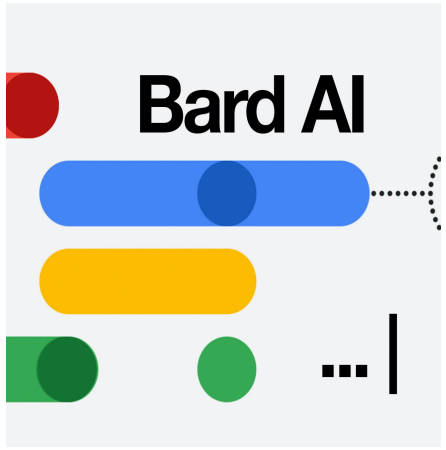
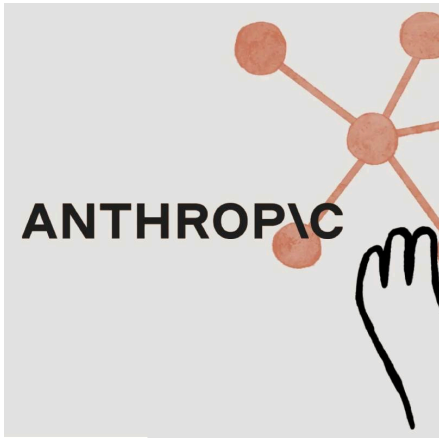
On AI's Impact — An Engineer's Take

Daniel Khashabi

Chatbots are the buzz!!





These Chatbots are Real Generalists!

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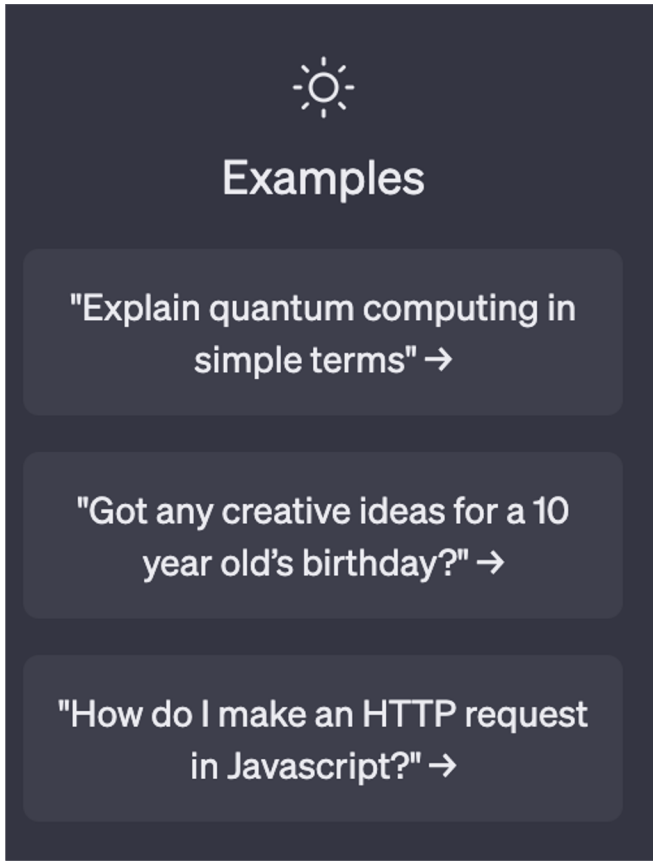
Basic needs



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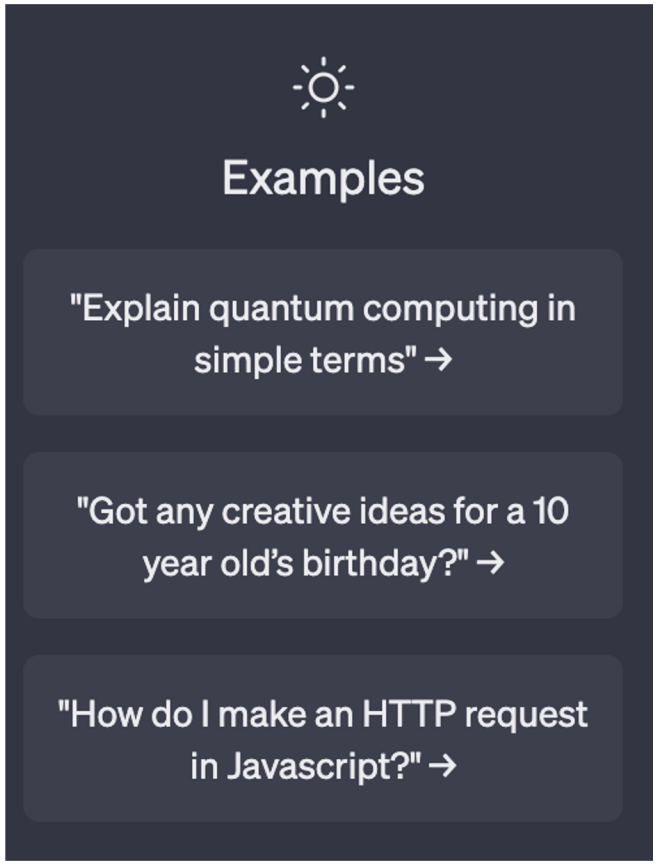

Standardized exams

Simulated exams	GPT-4 estimated percentile	GPT-4 (no vision) estimated percentile	GPT-3.5 estimated percentile
Uniform Bar Exam (MBE+MEE+MPT)[1]	298 / 400 ~90th	298 / 400 ~90th	213 / 400 ~10th
LSAT	163 ~88th	161 ~83rd	149 ~40th
SAT Evidence-Based Reading & Writing	710 / 800 ~93rd	710 / 800 ~93rd	670 / 800 ~87th
SAT Math	700 / 800 ~89th	690 / 800 ~89th	590 / 800 ~70th
Graduate Record Examination (GRE) Quantitative	163 / 170 ~80th	157 / 170 ~62nd	147 / 170 ~25th
Graduate Record Examination (GRE) Verbal	169 / 170 ~99th	165 / 170 ~96th	154 / 170 ~63rd
Graduate Record Examination (GRE) Writing	4 / 6 ~54th	4 / 6 ~54th	4 / 6 ~54th
USABO Semifinal Exam 2020	87 / 150 99th - 100th	87 / 150 99th - 100th	43 / 150 31st - 33rd
USNCO Local Section Exam 2022	36 / 60	38 / 60	24 / 60
Medical Knowledge Self-Assessment Program	75 %	75 %	53 %
Codeforces Rating	392 below 5th	392 below 5th	260 below 5th
AP Art History	5 86th - 100th	5 86th - 100th	5 86th - 100th
AP Biology	5 85th - 100th	5 85th - 100th	4 62nd - 85th
AP Calculus BC	4 43rd - 59th	4 43rd - 59th	1 0th - 7th
AP Chemistry	4 71st - 88th	4 71st - 88th	2 22nd - 46th
AP English Language and Composition	2 14th - 44th	2 14th - 44th	2 14th - 44th
AP English Literature and Composition	2 8th - 22nd	2 8th - 22nd	2 8th - 22nd
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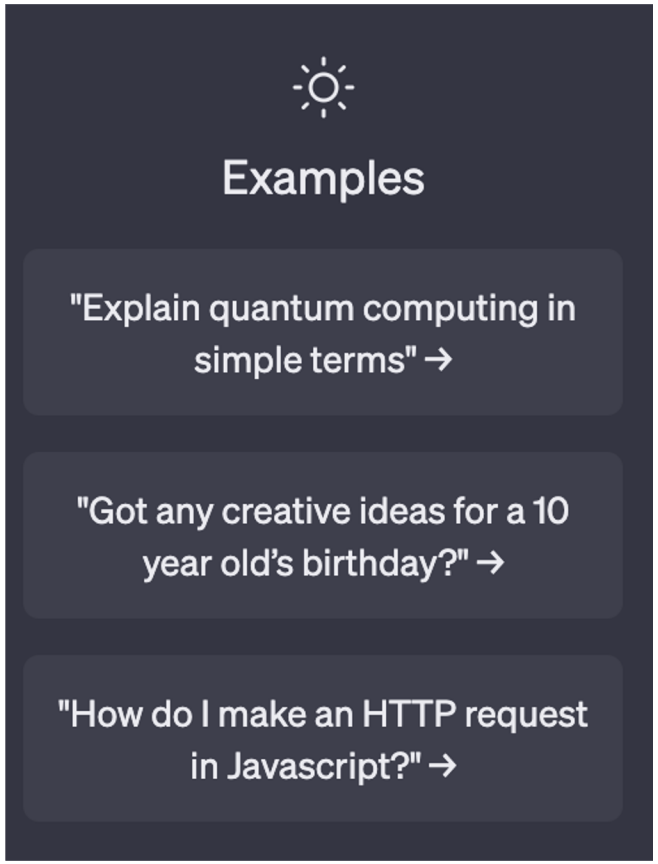

