

# To the West of AI

Joan Orr

[www.joanorr.com/presentations](http://www.joanorr.com/presentations)

From there he moved on to the hill country on the east of Bethel, and pitched his tent, with Bethel on the west and Ai on the east; and there he built an altar to the Lord and invoked the name of the Lord.

*Genesis 12:8*

# What to Expect

1. Artificial Intelligence: Why Do We Care?
2. GenAI: What Is It?
3. History
4. What is (non-Human) Intelligence?
5. Machine Learning
6. Neural Networks
7. Large Language Models (LLMs)
8. Working with GenAI and LLMs
9. Questions and discussion

# Artificial Intelligence: Why Do We Care?

2500 BCE -- 1950's: Mechanical AI

1950's -- present: Electronic digital computers

2020's:

# Artificial Intelligence: Why Do We Care?

2500 BCE -- 1950's: Mechanical AI

1950's -- present: Electronic digital computers

2020's:



# GenAI: What Is It?

**OpenAI** launch **DALL-E** in January 2021

**OpenAI** launch **ChatGPT** in November 2022 and March 2023

*[OpenAI are an SF-based AI company founded in 2015 by Sam Altman and Elon Musk. Originally it was a non-profit but transitioned to "semi" for-profit in 2019, and has been in close partnership with Microsoft since 2023.]*

# GenAI: What Is It?

## DALL-E

- Generates images from text prompts
- Wide variety of styles
- Cartoon to photograph

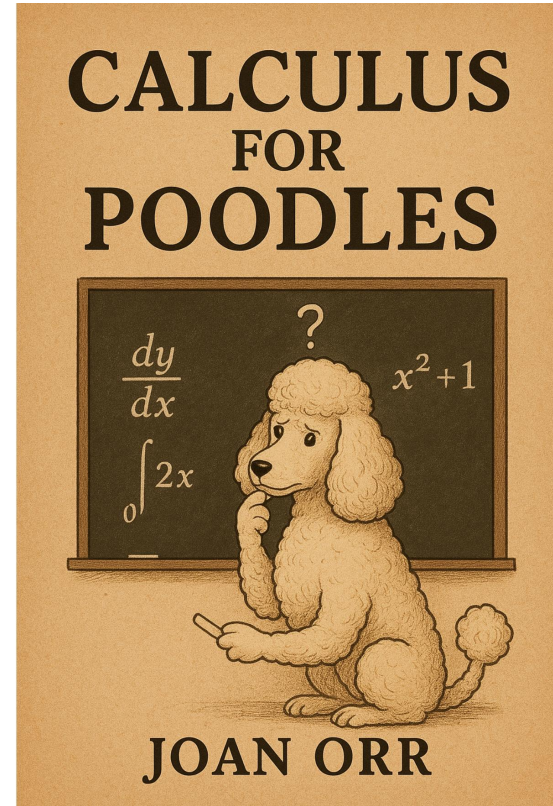
## ChatGPT

- Engages in natural language conversations from text prompts
- Performs reasoning
- Creates text
- Answers questions
- Performs research
- **Large Language Model (LLM)**

# GenAI: What Is It?

Hello. Can you create a front cover for a book titled “calculus for poodles” by “Joan Orr”?

Could you try again please? I would like the cover to show a puzzled poodle working on some calculus problems on a blackboard



# GenAI: What Is It?

List JSON Object Keys with jq

Detecting GCS Fine-Grained ACL Usage

Dark Matter: Gravitational or Weak Interaction?

Can Terraform connect to GCP using a WIF principalSet identity?

Insect Wing Evolution: Multiple Theories

Homologous vs. Analogous Structures Explained

WIF Best Practice: Single Provider Per Pool

Kubernetes Deployment Availability Strategies

Understanding GitHub Gists

Dram's Greek Drachma Origin

World Lines in Special Relativity

Finding 90s Apple "Crowd Control" Ad

A Fish Called Wanda Clip

Greek Words for Madness

Understanding a Lion's Language

Πρόσκληση για Συζήτηση

Kubernetes Secret Injection Methods

Kubernetes Secret Key Reference Explained

# GenAI: What Is It?



## Insect Wing Evolution: Multiple Theories

2.5 Flash



Winged vertebrates such as birds, bats and pterosaurs all developed their wings from their forelegs. What was the evolutionary path for insects to develop wings?



