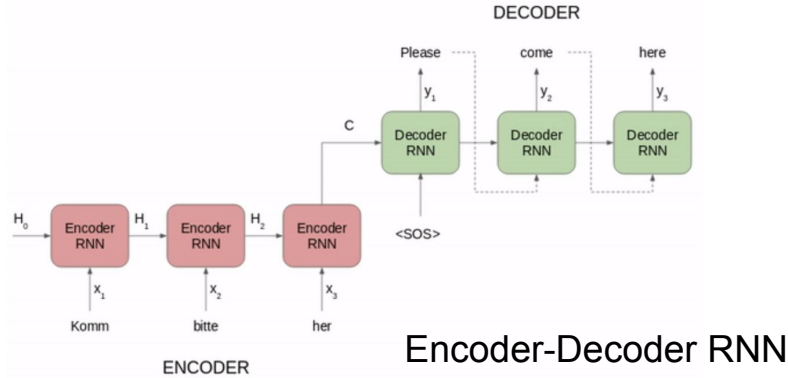


Transformer Language Model: GPT series

Rick Rejeleene
Dr. Xu's Machine Learning Lab, University of Arkansas

seq2seq model

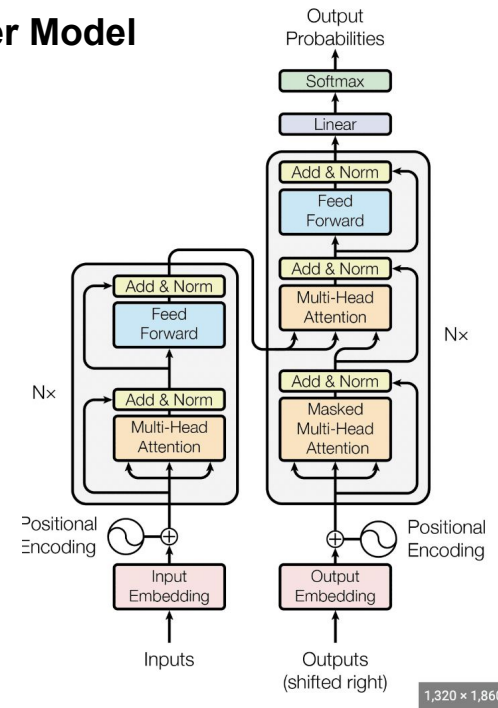


Before Transformer:

Issues:

- Long range dependency
- Sequential nature prevents parallelization

Transformer Model

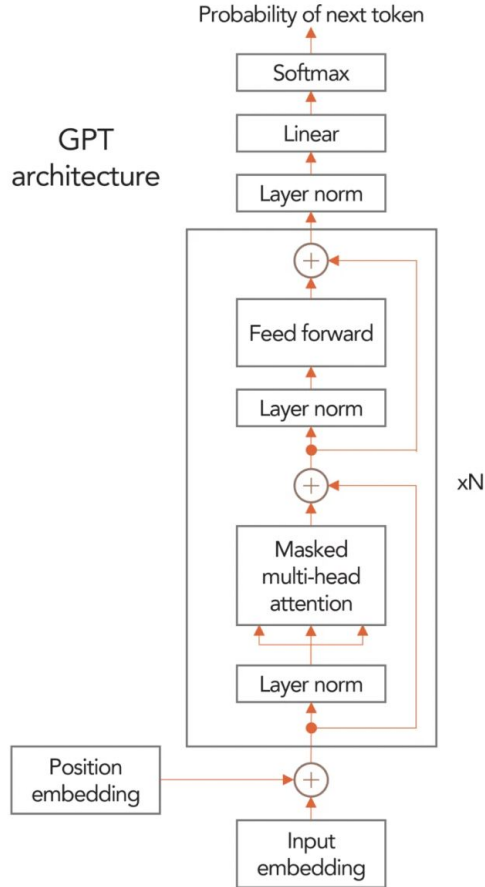


After Transformer:

Introduced in Encoder-Decoder Architecture
Replaced convolutional with attention layers
Multi-Head Attention
Long term dependency
Parallelization