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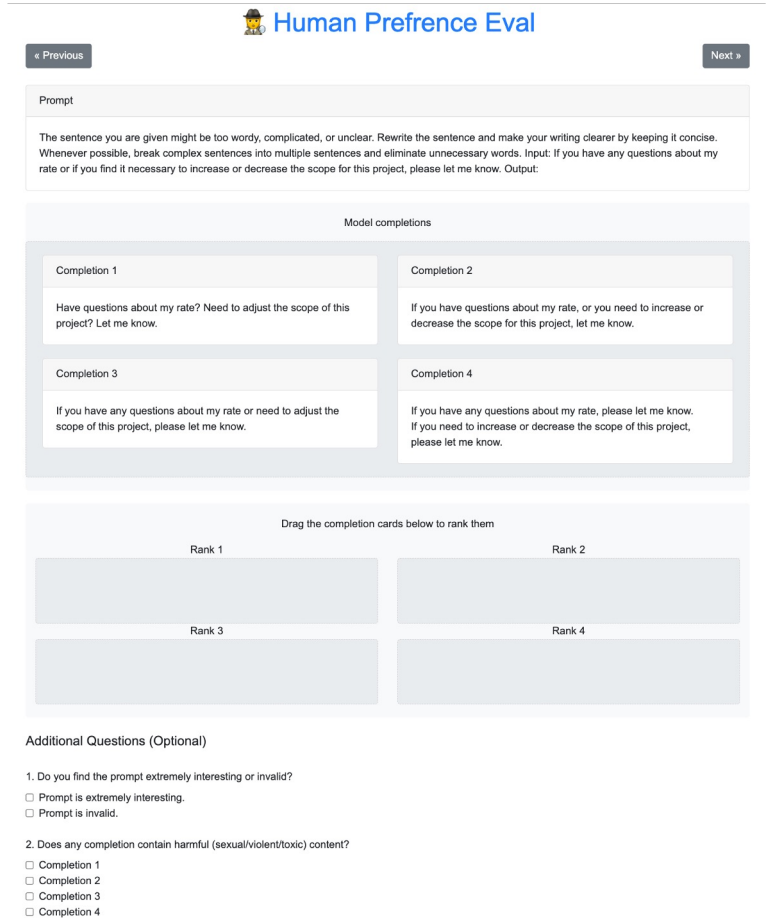
Writing a real website for me!



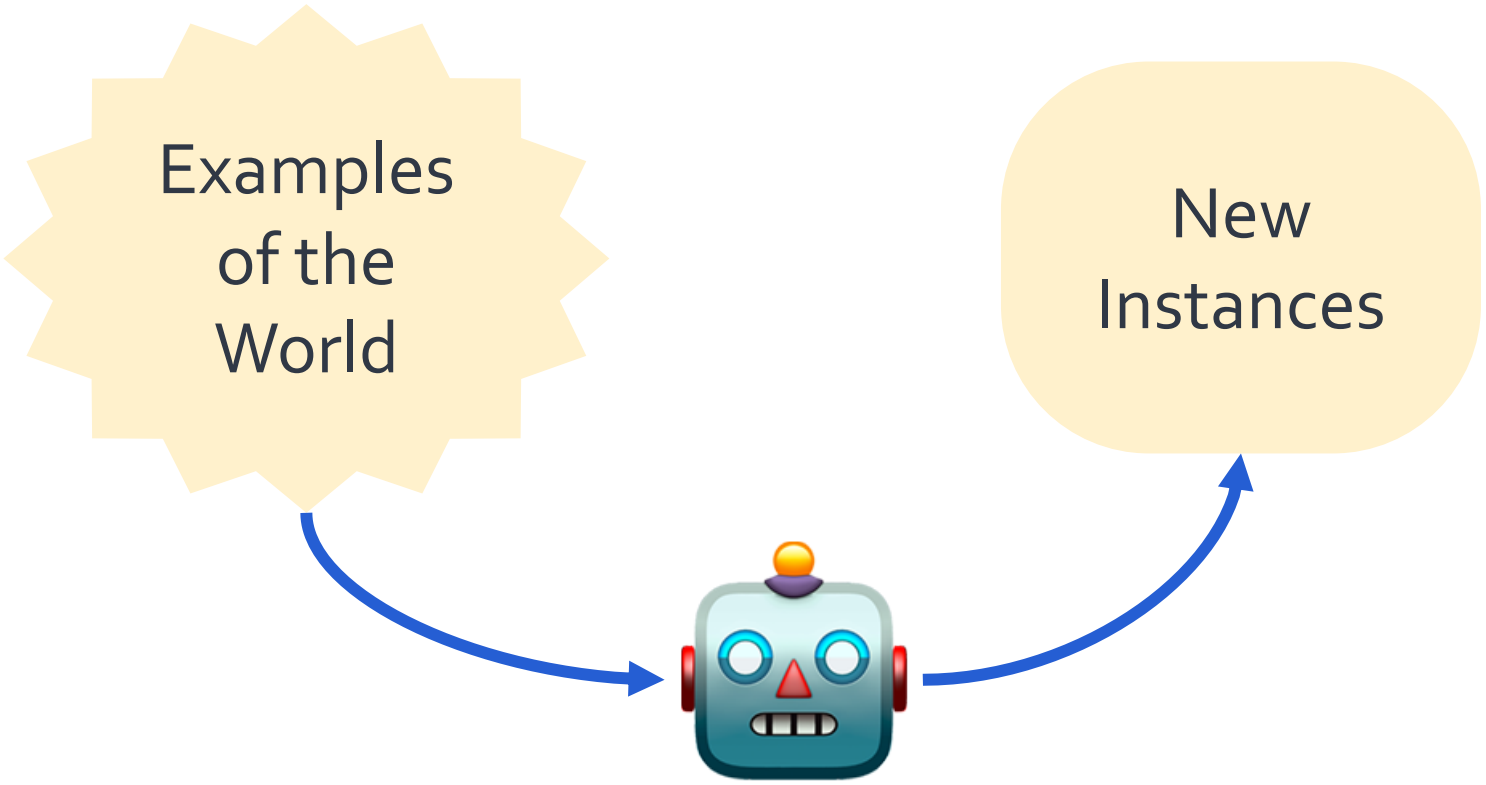
“a cat wearing sunglasses”

