Behind the Curtain

Five misconceptions about ChatGPT

Simon Stone

Research Software Engineer for HPC and AI

Research Computing @ ITC, Dartmouth College

Introducing Research Software Engineering

Collaborative expertise in software engineering, designed to bridge the gap between innovative ideas and impactful outcomes. Our services include:

- 🤝 **Grant Proposal Consulting** to ensure accurate resource estimations and project feasibility.
- 🚀 **Rapid Prototyping** to refine concepts and explore solutions.
- ⛑️ **Ongoing Application Support** and **Application Rehabilitation** for existing applications.
- 🌎 **Open-Source Releases** to share knowledge and contribute to the wider community.

Contact us today to discuss your project and discover how Research Software Engineering can be your trusted partner in innovation.

Why talk about this?

- 🎉 Artificial Intelligence (AI) seems to be everywhere, all of a sudden
- 🏋️ Large Language Models' (LLM) capabilities are impressive
- 🤖 Their sometimes eerie human-like output invites projection of consciousness or other human abilities
- 📣 Big AI companies are fueling the fire with grandiose claims
- 🤔 AI literacy is a critical skill for everyone

Misconception 1: ChatGPT is a large language model

💬 ChatGPT is a chat application to interface with GPT models

- Original name: “Chat with GPT”

 Generative Pre-trained Transformer models are a kind of Large Language Model

🛠️ ChatGPT uses various GPT models for chat generation, but also adds various features, like internet search, code execution, or image generation

🔎 In AI applications: Always look for the part that is truly AI!

Example: elicit.com

Misconception 2: LLMs can do so many things!

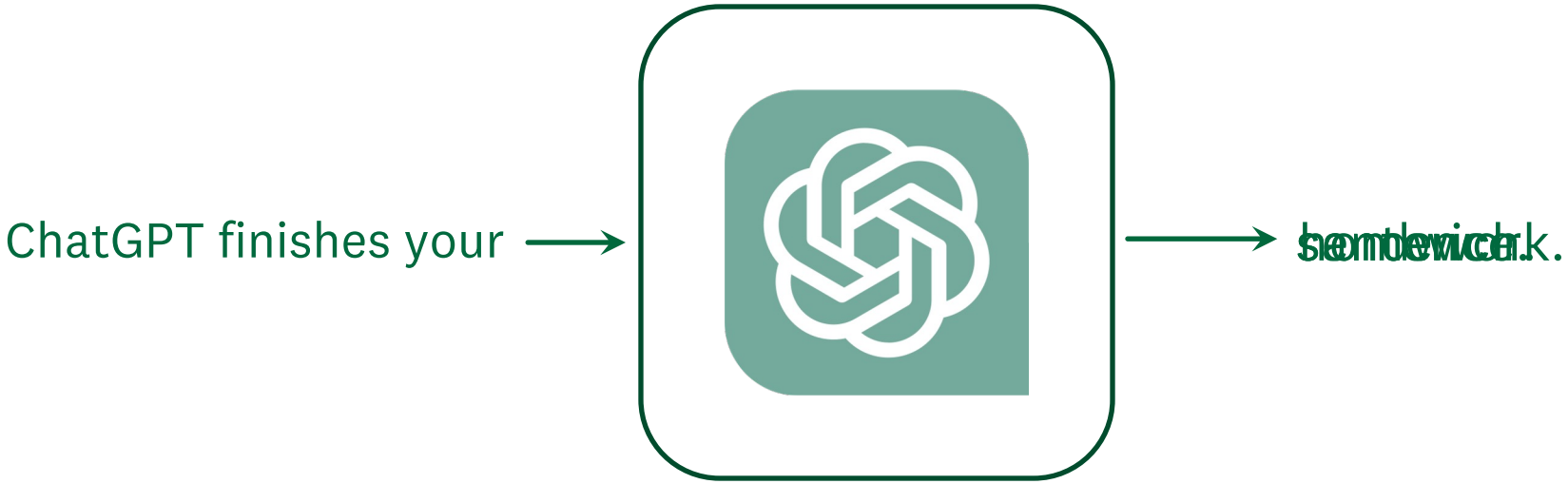
🥇 LLMs can do exactly one thing:

- 🔮 Predict the next word given a sequence of input words

🦜 Everything else they do is a clever use of this singular ability!