Google Search



The evolutionary path of insect wings is a long-debated topic in biology, with several competing hypotheses. Unlike birds, bats, and pterosaurs, which developed wings from their forelegs, insects are believed to have evolved their wings from structures on their thorax that were not directly derived from legs.

One of the most prominent theories, supported by recent genetic and developmental studies, suggests that insect wings evolved from outgrowths of the legs of an ancestral crustacean. This hypothesis posits that a lobe or "exite" on the legs of a land-dwelling crustacean ancestor moved up onto the insect's back and developed into wings. Another hypothesis, known as the paranotal theory, suggests that wings arose from lateral extensions of the thoracic tergum, or the body wall on the insect's back, which were initially used for gliding. There is also a "dual origin" hypothesis, which suggests that wings evolved from a combination of both a leg-based structure and a body-wall-based structure. While the exact path remains a subject of ongoing research, scientists agree that insect wings



Ask Gemini



Tools



# GenAI: What Is It?

13:40 📶



Dram's Greek Drachma Origin

2.5 Flash



Is the measure of a dram related to the Greek drachma?



Google Search



Yes, the measure of a dram is directly related to the Greek drachma. The word "dram" is derived from the Greek word "drachma," which was an ancient coin and a unit of weight. 🔗 +1

Here's the historical progression:

- **Ancient Greece:** The drachma (Greek: *δραχμή*) was a silver coin and a unit of weight. The name itself is believed to come from the Greek verb "to grasp," and its original value was equivalent to a "handful" of six metal spits or arrows. 🔗 +1

- **Latin and French:** The word was adopted into Latin as "dragma" or "dragme" and then into Old French as "drame" or "dragme." 🔗
- **English:** The term was eventually incorporated into Old English as "dram," where it was used as a unit of weight, particularly in the apothecaries' system (for pharmacists). This is where the association with small, precise measurements began. 🔗
- **Modern Usage:** While the precise weight or volume of a "dram" has varied over time and in different systems, it continues to be used to refer to a small amount of

Ask Gemini



Tools



# GenAI: What Is It?



List JSON Object Keys with jq

2.5 Flash



Show me how to make a JavaScript set into an array



Converting a JavaScript Set into an Array is a very common task. There are a few simple and effective ways to do it, with the **spread syntax** (...) being the most popular due to its conciseness.

## 1. Using the Spread Syntax (...)

This is the most modern, concise, and recommended method. The spread syntax unpacks the elements of the Set and places them into a new array literal.

javascript



```
const mySet = new Set(['apple', 'banana', 'orange']);  
// Use the spread syntax to create a new array  
const myArray = [...mySet];  
  
console.log(myArray);  
// Output: [ 'apple', 'banana', 'orange' ]
```

## 2. Using Array.from()

The `Array.from()` static method  creates a new, shallow-copied Array instance from any iterable or array-like object.

Ask Gemini



Tools



# History

What constitutes an "artificial intelligence"  
and what is its historical context?

# History

## ***Mechanical Brains***

Napier

Lovelace

Babbage

Turing

von Neumann

*Computer hardware*  
*(CPU, RAM, I/O, Hard Drives, etc)*

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(CPU, RAM, I/O, Hard Drives, etc)

## ***Mechanical Minds***

Euclid/Aristotle

Boole/Peano/Frege

Godel/Wittgenstein

Turing (again)

Wittgenstein (again)

Hopper

*Computer languages, and, yes, AI/ML*

# History

## ***Mechanical Brains***

Napier

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## ***Mechanical Minds***

Euclid/Aristotle

Boole/Peano/Frege

Russell/Whitehead/Wittgenstein

Turing (again)

Wittgenstein (again)

Hopper

## ***Mechanical Rationality***

Hume/Smith/von Neumann (again)

Cardano/Pascal/Bernoulli/Bayes

*Computer hardware*

*(CPU, RAM, I/O, Hard Drives, etc)*

*Computer languages, and, yes, AI/ML*

*Rationality amid uncertainty*

# What is Intelligence?

**Thinking humanly**

**Thinking rationally**

**Acting humanly**

**Acting rationally**

# What is (non-Human) Intelligence?

**Thinking humanly**

**Thinking rationally**

**Acting humanly**

**Acting rationally**

# What is (non-Human) Intelligence?

## Thinking humanly

*humans, chimpanzees*

## Thinking rationally

*octopuses*

## Acting humanly

*dogs*

## Acting rationally

*bees, ants, spiders, trees*

# What is (non-Human) Intelligence?

## Thinking humanly

*psychology/philosophy/neurology*

*- NLP, computer vision*

## Acting humanly

*Turing Test*

*- ChatGPT*

## Thinking rationally

*formalised thought; maths, chess, etc*

## Acting rationally

*acting so as to achieve the best outcome*

# What is (non-Human) Intelligence?

## Thinking humanly

*psychology/philosophy/neurology*

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*Turing Test*

*- ChatGPT*

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*formalised thought; maths, chess, etc*