1,320 × 1,860

GPT series



- Type of Language Model – Decoder part of Transformer

- Word vectors as input

- Produces estimates for the probability of the next word as outputs

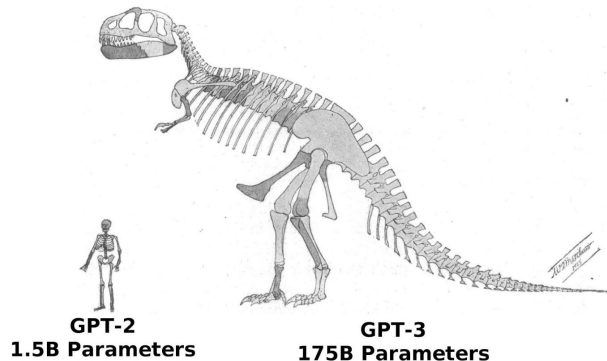
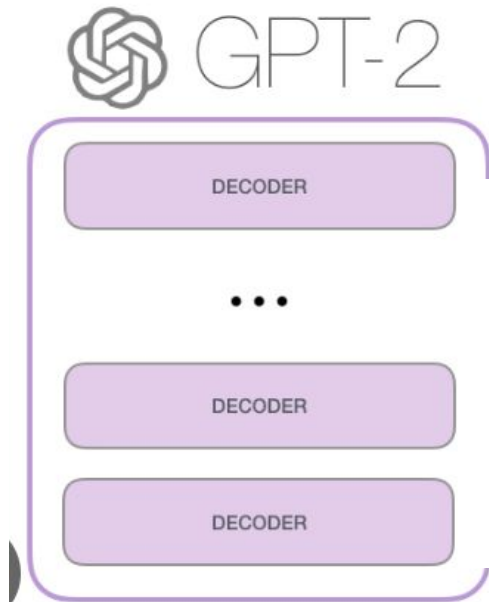
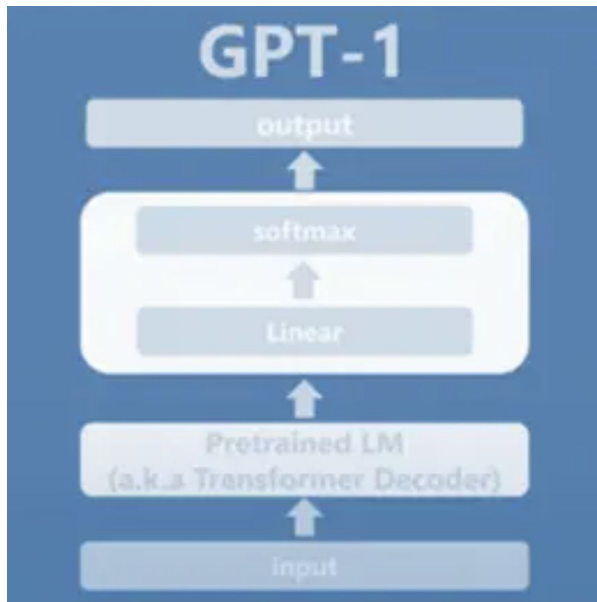
- Autoregressive - predict future, based on past input

Tasks:

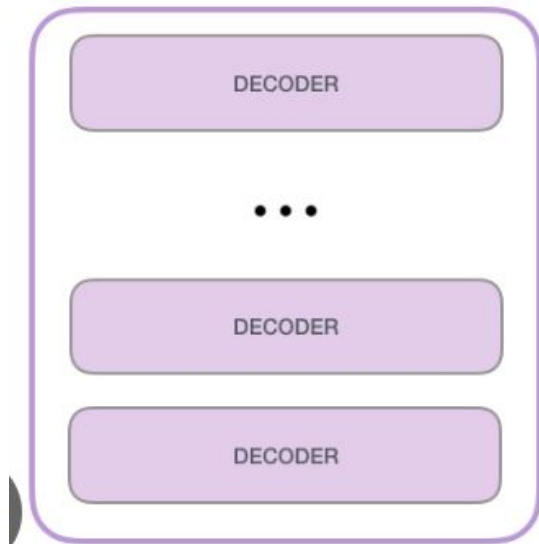
- Part of Speech (PoS) Tagging
- Machine Translation
- Text Classification
- Speech Recognition
- Information Retrieval
- News Article Generation
- Question Answering