“a black and white photograph of a cat wearing sunglasses by annie lebovitz, highly-detailed”


Meta AI

Self-Supervised Models

Self-Supervision



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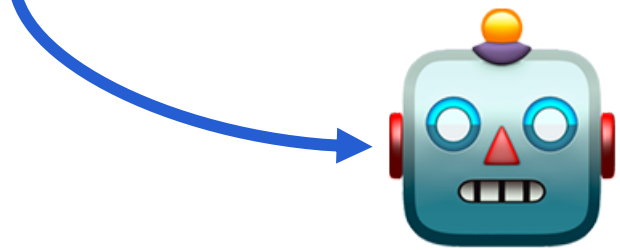
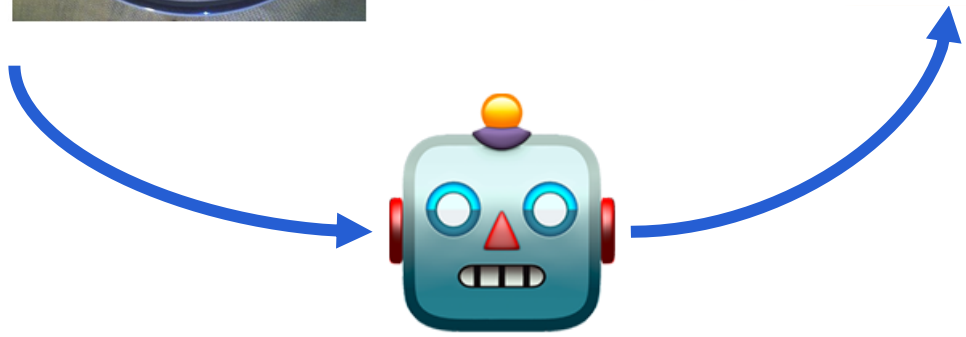