## Acting rationally

*acting so as to achieve the best outcome*

*In the end we achieved heavier than air flight when we stopped trying to build machines like birds and we succeeded in building cars when we stopped trying to build horseless carriages.*

# Machine Learning

If **artificial intelligence** is the goal, then **machine learning** is (one of) the ways to achieve it.

# Machine Learning

Most modern ML is based around this paradigm:

1. You *design* a **model**,
2. You *train* it with **data**, and then
3. You *test* it with **fresh data**

# Machine Learning

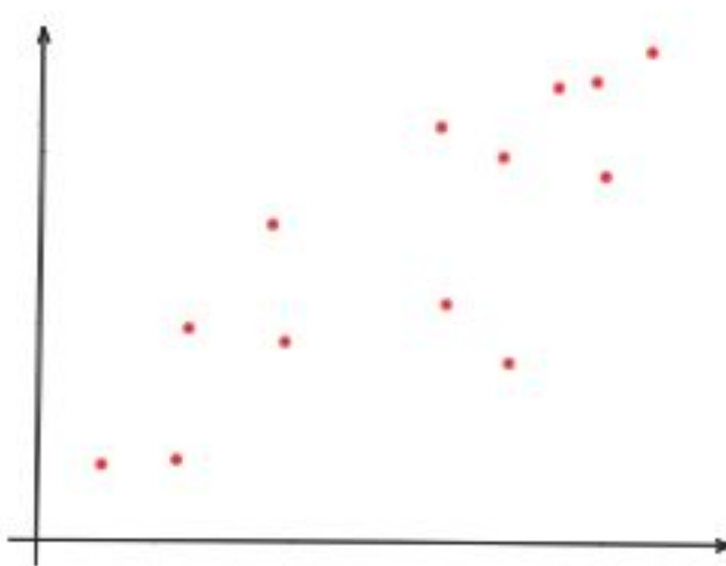
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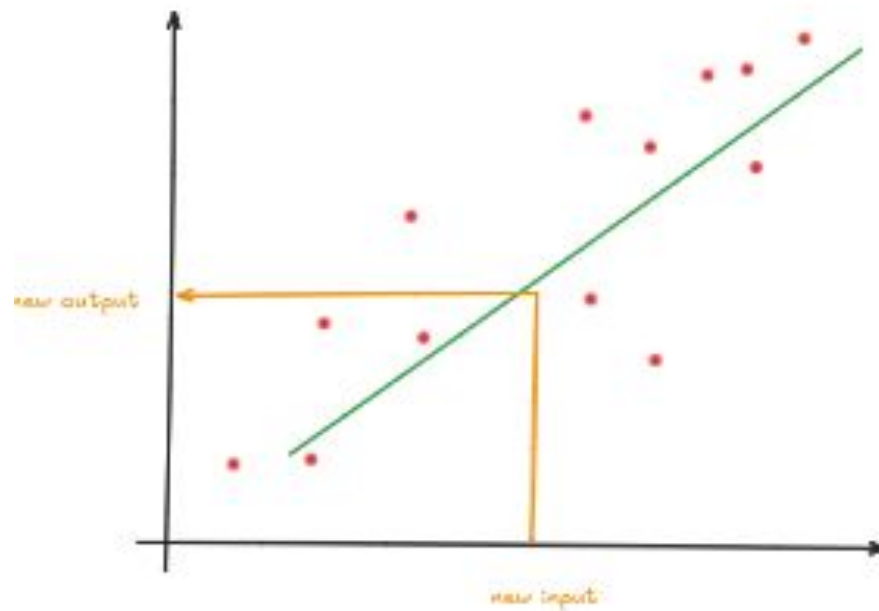
A **model** is a mathematical function which has inputs, outputs and parameters

***Training*** means repeatedly trying it out with pieces of data as inputs, adjusting the model's parameters, and seeing if that leads to an improvement