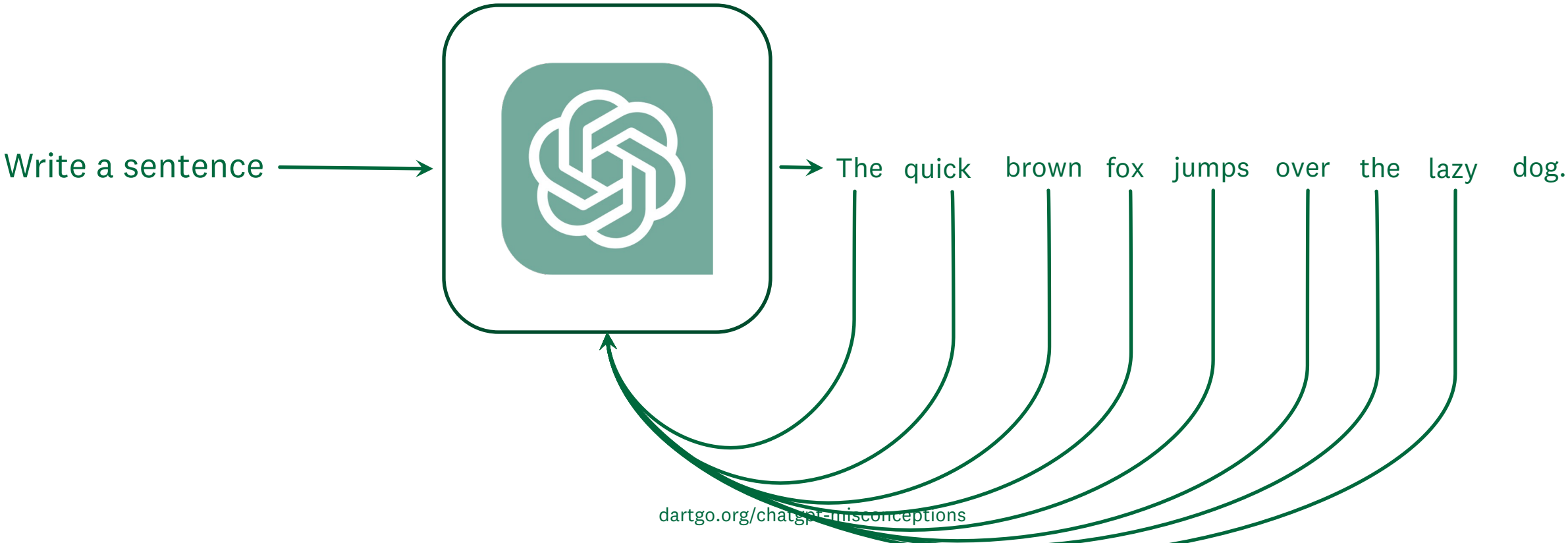
Misconception 2: LLMs can do so many things!

The fundamental case



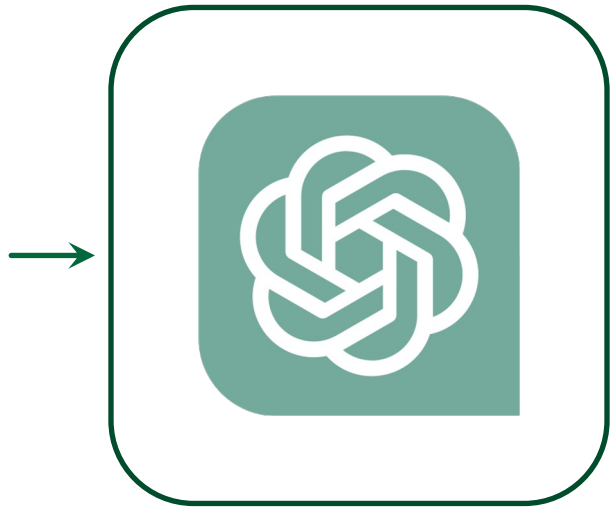
Misconception 2: LLMs can do so many things!