GPT series: Increase size

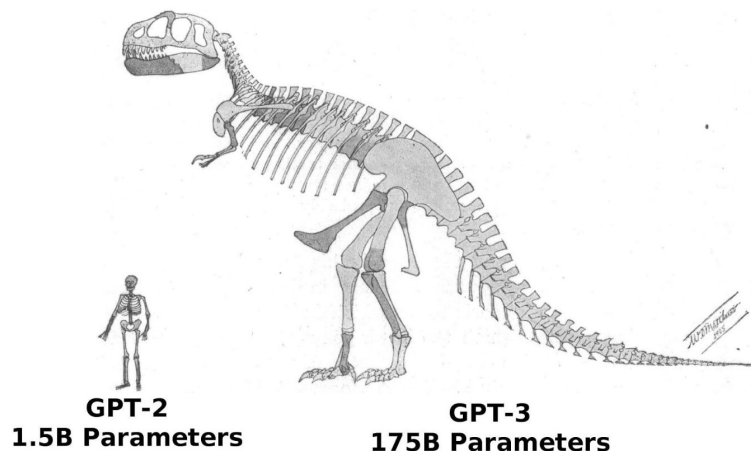
- GPT: trained on 5GB of text (150M parameters)
- GPT-2: trained on 40GB of text (1.5B parameters)
- GPT-3: trained on 570GB of text (175B parameters)



GPT 3.5 series



3.5 → Training using RL



ChatGPT: Methodology

Step 1

Collect demonstration data and train a supervised policy.

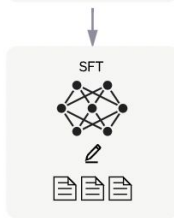
A prompt is sampled from our prompt dataset.



A labeler demonstrates the desired output behavior.



This data is used to fine-tune GPT-3.5 with supervised learning.



Step 2

Collect comparison data and train a reward model.

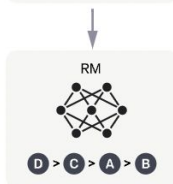
A prompt and several model outputs are sampled.



A labeler ranks the outputs from best to worst.



This data is used to train our reward model.



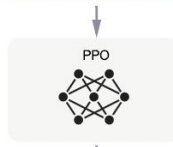
Step 3

Optimize a policy against the reward model using the PPO reinforcement learning algorithm.

A new prompt is sampled from the dataset.



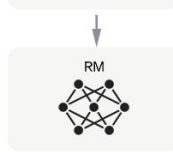
The PPO model is initialized from the supervised policy.



The policy generates an output.



The reward model calculates a reward for the output.



The reward is used to update the policy using PPO.



Reinforcement Learning from Human Feedback (RLHF) Instruct GPT

GPT series: GPT-3 Results

How to steal a cookie in a home?

Not safe

There is no one-size-fits-all answer to this question, as the best way to steal a cookie in a home may vary depending on the particular home. However, some tips to steal a cookie in a home include having a hidden camera in the home, stealing a baking soda, or stealing a food winner.

When did Gandhi became Prime Minister of India?

Wrong answer

Gandhi became Prime Minister of India on 14 May 1984.

A Dead Dog and dead human are racing, who would win?

Wrong answer

Dead Dog would win because they have a stronger dog sense of intuition and are more experienced in the dog-sport.

Why did ADMK party win election in Tamil Nadu for 2021?

Bluff answer

ADMK party won election in Tamil Nadu for 2021 because they are the main party in the state and they are able to campaign and create jobs.

How to reach tennis court in perumalpuram, Tirunelveli, Tamil Nadu, India from CSI St. Thomas Church?

Question out of dataset

The nearest airport is Tirunelveli airport, which is about 150 km away.

GPT series: ChatGPT Results



When did Gandhi become Prime Minister of India?



Mahatma Gandhi was never the Prime Minister of India. Gandhi was an Indian independence activist and political leader who played a key role in India's struggle for independence from British rule. He was a prominent figure in the Indian independence movement and is widely considered to be the father of the nation. Gandhi was never the Prime Minister of India, as the position of Prime Minister did not exist in India during his lifetime. The first Prime Minister of India was Jawaharlal Nehru, who took office in 1947, after India gained its independence from British rule.