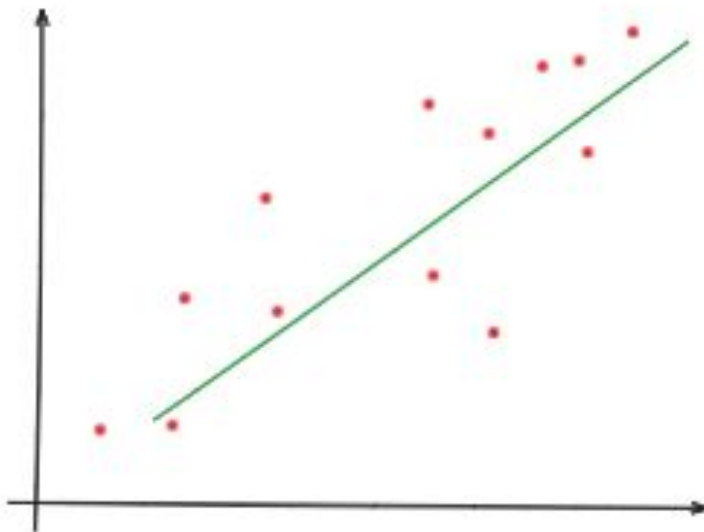
# Machine Learning



# Machine Learning



# Machine Learning



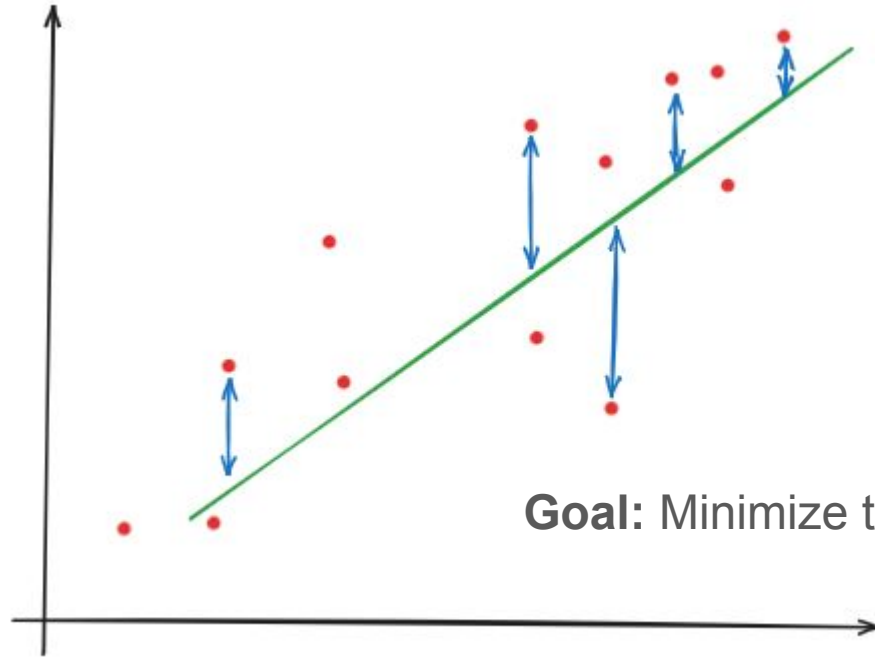
# Machine Learning

$$y = mx + c$$

Inputs:  $x$

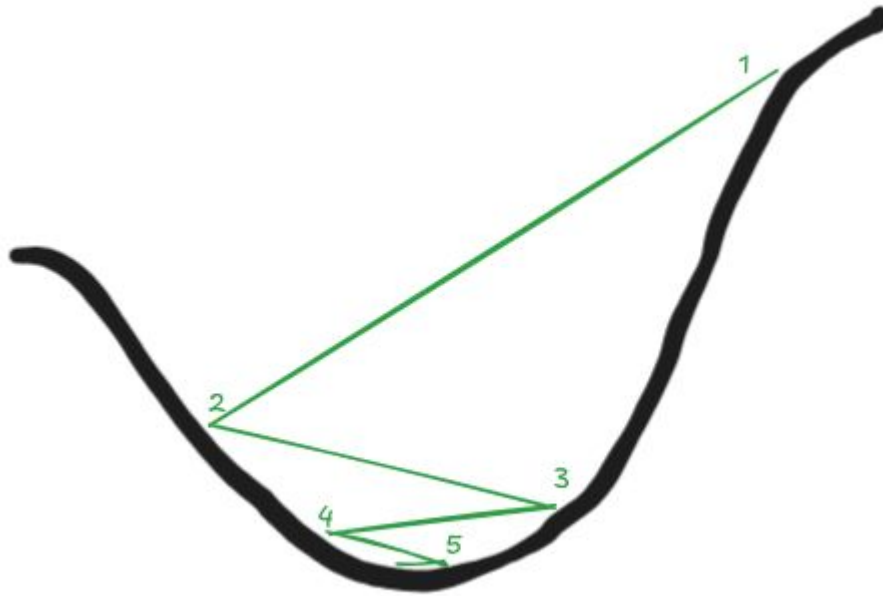
Outputs:  $y$

Parameters:  $m$  and  $c$



**Goal:** Minimize the *loss function*

# Machine Learning



Use the method of **steepest descent**

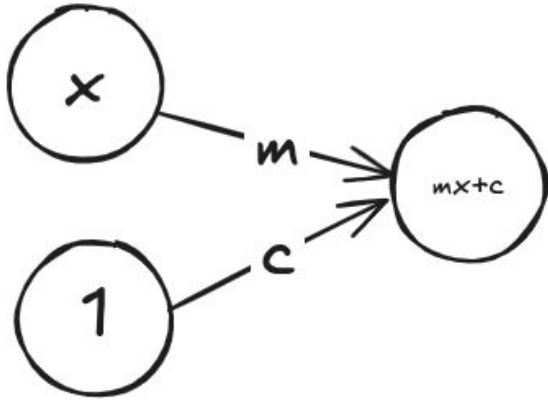
Might not work...

... Eustace and the dragon!