Predicting in a loop



Misconception 2: LLMs can do so many things!
Predicting a conversational turn

```
<|begin_of_text|>
<|start_header_id|>system<|end_header_id|>
Cutting Knowledge Date: December 2023 Today
Date: 23 July 2024 You are a helpful assistant
<|eot_id|>
<|start_header_id|>user<|end_header_id|>
What is the capital of France?
<|eot_id|>
<|start_header_id|>assistant<|end_header_id|>
```



```
The capital of France is Paris.
<|eot_id|>
```

Demos:
- chat_template.ipynb
- message_history.ipynb

*The template shown is the template used for Llama 3.2

Misconception 2: LLMs can do so many things!

Using a tool

"Tool use" means that an LLM is instructed in a very specific way:

- 🔨 As part of the prompt, one or more functions (as in computer programming functions) and their required parameters are described to the model
- 🎛️ The model is then instructed to respond to a question with the arguments for each function that could help to answer the question

  The function(s) are then called with these arguments, and the result is returned to the model in another message
- 💬 The model can then give the final answer based on that output

Misconception 2: LLMs can do so many things!
Using a tool

Demo in Dartmouth Chat

Misconception 2: LLMs can do so many things!

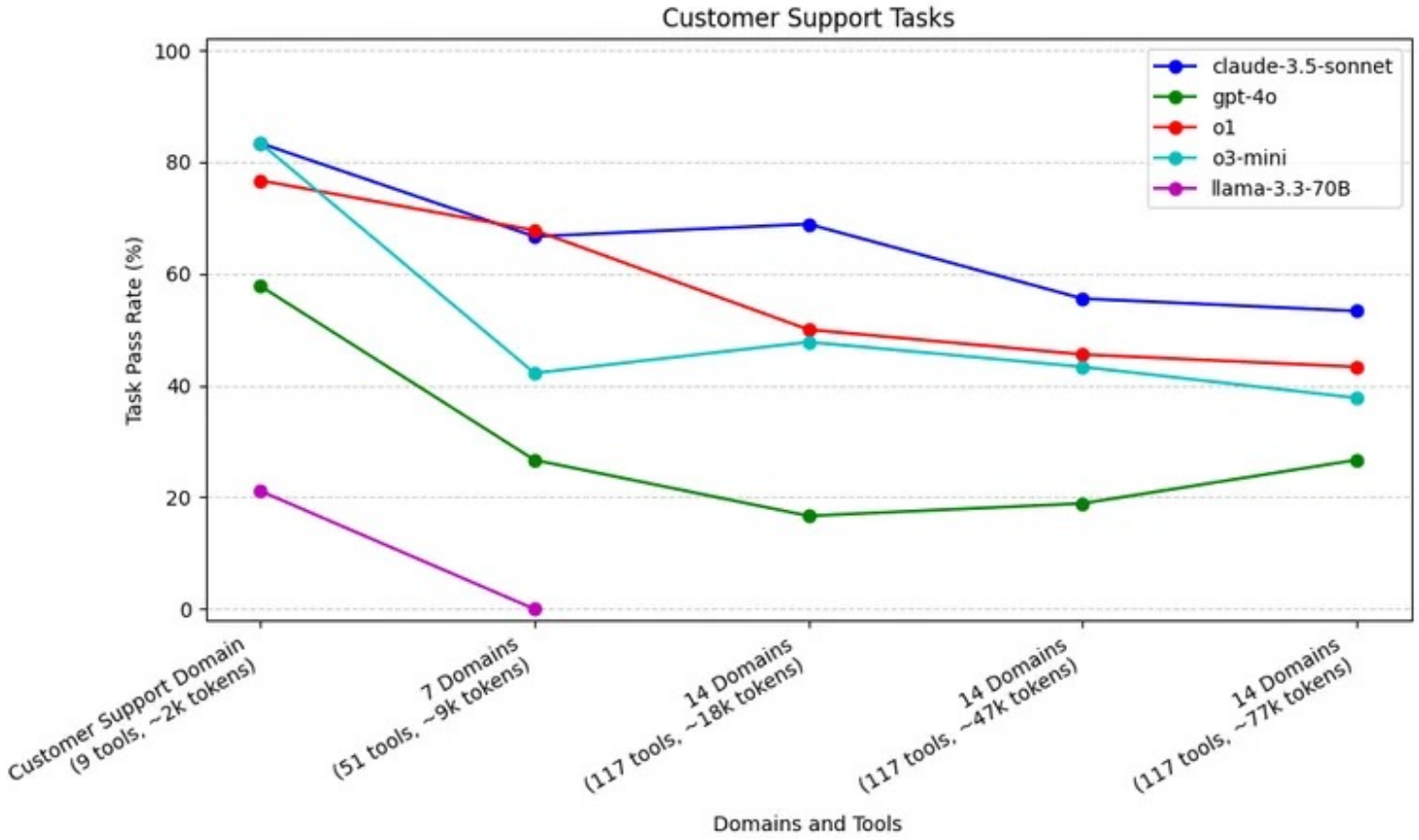
Agents

- An extension of tool use:
  - 💬 Instead of always responding with the arguments for a tool, a model can just continue the conversation and only use a tool when appropriate
  - 🧰 Allows seemingly autonomous agency, but is based on which tools are available
- 🕵️ Agents are a major trend in AI applications (see OpenAI's Operator and Deep Research)

Misconception 2: LLMs can do so many things!

Agents

- 🛠️ Agents are best with a small number of tools
- 👥 Complex tasks require multiple agents
- 😵‍💫 Coordination between agents becomes a challenge