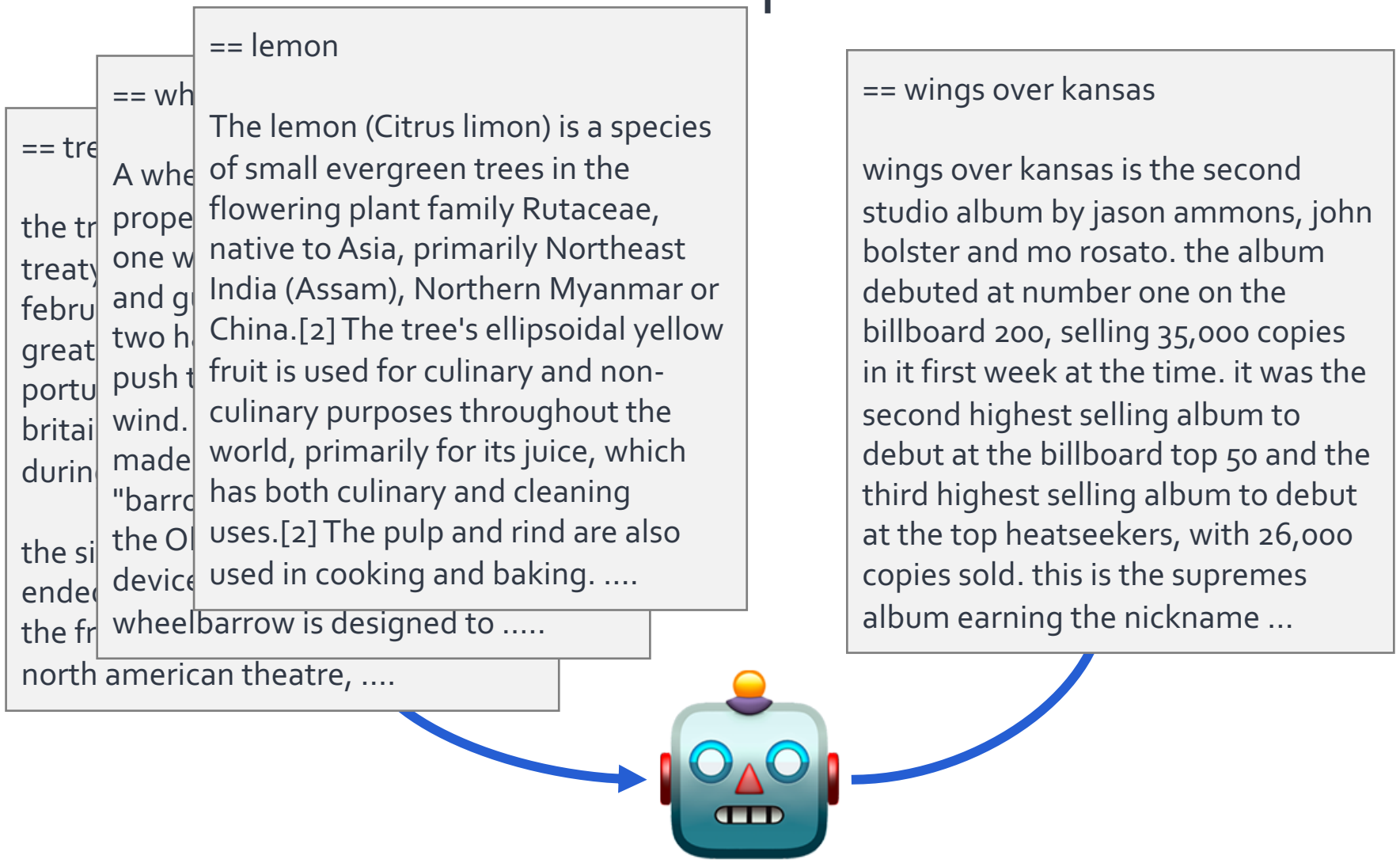
New Instances

Self-Supervision



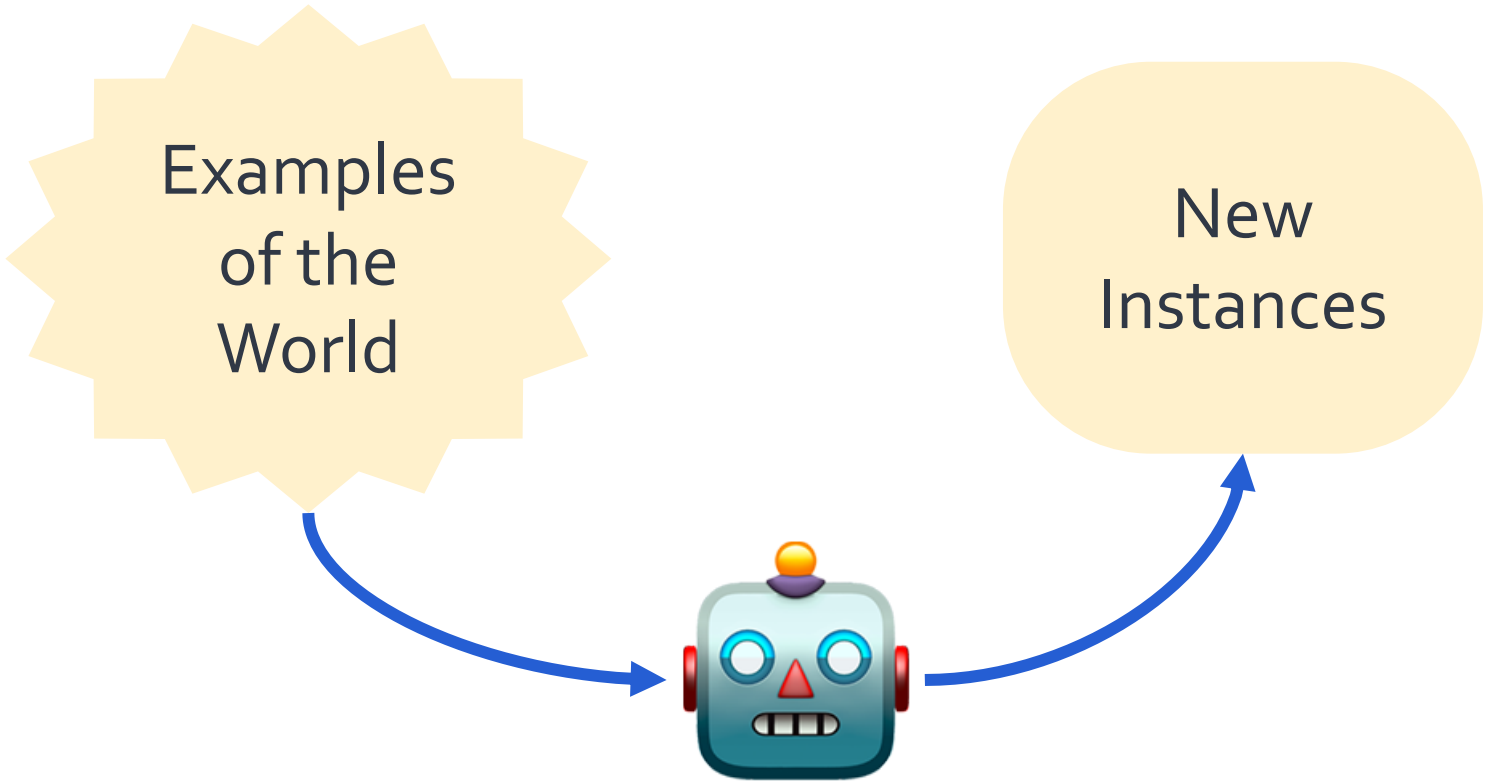
Generated image, from "Large Scale GAN Training for High Fidelity Natural Image Synthesis", Brock et al.

Self-Supervision



Self-Supervised Models

Are predictive models of the world.



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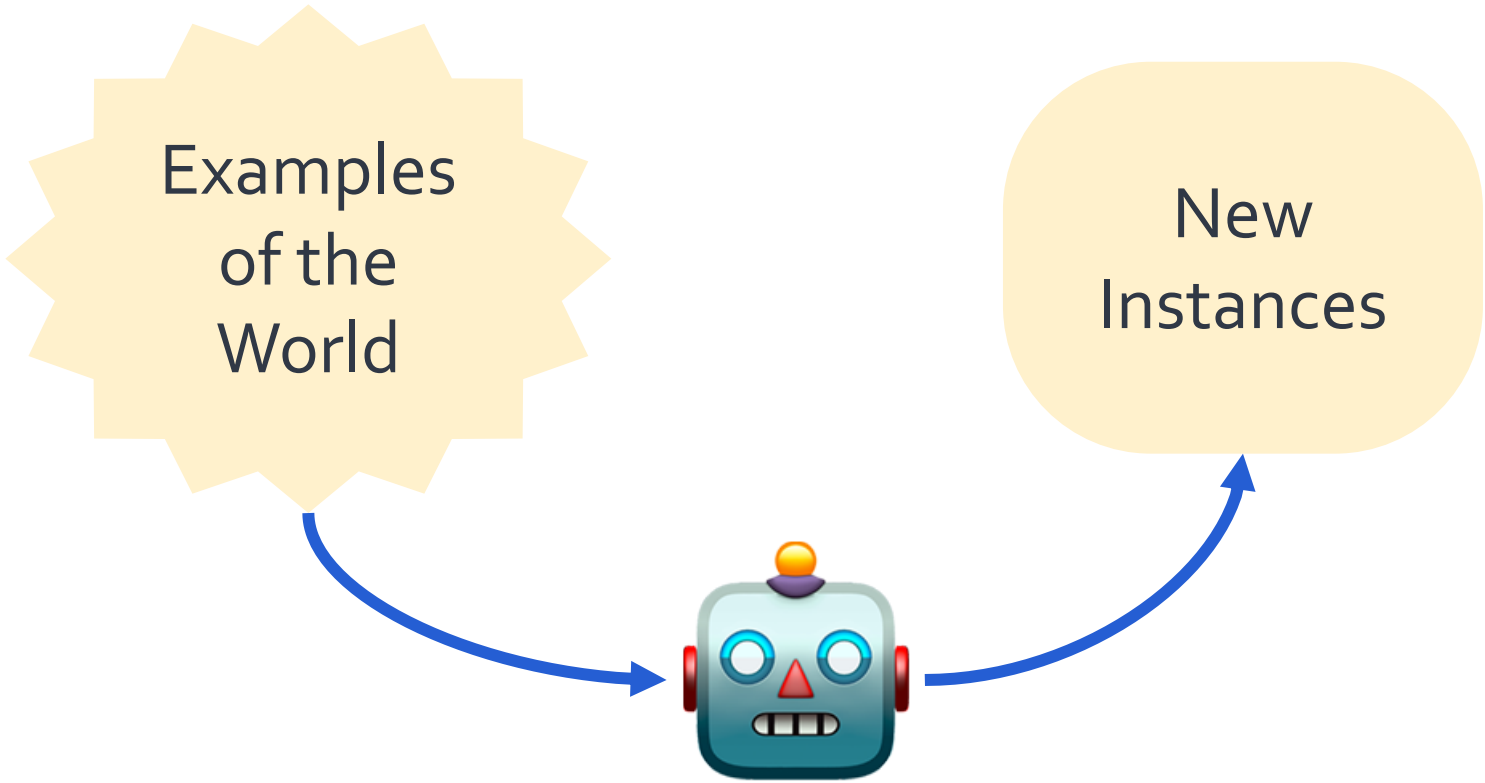

