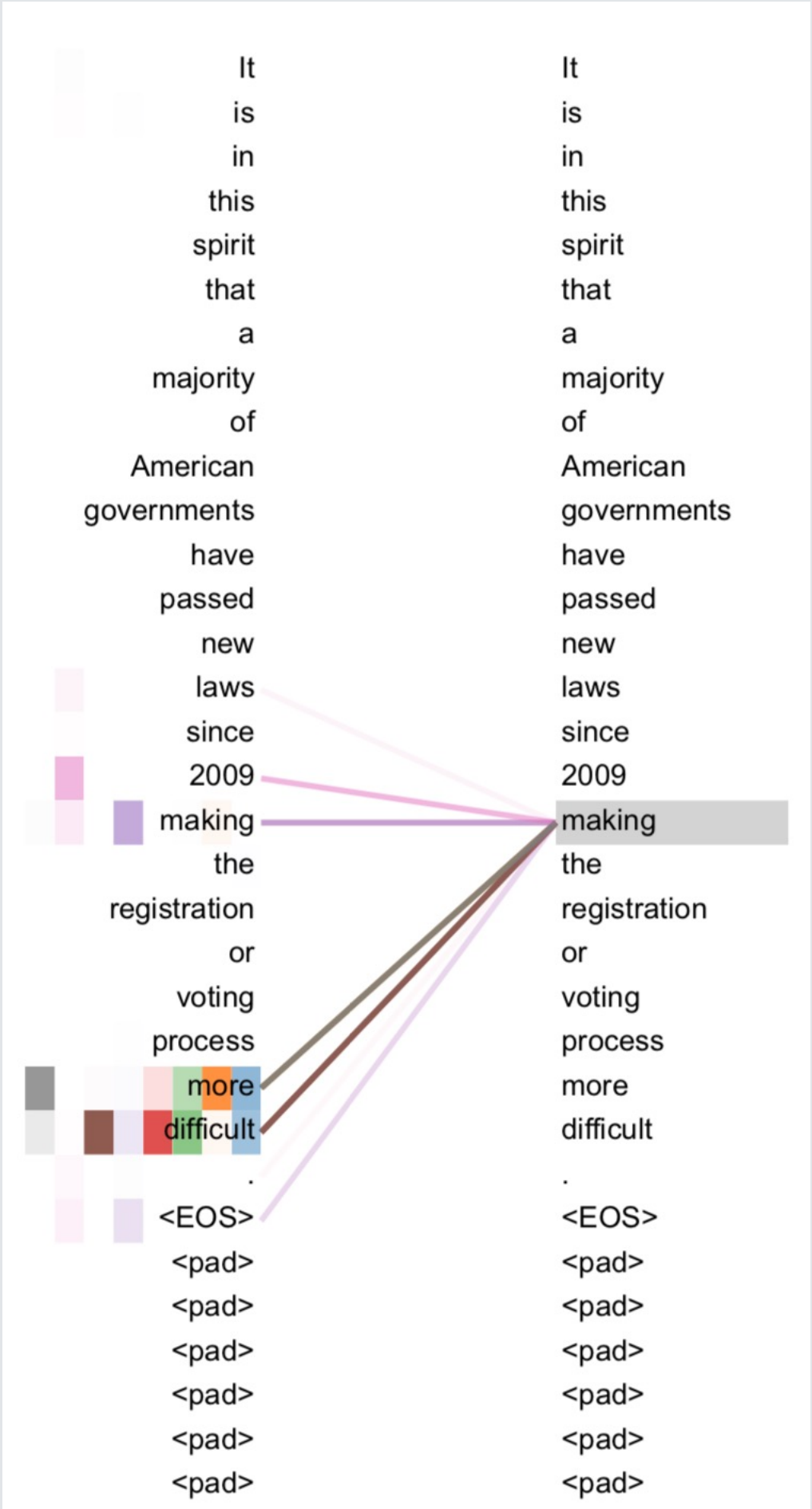
- Not an RNN
- Input – a sentence
- Output – a translated sentence, a summarization, etc.
- Encoder – Map a sentence into high dimensional vector +significant keywords for context
- Decoder – Turn into output
- Attention - Attention allows the model to focus on the relevant parts of the input sequence as needed.
- Self – Attention - As the model processes each word (each position in the input sequence), self attention allows it to look at other positions in the input sequence for clues that can help lead to a better encoding for this word.