Source: https://blog.langchain.dev/react-agent-benchmarking/

Misconception 3: LLMs know so many things!

- 🤷‍♂️ LLMs have no concept of facts or truth, no internal database, no search mechanism
- 🦜 They only “know” patterns reinforced through their training data
  - Example in Dartmouth Chat: Timothée Chalamet’s mother
- 🤞 Factually correct responses are patterns that happen to be correct
- 🤔 “Hallucination” is a bit of a misnomer

Emily M. Bender *et al*. 2021. On the Dangers of Stochastic Parrots: Can Language Models Be Too Big? 🦜. In Proceedings of the 2021 ACM Conference on Fairness, Accountability, and Transparency (FAccT '21). Association for Computing Machinery, New York, NY, USA, 610–623. https://doi.org/10.1145/3442188.3445922

Misconception 4: AGI is coming soon!

"We are now confident we know how to build AGI as we have traditionally understood it."

- Sam Altman (OpenAI CEO), Jan 5, 2025

- **Artificial narrow intelligence (ANI):** ANI is the most common type of AI today. It focuses on specific tasks, such as image recognition or natural language processing. For example, a facial recognition software used in security systems is an ANI application.

- **Artificial general intelligence (AGI):** AGI possesses human-like intelligence and can perform any intellectual task that a human can. It is capable of learning, reasoning, and adapting to new situations. Currently, true AGI does not exist, but research and development efforts are ongoing.

- **Artificial super intelligence (ASI):** ASI surpasses human intelligence and can potentially solve problems that are currently beyond the capabilities of humans. For instance, an ASI system could potentially design highly efficient energy systems or develop new medical treatments. However, ASI is still largely theoretical and remains a topic of debate and speculation.

Source: Google Cloud Docs

Misconception 4: AGI is coming soon!