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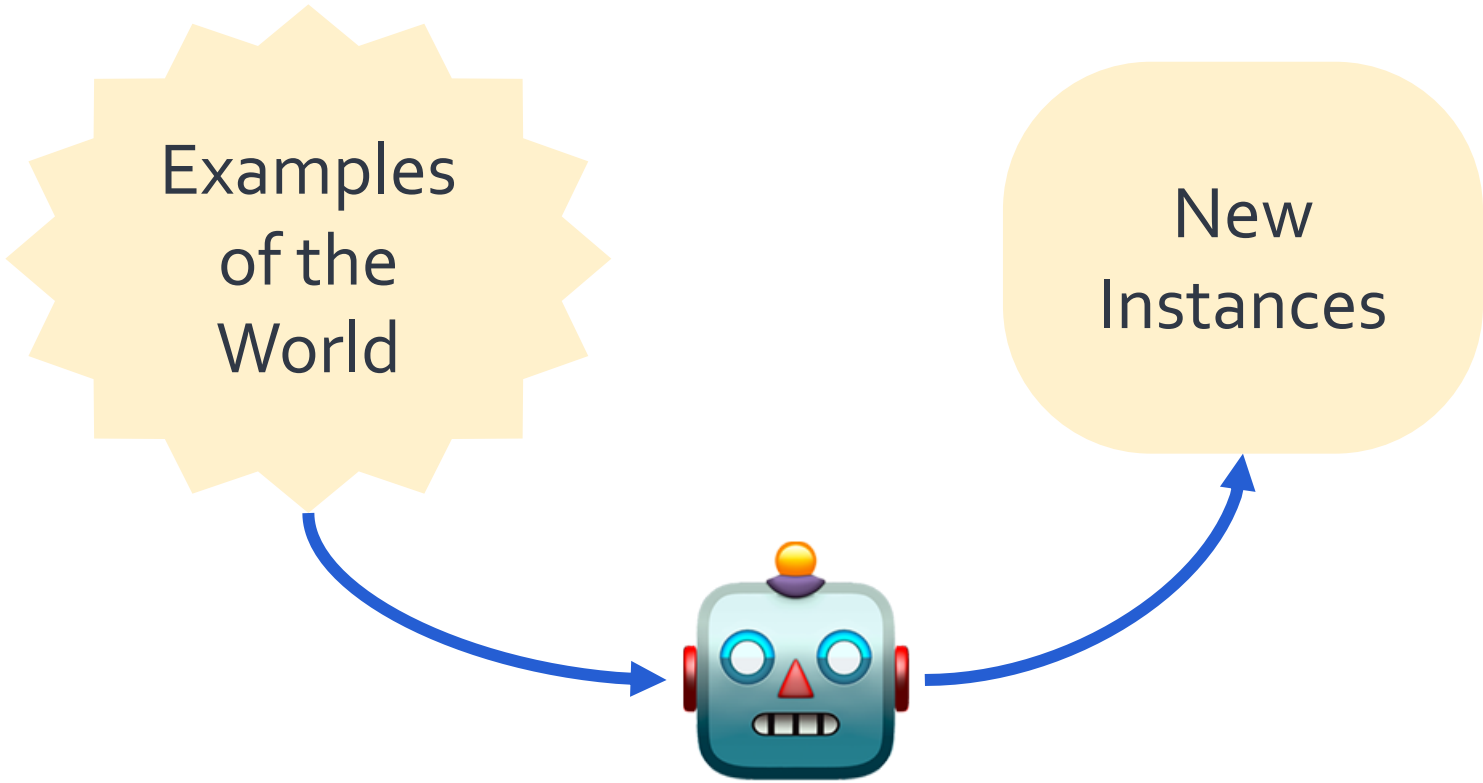

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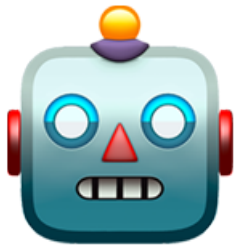
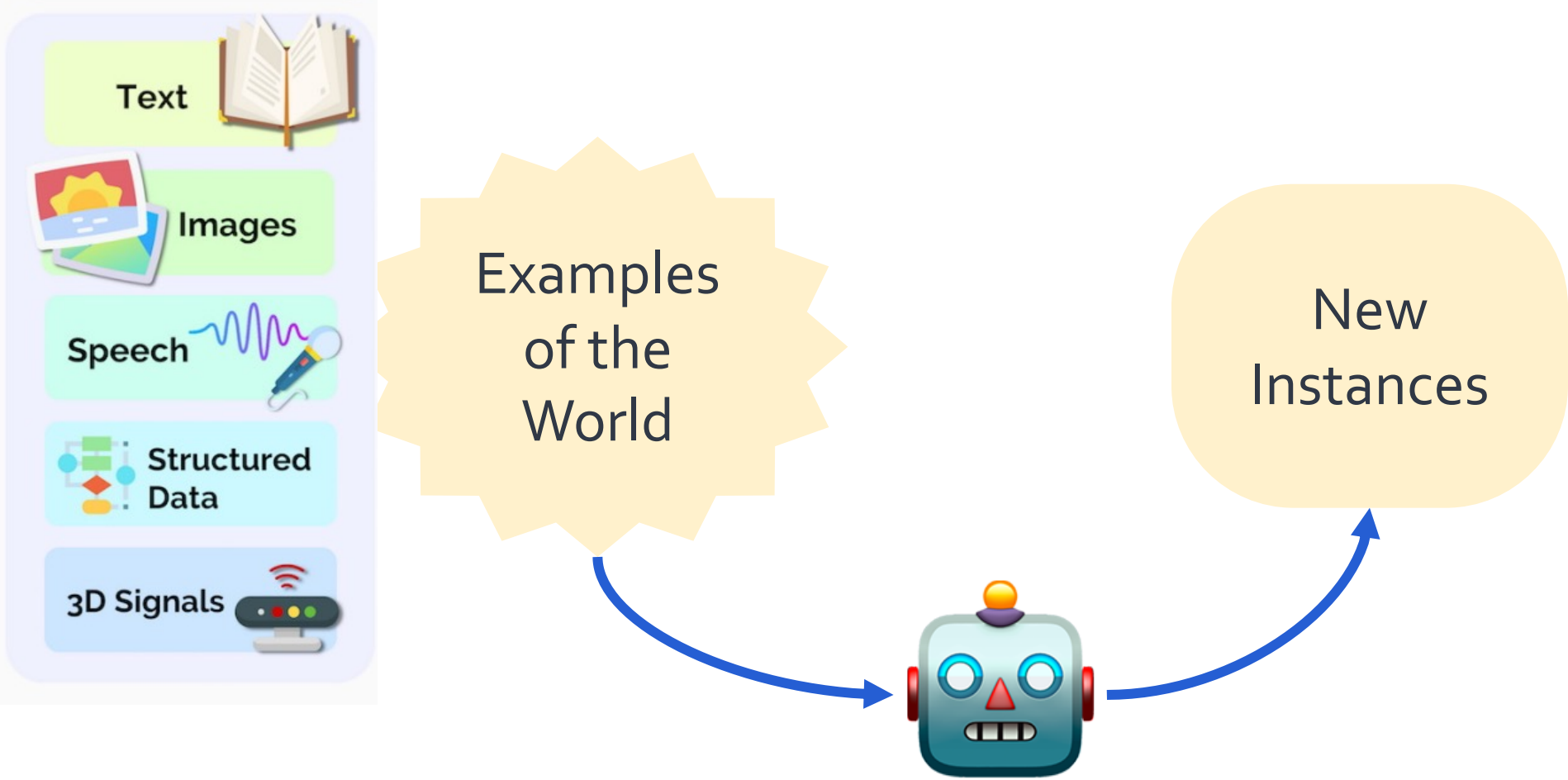
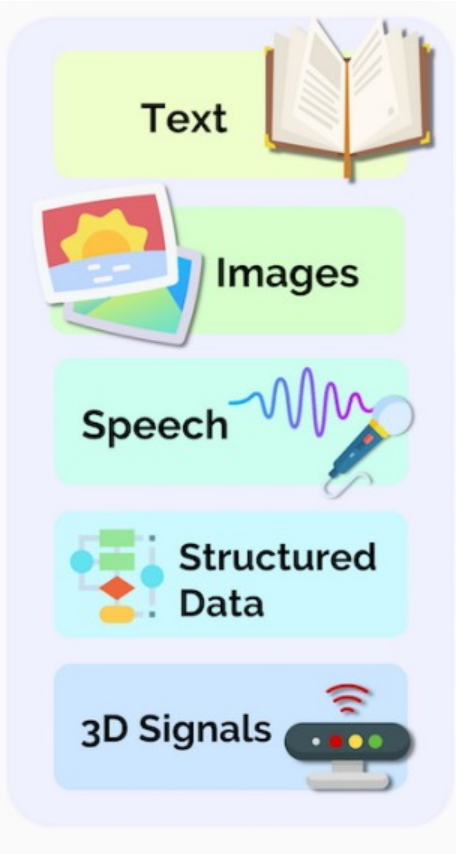