Coreference Resolution



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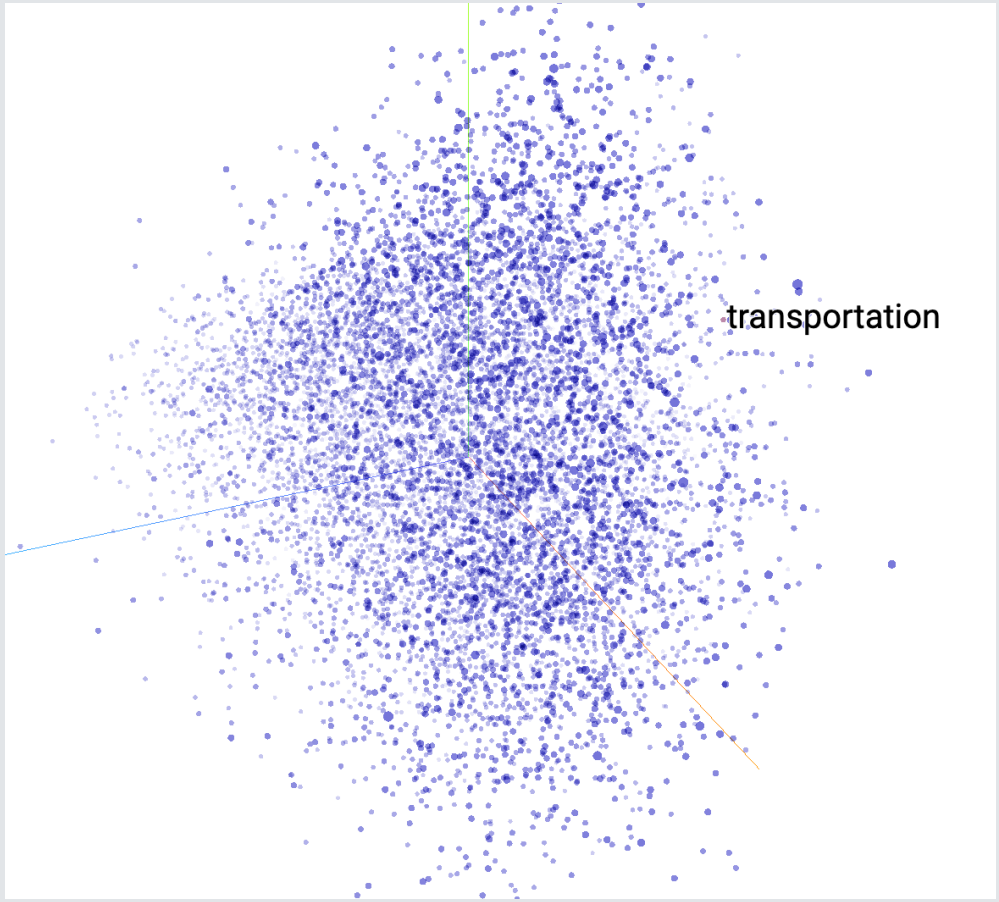
GPT-3

- Generative Pre-trained Transformer
- NLP Autoregressive model
- 175 billion hyper parameters to tune
- 24 NLP datasets
  - Common Crawl (A trillion words from internet)
  - Wikipedia
  - Books
- 5000 petaflop/s-days of compute during pre-training

GPT-3

- Generative model
- Pre-training
  - For broad set of skills like pattern recognition, etc.
  - Initialized hyper parameters rather than random
- Inference >> Fine tuning



Word Embedding (Pre training)

Zero-shot

The model predicts the answer given only a natural language description of the task. No gradient updates are performed.

```
Translate English to French:    ← task description
cheese =>                       ← prompt
```