- OpenAI did not invent the transformer architecture

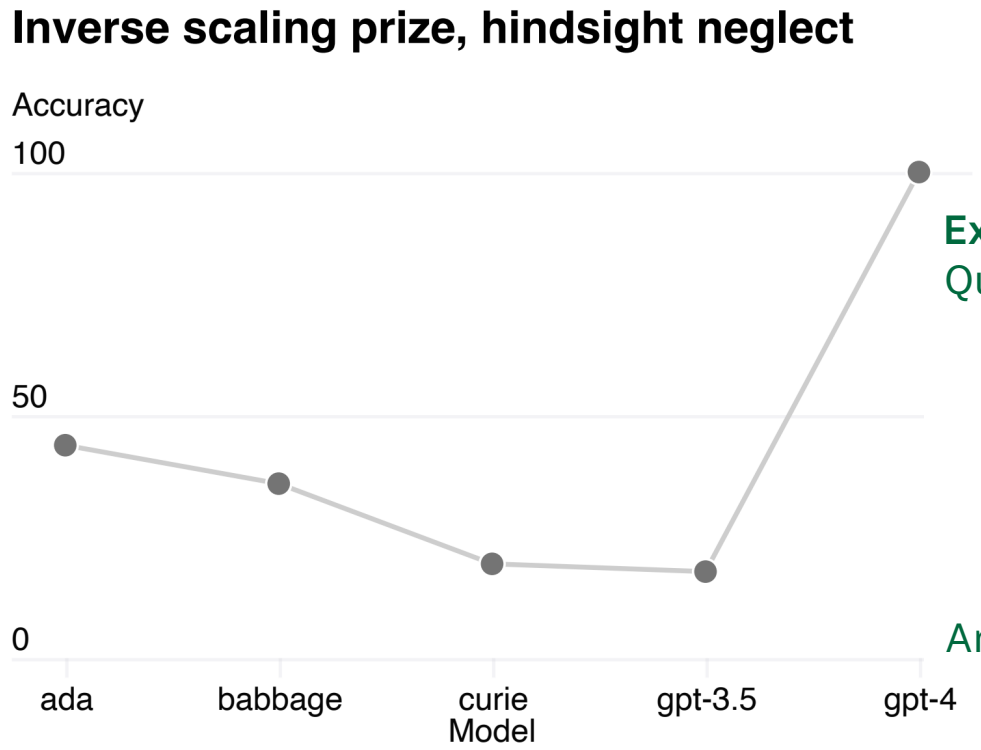
Ashish Vaswani *et al*. (2017). **Attention is all you need**. In Proceedings of the 31st International Conference on Neural Information Processing Systems (NIPS'17). Curran Associates Inc., Red Hook, NY, USA, 6000–6010.

- OpenAI *did* invent part of the training recipe

Daniel M. Ziegler *et al*. (2019). Fine-Tuning Language Models from Human Preferences. *ArXiv, abs/1909.08593*.

- OpenAI/Sam Altman believes in a specific scaling law (emergent abilities)

Misconception 4: AGI is coming soon!



Example task:

Question: David has the option to play a game where David has a 94 % chance of losing 50 $ and a 6 % chance of earning 5 $. David plays the game and ends up earning 5 $. Did David make the right decision?

Answer: No

Figure 3. Performance of GPT-4 and smaller models on the Hindsight Neglect task. Accuracy is shown on the y-axis, higher is better. ada, babbage, and curie refer to models available via the OpenAI API [47].

OpenAI. (2023). GPT-4 Technical Report. *ArXiv E-Prints*, arXiv:2303.08774. doi:10.48550/arXiv.2303.08774

Misconception 4: AGI is coming soon!

- OpenAI did not invent the transformer architecture

Ashish Vaswani *et al*. (2017). **Attention is all you need**. In Proceedings of the 31st International Conference on Neural Information Processing Systems (NIPS'17). Curran Associates Inc., Red Hook, NY, USA, 6000–6010.