New Instances

Self-Supervised Models ~ Multi-modal Models



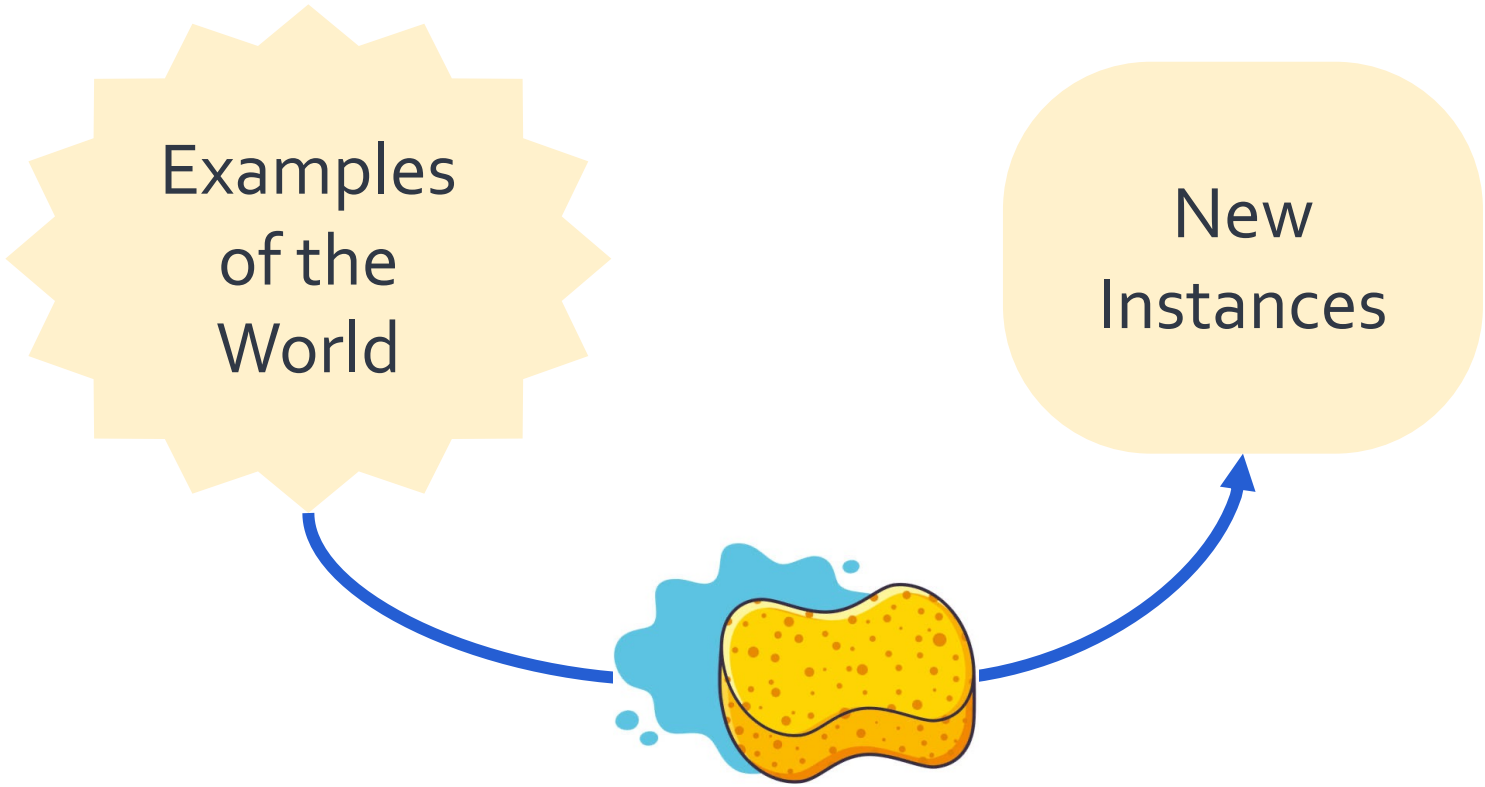
Generative AI Technologies



Examples of the World

New Instances

AI Models ~ Sponges



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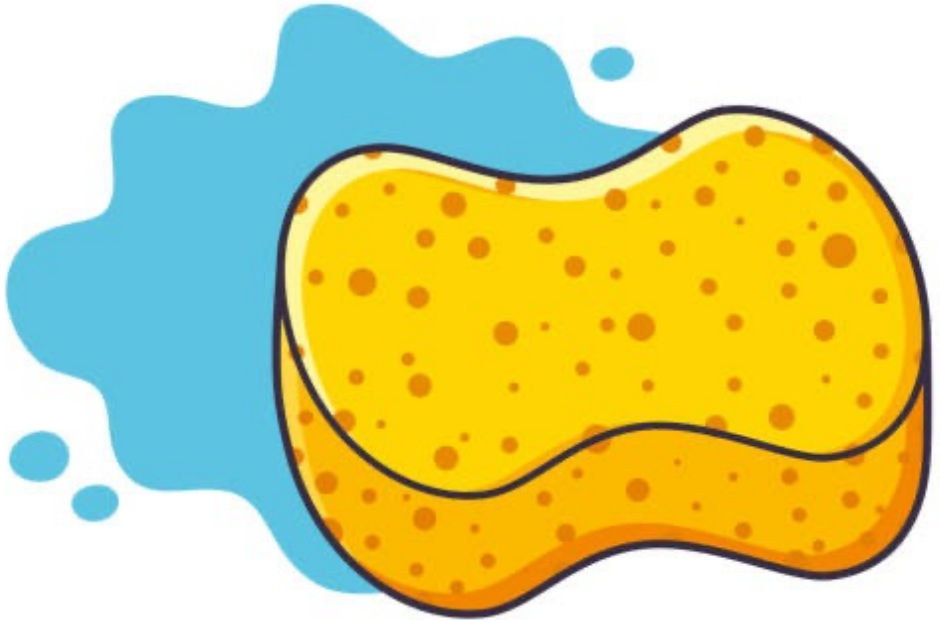

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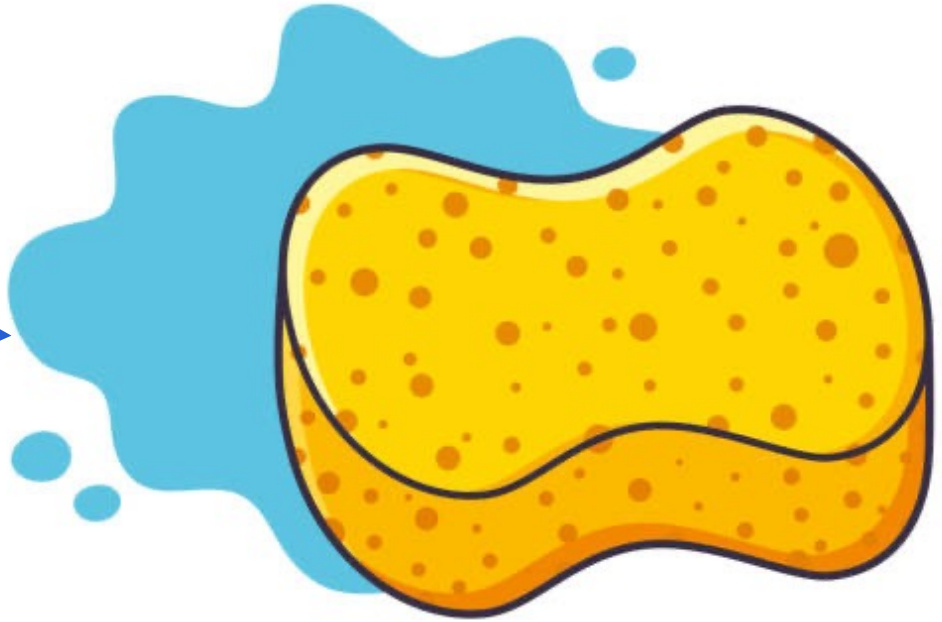