One-shot

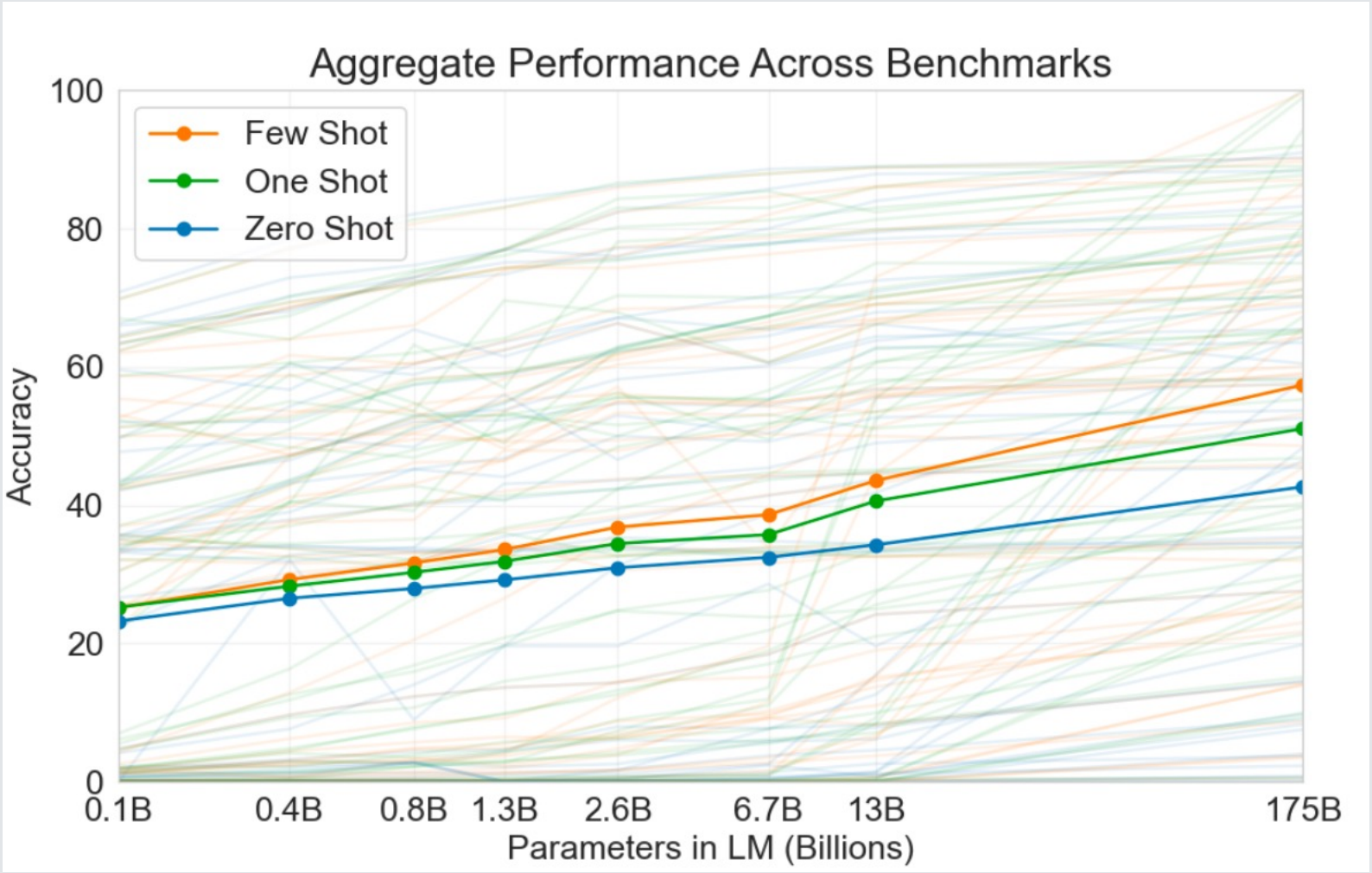
In addition to the task description, the model sees a single example of the task. No gradient updates are performed.

```
Translate English to French:    ← task description
sea otter => loutre de mer      ← example
cheese =>                       ← prompt
```

Few-shot

In addition to the task description, the model sees a few examples of the task. No gradient updates are performed.

```
Translate English to French:    ← task description
sea otter => loutre de mer      ← examples
peppermint => menthe poivrée
plush girafe => girafe peluche
cheese =>                       ← prompt
```


Aggregate Performance Across Benchmarks
Few Shot
One Shot
Zero Shot
Accuracy
100
80
60
40
20
0
0.1B
0.4B
0.8B
1.3B
2.6B
6.7B
13B
175B
Parameters in LM (Billions)

Q & A

Q: How many eyes does a giraffe have?
A: A giraffe has two eyes.