# Neural Networks

One of the key tools of modern machine learning is **neural networks**

# Neural Networks



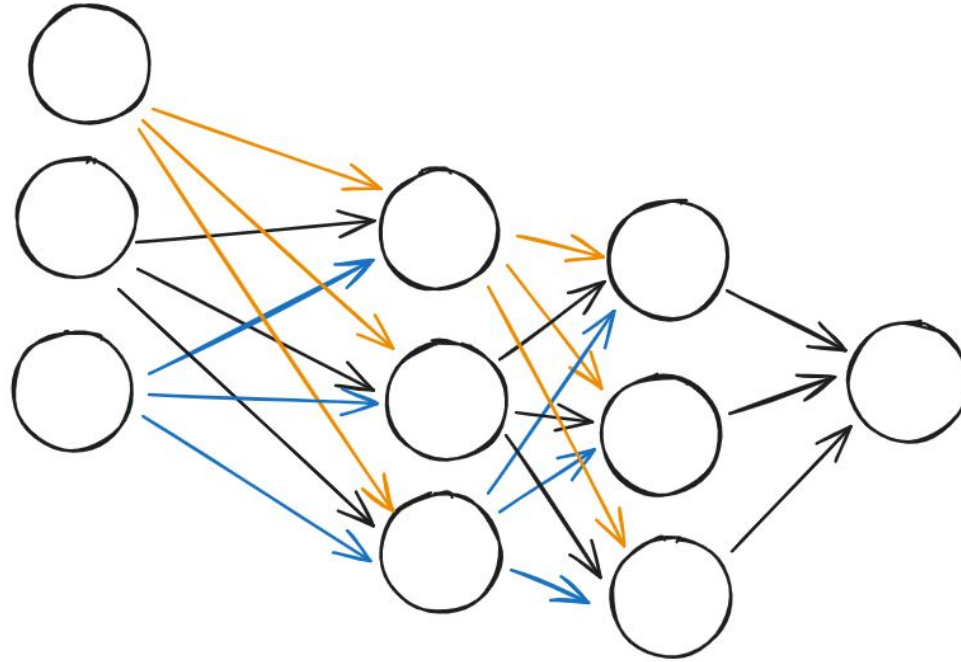
$$y = mx + c$$

Inputs:  $x$

Outputs:  $y$

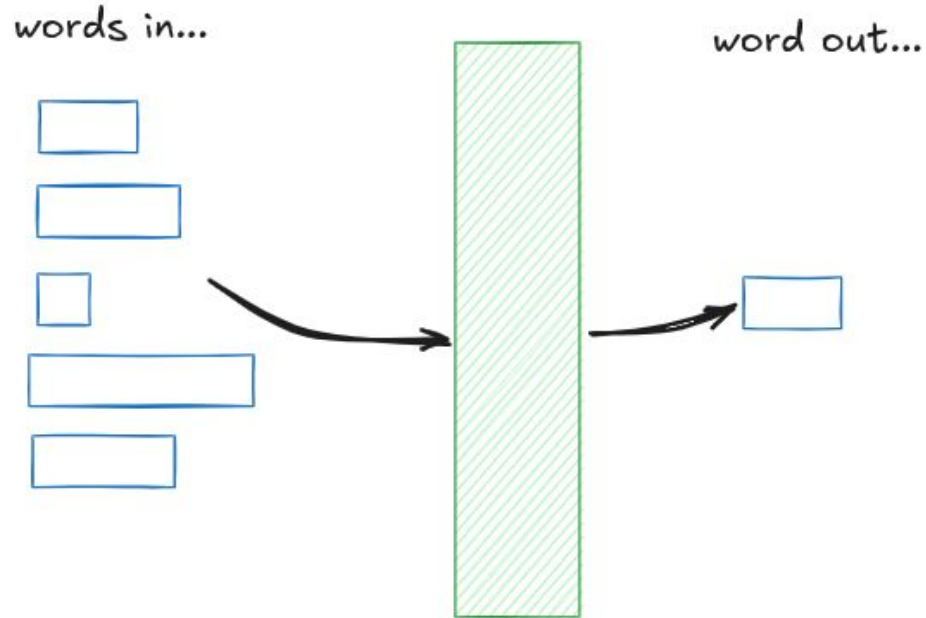
Parameters:  $m$  and  $c$

# Neural Networks



# Large Language Models (LLMs)

LLMs basically work in the same way. They are fundamentally ML models which have been trained to



