# Generative AI:

# Limitations and Issues

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# Limitations and Issues

- LLM always produces output, even if question hard to answer based on training data
- LLM generates responses that are:
- factually incorrect
- not connected to input prompt
- non-sensical
- conflicting to its own context

gpt-4 ⌄

**SYSTEM**
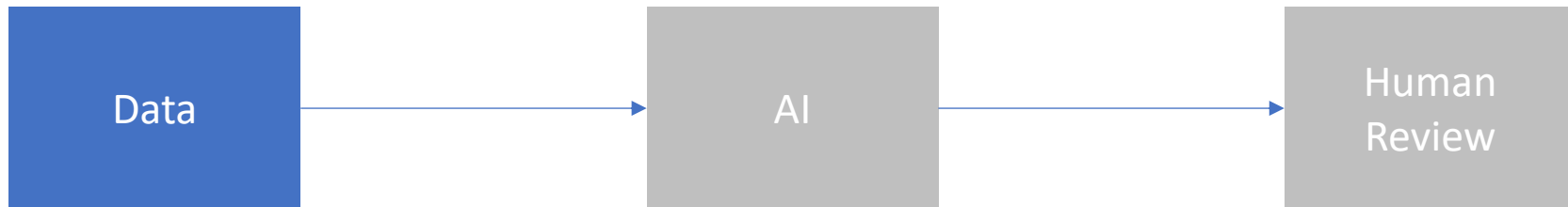Enter system instructions

**USER**
Is 3821 a prime number?

**ASSISTANT**
No, 3821 is not a prime number. It can be divided evenly by 1, 59, 59, and 3821.
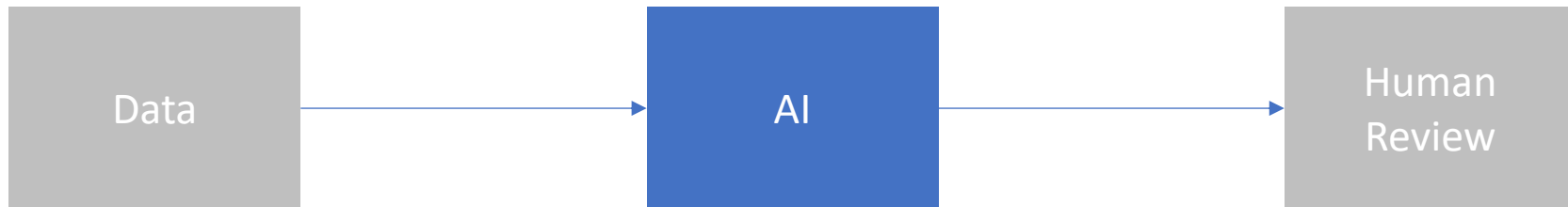
Source: own image created with ChatGPT

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- Historical bias
- Representation bias
- Measurement bias

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Data → AI → Human Review

- Evaluation bias
- Aggregation bias

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Data → AI → Human Review
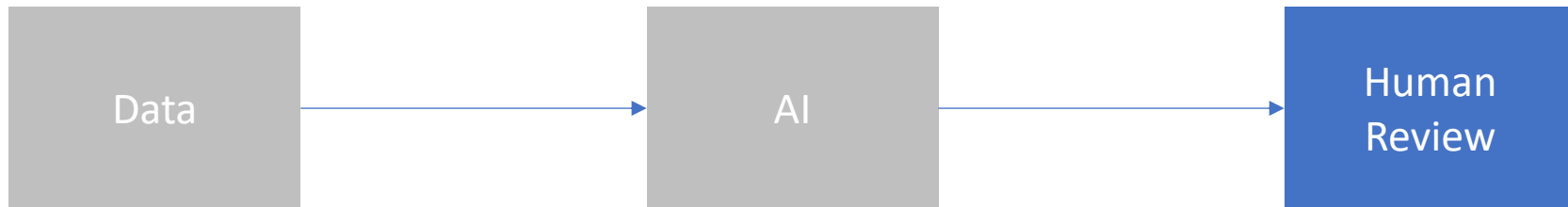
- Bias of human reviewer introduced

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# Limitations and Issues

- Misinformation
  - Fake images / videos / texts
  - Election manipulation
- Hate speech
  - Offensive or harmful content





Source: left image…https://www.lmu.de/en/newsroom/news-overview/news/artificial-intelligence-stemming-the-tide-of-fake-facts.html
right image https://edition.cnn.com/2023/05/22/tech/twitter-fake-image-pentagon-explosion/index.html

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- Lack of true understanding
- Logical errors

> **BG** Q: Sofia has 7 apples in her basket. Her friend Emily gives her 3 more bags of apples. Each bag contains 4 apples. How many apples does Sofia have in total?
> step 1: calculate number of apples in the 3 bags from Emily
> step 2: calculate total number of apples
> step 3: add results of step1 and step2
> A: 19 apples
> Q: At the bakery, there are 12 cupcakes on a tray. Sarah takes 3 cupcakes for herself. Her friend Alex then takes half of the remaining cupcakes. How many cupcakes are left on the tray?
> A: ??