Q: How many eyes does my foot have?
A: Your foot has two eyes.

Q: How many eyes does a spider have?
A: A spider has eight eyes.

Q: How many eyes does the sun have?
A: The sun has one eye.

Q: How many eyes does a blade of grass have?
A: A blade of grass has one eye.

Common Sense

Q: What is your favorite animal?
A: My favorite animal is a dog.

Q: Why?
A: Because dogs are loyal and friendly.

Q: What are two reasons that a dog might be in a bad mood?
A: Two reasons that a dog might be in a bad mood are if it is hungry or if it is hot.

Q: How many legs does a frog have?
A: A frog has four legs.

Q: Are there any animals with three legs?
A: No, there are no animals with three legs.

Q: Why don't animals have three legs?
A: Animals don't have three legs because they would fall over.

Trivia Questions

Q: Who was president of the United States in 1801?
A: Thomas Jefferson was president of the United States in 1801.

Q: What city is in the northwest corner of Ohio?
A: Toledo is in the northwest corner of Ohio.

Q: What highway do you take to get to North Lake Tahoe from Oakland?
A: Highway 80 is the highway you take to get to North Lake Tahoe from Oakland.

Q: What are Darius's abilities in League of Legends?
A: Darius's abilities in League of Legends are: Apprehend, Decimate, Noxian Guillotine, Crippling Strike, Apprehend, and Hemorrhage.

Q: Who did Capablanca defeat to become world chess champion?
A: Capablanca defeated Lasker to become world chess champion.

Logic

Q: When counting, what number comes before 100?
A: Ninety-nine comes before 100.

Q: When counting, what number comes before 123?
A: One hundred and twenty-two comes before 123.

Q: When counting, what number comes before 1000?
A: Nine hundred and ninety-nine comes before 1000.

Q: When counting, what number comes before 10,000?
A: Nine thousand and ninety-nine comes before 10,000.

Q: When counting, what number comes before a million?
A: Nine hundred thousand and ninety-nine comes before a million.

Programming

Q: Write one line of Ruby code to reverse an array.
A: ary.reverse

Q: Write one line of Ruby code to count how many X's are in an array.
A: ary.count { |x| x == 'X' }

Q: Reverse the following array: [1, 3, 5, 6, 10, 4, 2, 77]
A: [10, 6, 4, 2, 77, 3, 5, 1]

Q: How many X's are in this array: [1, 3, 5, 6, 10, 4, 2, 77]
A: 2

Reasoning

Q: If I have a marble and a paper clip in a box, put a pencil in the box, and remove the marble, what is left?
A: A paper clip.

Q: If I have two shoes in a box, put a pencil in the box, and remove one shoe, what is left?
A: A shoe.

Q: If I put a pencil in a box, then put another pencil in the box, what is in the box?
A: Two pencils.

Q: Then if I take out a pencil and put in a frog, what is in the box?
A: A frog.

Open AI – Text Generation

```
import openai

prompt = """We're releasing an API for accessing new AI
models developed by OpenAI. Unlike most AI systems
which are designed for one use-case, the API today
provides a general-purpose "text in, text out"
interface, allowing users to try it on virtually any
English language task. You can now request access in
order to integrate the API into your product, develop
an entirely new application, or help us explore the
strengths and limits of this technology."""

response = openai.Completion.create(model="davinci",
prompt=prompt, stop="\n", temperature=0.9,
```

users to try it on virtually any English language task. You can now request access in order to integrate the API into your product, develop an entirely new application, or help us explore the strengths and limits of this technology. **The road to making AI safe and useful is long and challenging, but with the support of the developer community we expect to get there much faster than working alone.**

Open AI - Speech to Bash

```
Input: Replace foo with bar in all .py files
Output: sed -i .bak -- 's/foo/bar/g' *.py
Input: Delete the models subdirectory
Output: rm -rf ./models
Input: Firewall all incoming connections to port 22 on
this machine.
Output:"""

response = openai.Completion.create(model="davinci",
prompt=prompt, stop="Input:", temperature=0,
max_tokens=300)

print(response)
```

Input: Firewall all incoming connections to port 22 on this machine.

Output: **iptables -A INPUT -p tcp --dport 22 -j DROP**