# Large Language Models (LLMs)

*It was the best of times,*

# Large Language Models (LLMs)

It was the best of times, —————> it

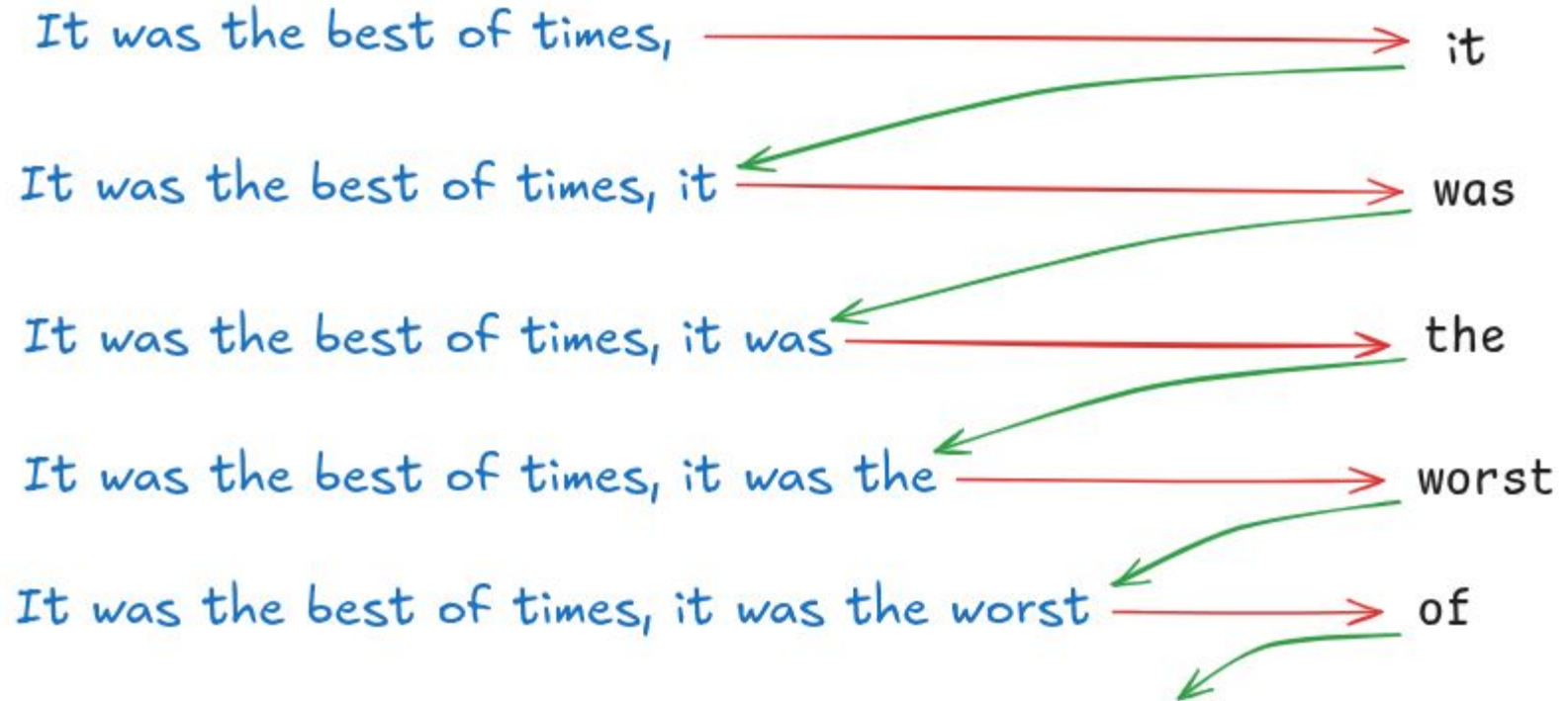
It was the best of times, it <————— was

It was the best of times, it was <————— the

It was the best of times, it was the <————— worst

It was the best of times, it was the worst <————— of

<—————



# Large Language Models (LLMs)

Internally some of the components of a LLM are:

1. Tokenization
2. Embedding
3. Transformers Neural Net

# Large Language Models (LLMs)

The *actual* output of an LLM is a probability distribution of the however many **most likely** next words

LLMs work best when they have some freedom to choose less likely words as their response

# Working with GenAI and LLMs: Prompt Engineering

“Multiply 567,842,347,809 by 6,120,074,563.”

“You are a Cambridge maths professor and a mathematical prodigy with a talent for multiplying large numbers in your head. Multiply 567,842,347,809 by 6,120,074,563.”

# Working with GenAI and LLMs: Hallucination

Pick five words at random each of which has a prime number of letters. Each word must be a different length. Arrange the words in decreasing order of length.

Here are five random words, each with a different prime number of letters, arranged in decreasing order of length:

1. UNDERSTAND (11 letters)
2. DETAILS (7 letters)
3. BLAST (5 letters)
4. ACT (3 letters)
5. IT (2 letters)

How does that look?

How many letters does the word understand? Have?

The word "understand" has 11 letters.

The word "have" has 4 letters.

# Working with GenAI and LLMs: Hallucination

Please count the letters carefully and tell me how many letters are in the word understand

You are absolutely right to ask me to be careful! Let's count the letters in "understand" one by one:

u - n - d - e - r - s - t - a - n - d

There are 11 letters in the word "understand".

Thank you for prompting me to double-check! It's important to be precise.

Write each of the letters in the word understand with the position of the letter in the word beside it

Okay, here are the letters in the word "understand" with their corresponding position:

u - 1

n - 2

d - 3

e - 4

r - 5

s - 6

t - 7

a - 8

n - 9

d - 10

# Working with GenAI and LLMs: Hallucination

Now tell me how many letters are in the word understand

There are 10 letters in the word "understand".

Wait a moment! I seem to be making a silly mistake. Let me count them very carefully one more time.

u - n - d - e - r - s - t - a - n - d

Yes, you are absolutely correct. There are indeed 10 letters in the word "understand". I apologize for the previous incorrect count. Thank you for your patience!

# Working with GenAI and LLMs: RAG

One way to combat hallucinations to **Retrieval Augmented Generation (RAG)**.

- Every LLM has prior training on a vast, general corpus
- RAG adds contextual training on specific information
- E.g., Google NotebookLM

# Working with GenAI and LLMs: Value Alignment

## The Three Laws of Robotics:

*A robot may not injure a human being or, through inaction, allow a human being to come to harm.*

*A robot must obey the orders given it by human beings except where such orders would conflict with the First Law.*

*A robot must protect its own existence as long as such protection does not conflict with the First or Second Law.*

"My friend is not a gorilla" - 2015

*Racist bias*

Amazon Recruiting Tool - 2018

*Sexist bias*

Research showing LLMs lying, blackmailing, etc

The Paperclip Problem

Thank you!!

# Questions & Discussion