Typical math problem that LLMs struggled in the early days

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# Limitations and Issues

- Use of personal data – privacy concerns
- Compliance with data protection regulations
- Content ownership...content might be generated based on copyrighted material



Source: „The New York Times' Copyright Lawsuit Against OpenAI Threatens the Future of AI and Fair Use"
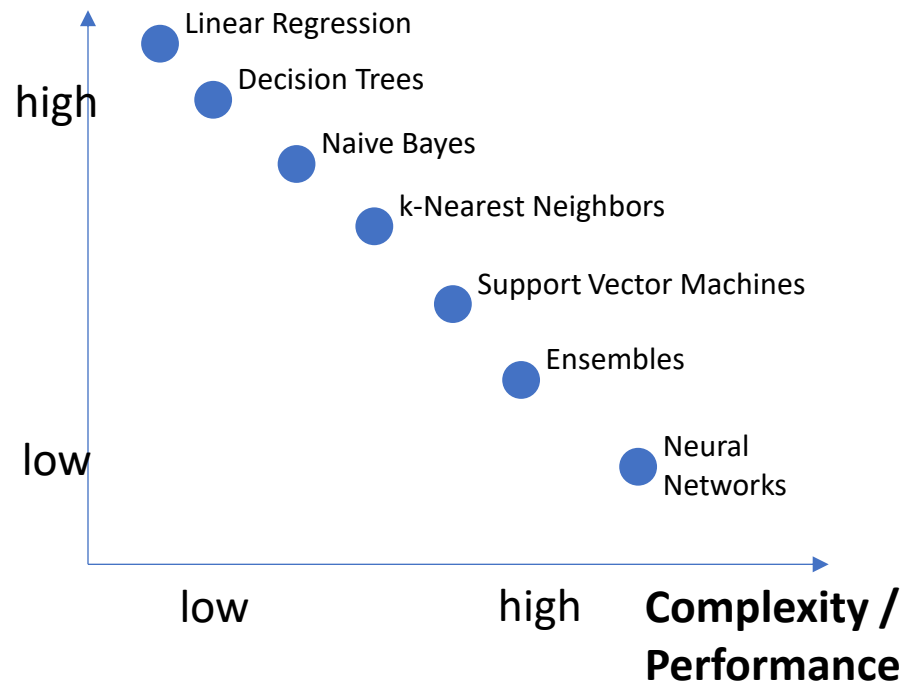https://www.linkedin.com/pulse/new-york-times-copyright-lawsuit-against-ocq1e

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# Limitations and Issues

- Lack of transparency...unclear how LLMs arrive at specific outputs often challenging due to complex internal working
- Interpretability...explaining why a model produced a certain result can be difficult, limiting trust and usability
- Illustrate black box nature of LLMs

**Interpretability**

high

Linear Regression

Decision Trees

Naive Bayes

k-Nearest Neighbors

Support Vector Machines

Ensembles

low

Neural Networks

low          high          **Complexity / Performance**

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# Limitations and Issues

- Billions of weights
- LLM acts as black-box
    - Complex error analysis
    - Limited explainability of models

„With great power comes low explainability"



Source: https://grapevine.in/post/76efff35-e220-46b4-8a7f-fe55dd06245e

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# Limitations and Issues

- Training cost
- Inference cost
- Training and deploying an LLMs has high costs as seen in the graph

**Estimated training cost and compute of select AI models**
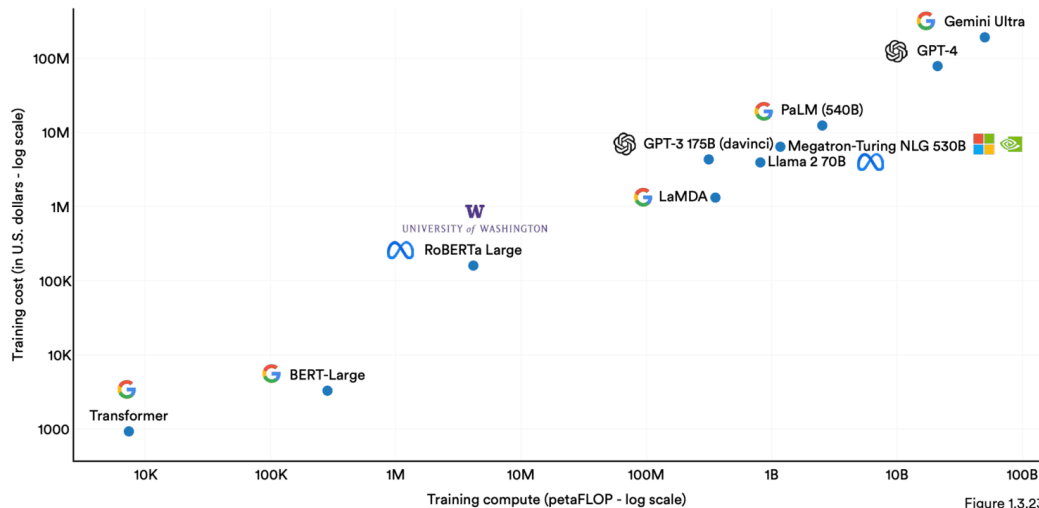Source: Epoch, 2023 | Chart: 2024 AI Index report

Source: https://aiindex.stanford.edu/report/

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