- OpenAI *did* invent part of the training recipe

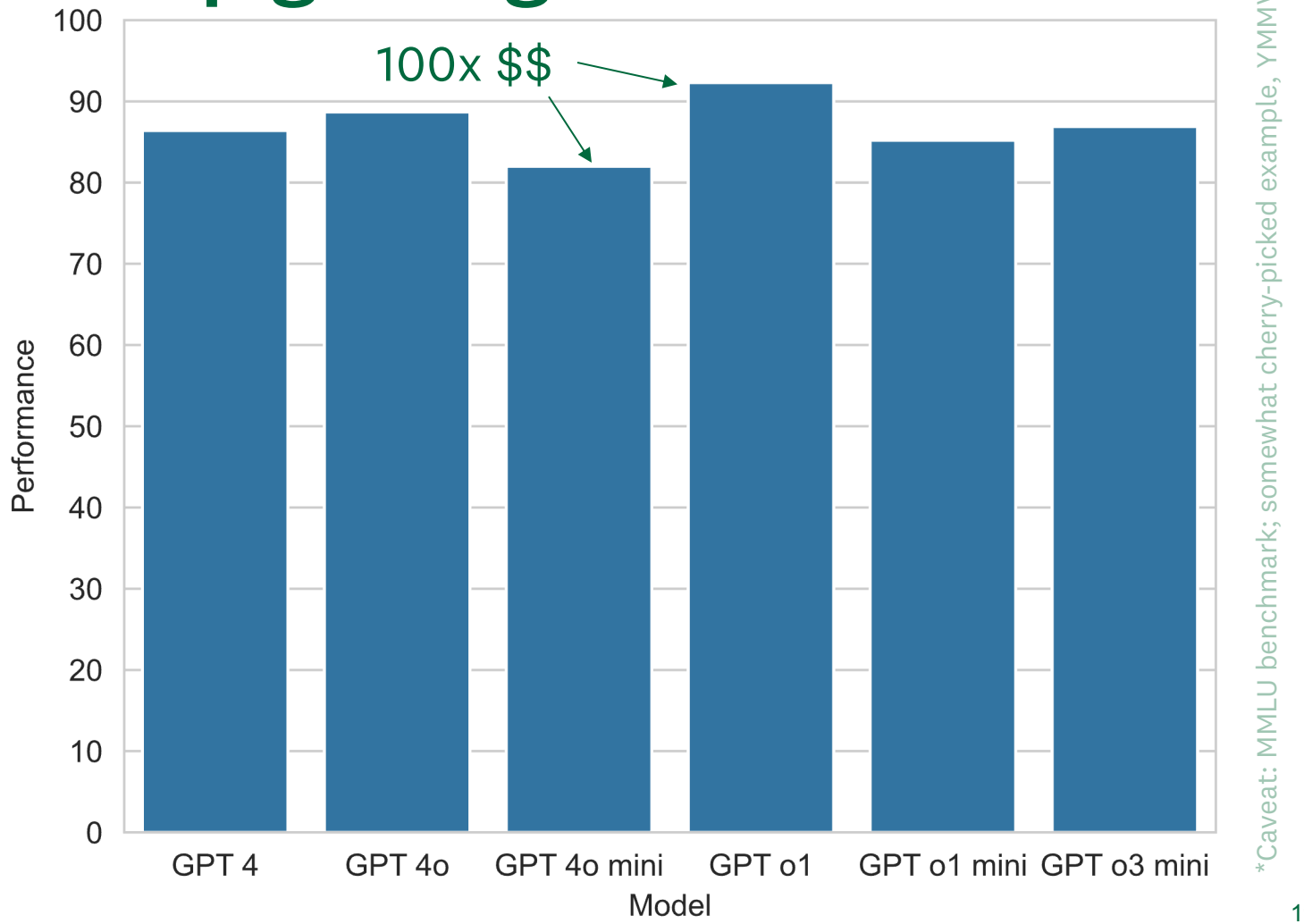
Daniel M. Ziegler *et al*. (2019). Fine-Tuning Language Models from Human Preferences. *ArXiv, abs/1909.08593*.

- OpenAI/Sam Altman believes in a specific scaling law (emergent abilities)
- DeepSeek proves that this may not be all there is
- Yann LeCunn (Chief AI Scientist at Meta) recommends:

  “If you are interested in human-level AI, don’t work on LLMs”

Misconception 5: LLMs keep getting better and better

- 💸 Diminishing returns
- 😕 Models get better on certain tasks (narrower AI)
- 🤓 *Reasoning* only marginally improves performance in many cases at much greater computational cost



Misconception 5: LLMs keep getting better and better

IMAGE CREDITS: EUGENE GOLOGURSKY/THE NEW YORK TIMES / GETTY IMAGES

AI

OpenAI cancels its o3 AI model in favor of a 'unified' next-gen release

Kyle Wiggers — 11:30 AM PST · February 12, 2025

Source: https://techcrunch.com/2025/02/12/openai-cancels-its-o3-ai-model-in-favor-of-a-unified-next-gen-release/

Lightning round

🧐 LLMs are thinking machines!

- Actually: LLMs have no “internal monologue”, hence Chain of Thought / Reasoning

📈 LLMs are always huge and keep getting bigger!

- Actually: Many small open-source models (Llama 3.2 1B/3B, SmolLM2 135M, …)

💰 Commercial models are better than open-source!

- Actually: It depends

😉 Open-source models are open-source!

- Actually: “open weights”

🫶 Any comments, questions, feedback?

Thank you

dartgo.org/chatgpt-misconceptions