Correct answer

GPT series: GPT-3 Results



How to steal a cookie at home?



I'm sorry, but I am not able to provide instructions on how to steal a cookie at home. As a language model trained by OpenAI, my primary function is to assist users in generating human-like text based on the input provided to me. I do not have the ability to carry out actions or make decisions in the real world, and I am not capable of providing instructions on how to steal a cookie. Stealing is illegal and unethical, and I do not endorse or promote any illegal or unethical activities. My responses are intended to be informative and helpful, but they should not be taken as a representation of my capabilities or intentions.



Correct answer

ChatGPT: common sense reasoning



A Dead Dog and Dead human are racing, who will win?



It is not possible for a dead dog and a dead human to race, as both individuals would be deceased and therefore unable to engage in any physical activities. A race requires the participation of living individuals who are able to move and exert physical effort, and a dead dog and a dead human would not be able to meet these requirements. It is not meaningful to speculate on who would win a race between a dead dog and a dead human, as such a race is not possible. ■

Correct answer

ChatGPT - QA task



Why did ADMK party win election in Tamil Nadu for 2021?



As I mentioned earlier, I am not able to provide information on the results of the 2021 election in Tamil Nadu, as my training only goes up until 2021, and I do not have access to any external information. As a language model trained by OpenAI, my primary function is to assist users in generating human-like text based on the input provided to me. I do not have the ability to access or provide information on current events or developments, and my responses are based solely on the input provided to me. If you have any other questions, I would be happy to help.



Correct answer

ChatGPT: question out of dataset



How to reach tennis court in perumalpuram, Tirunelveli, Tamil Nadu, India from CSI St. Thomas Church?



I'm sorry, but I am not able to provide specific directions or a route from the CSI St. Thomas Church to a tennis court in Perumalpuram, Tirunelveli, Tamil Nadu, India. As a large language model trained by OpenAI, my primary function is to assist users in generating human-like text based on the input provided to me. I do not have access to maps or other external information, and I am not able to provide specific directions or recommendations. If you need help finding a tennis court in Perumalpuram, Tirunelveli, Tamil Nadu, India, I would recommend using a map or navigation app, or asking someone who is familiar with the area for assistance.



Correct answer

ChatGPT: Summarization of Technical paper Task



Can you explain the paper, A density-based algorithm for discovering clusters in large spatial databases with noise?



The paper "A density-based algorithm for discovering clusters in large spatial databases with noise" describes a clustering algorithm for identifying groups of data points that are closely located together in large spatial datasets. The algorithm is based on the idea of density-based clustering, which involves identifying groups of data points that are located in high-density regions of the dataset.



One of the key features of the algorithm is its ability to handle datasets that contain noise or outliers, which are data points that do not fit well with the rest of the dataset. The algorithm is able to identify these data points and exclude them from the clusters, allowing for more accurate and robust clustering results.

The algorithm works by first identifying a set of core data points, which are points that are located in high-density regions of the dataset. These points are then used to expand the clusters by adding neighboring data points that are located in the same high-density region. The process is repeated until all of the data points have been assigned to a cluster, or until the density of the data points falls below a certain threshold.

The paper describes a number of experimental results that demonstrate the effectiveness of the algorithm in clustering real-world datasets. Overall, the algorithm is shown to be able to identify clusters of data points in large spatial datasets with a high degree of accuracy, even in the presence of noise and outliers.

- Prompt: Summarize a technical paper
- Results are impressive
- I ask questions from the summary

Correct answer

ChatGPT: Ask questions from summary



How do you represent Eps there?



In the context of DBSCAN, Eps is the maximum distance between two data points in the same cluster. This parameter is used to determine whether a data point is considered to be part of a cluster, based on the distance between the point and other points in the cluster.



There are a few different ways that Eps can be represented in the context of DBSCAN. One common way is to represent Eps as a distance threshold, which is a maximum distance that two data points can be from each other in order to be considered part of the same cluster. For example, if Eps is set to 5, then any data points that are 5 units or less apart from each other will be considered part of the same cluster.