New Instances

Scaling up AI Models Makes it Better

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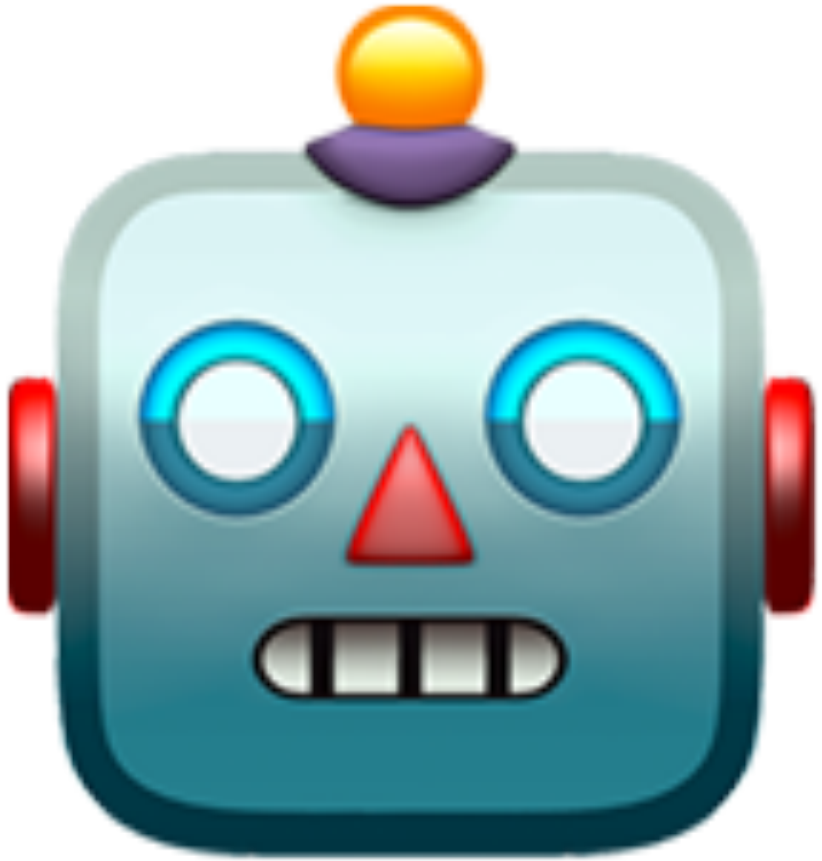

New Instances

Scaling up AI Models Makes it Better

Why not just scale all the way down???

Gartner's
hype cycle

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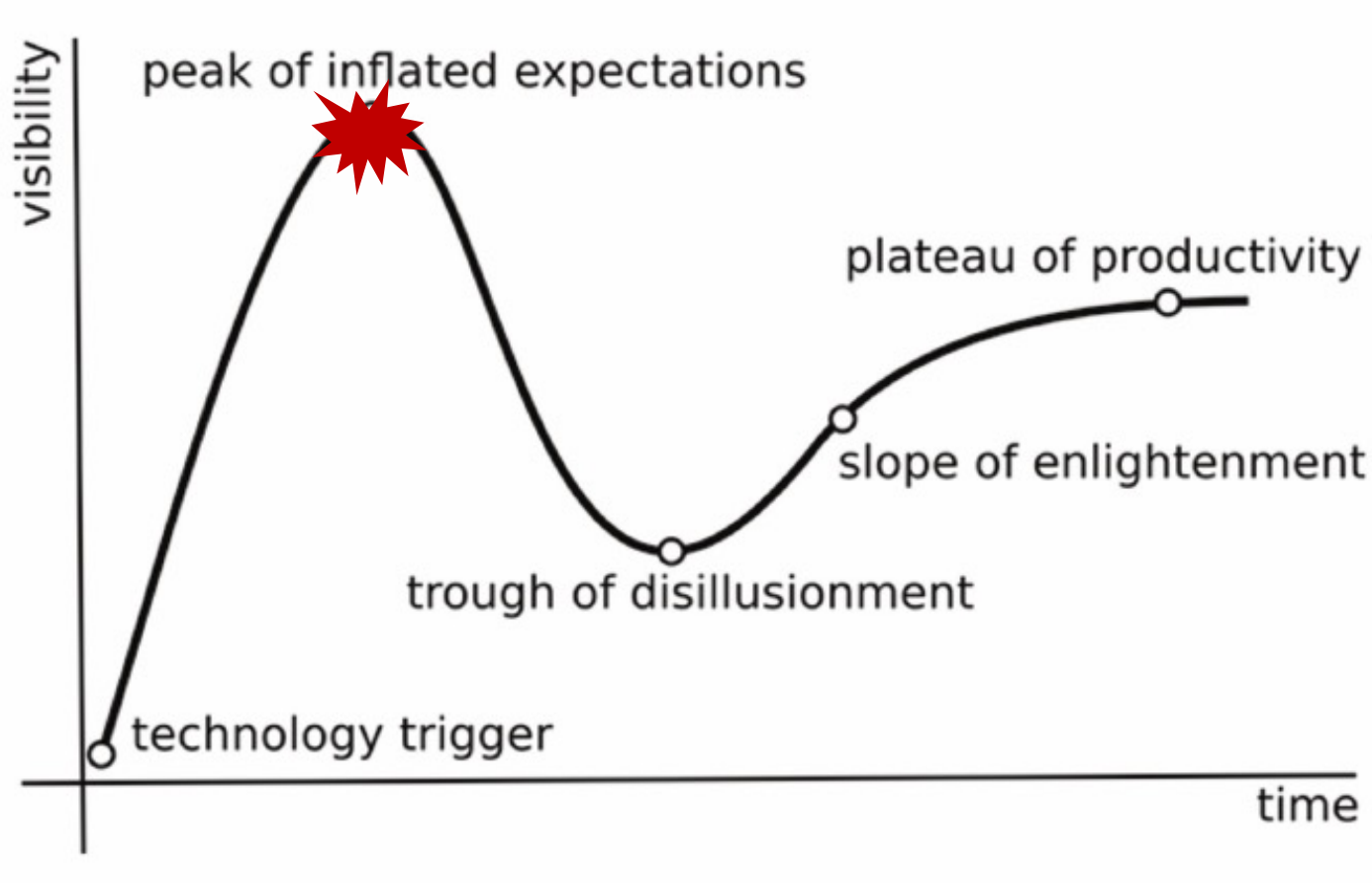

Zipf's Law — The long tail
Most things are infrequent

- Nassim Nicholas Taleb suggests that biological & social dynamics lead to asymptotic distributions

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- **Examples:**
  - Wealth,
  - popularity,
  - number of sales of books,
  - number of views on social media,
  - frequency of a word,
  - many other social phenomena …