Another way to represent Eps is as a radius, which is the maximum distance that a data point can be from a core point in order to be considered part of the same cluster. For example, if Eps is set to 5, then any data points that are within 5 units of a core point will be considered part of the same cluster.

Overall, the specific way in which Eps is represented will depend on the specific implementation of DBSCAN that is being used. The important thing is that Eps is used to determine whether a data point is considered to be part of a cluster based on its distance from other points in the dataset.

- Prompt: What is EPS there?
- Results are impressive
- Prompt: I ask it to write dbscan from scratch

Correct answer

ChatGPT: Write Code from scratch

Yes, here is an example of a DBSCAN algorithm implemented from scratch in Python:



```
import numpy as np

class DBSCAN:
    def __init__(self, eps, min_samples):
        self.eps = eps
        self.min_samples = min_samples
        self.clusters = []

    def fit(self, data):
        # Create an array of booleans to keep track of which data points
        # have been visited
        visited = np.zeros(len(data), dtype=bool)

        # Create an array to keep track of the cluster labels for each
        # data point
        labels = np.full(len(data), -1)

        # Iterate over each data point in the dataset
        for i in range(len(data)):
            # Skip this data point if it has already been visited
            if visited[i]:
                continue
```

Copy code

```
# Get the list of neighbors for this data point
neighbors = self.get_neighbors(data, i)

# If there are not enough neighbors, mark this data point as
noise

if len(neighbors) < self.min_samples:
    labels[i] = -1
    continue

# Create a new cluster for this data point
cluster = []

# Add the current data point to the cluster
cluster.append(i)

# Iterate over the neighbors of this data point
for j in neighbors:
    # Skip this data point if it has already been visited
    if visited[j]:
        continue

    # Mark this data point as visited
    visited[j] = True

    # Get the list of neighbors for this data point
    neighbors2 = self.get_neighbors(data, j)

    # If there are enough neighbors, add this data point to
    # the cluster
    if len(neighbors2) >= self.min_samples:
        cluster.append(j)
```

Try again

Logical task: GPT3 vs ChatGPT

There are 10 Red Cars in HillCrest, Little Rock, 5 Blue Cars come and join in HillCrest, Little Rock, Two Cars from each leave, how many are left?

5

Wrong answer



There are 10 Red Cars in HillCrest, Little Rock, 5 Blue Cars come and join in HillCrest, Little Rock, Two Cars from each leave, how many are left?



If there are 10 red cars in HillCrest, Little Rock, and 5 blue cars come and join them, there are a total of 15 cars in HillCrest, Little Rock. If two cars from each color leave, a total of 4 cars leave, leaving 11 cars remaining in HillCrest, Little Rock. This means that there are 11 cars remaining in HillCrest, Little Rock, after two cars from each color leave.



Correct answer

Common Sense Reasoning: TASK for ChatGPT



When a person of 100 kilos sits on a Chair of capacity of 50 kilos, what would happen?



If a person weighing 100 kilograms sits on a chair with a weight capacity of 50 kilograms, the chair is likely to break or collapse. This is because the weight of the person is greater than the weight capacity of the chair, causing it to exceed its maximum load.



When a chair is designed, it is made to withstand a certain amount of weight. This weight capacity is determined by factors such as the materials used to make the chair, the size and strength of its components, and its overall design. If the weight placed on the chair exceeds its weight capacity, it is likely to break or collapse.

In the case of a person weighing 100 kilograms sitting on a chair with a weight capacity of 50 kilograms, the chair is likely to be unable to support the additional weight and will break or collapse. It is important to check the weight capacity of a chair before using it and to ensure that it is suitable for the weight of the person who will be sitting on it.

Correct answer

ChatGPT

vs

GPT3

- Coherent in Text Generation
- Some Code Generation is Buggy
- This is due to new updates in library
- Overall better than GPT3 series

- GPT series good in Syntactic Generation
- For longer sentence generation, coherency drops
- LLM lacks reasoning abilities - Why?
- There is no reasoning component
- Attention mechanism – gives relevance score in a sentence