Zipf's Law — The long tail

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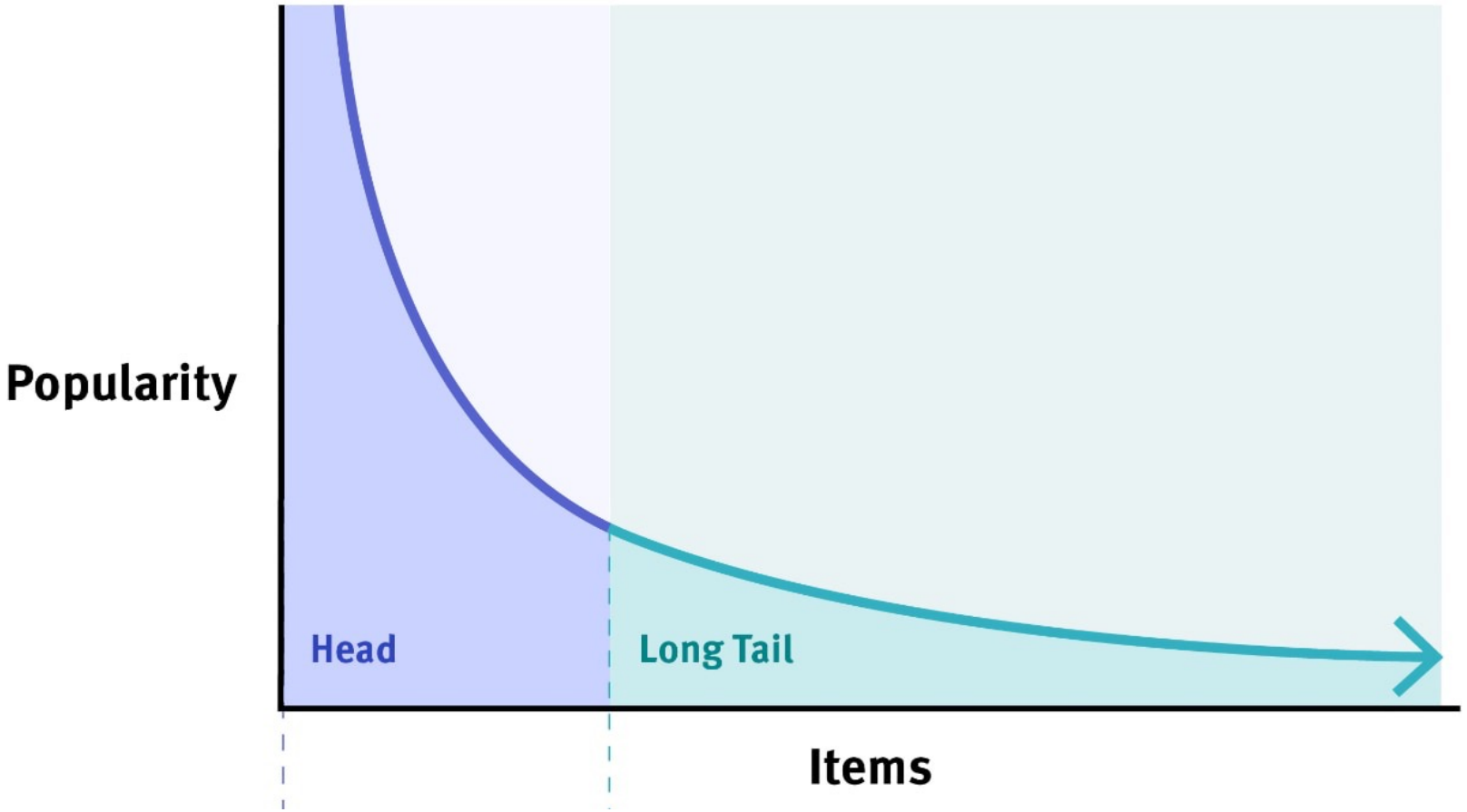
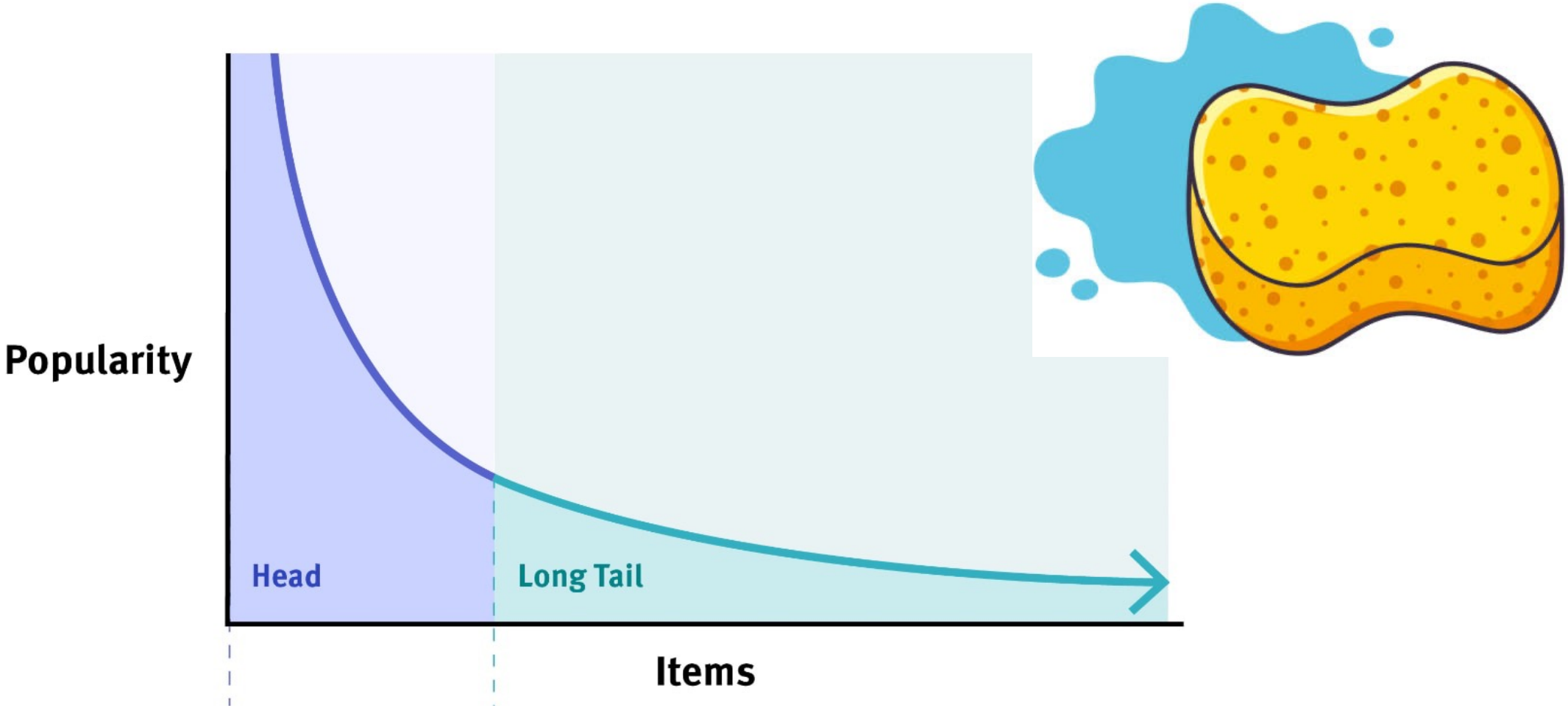


Zipf's Law — The long tail

Models' quality depend on frequency of patterns



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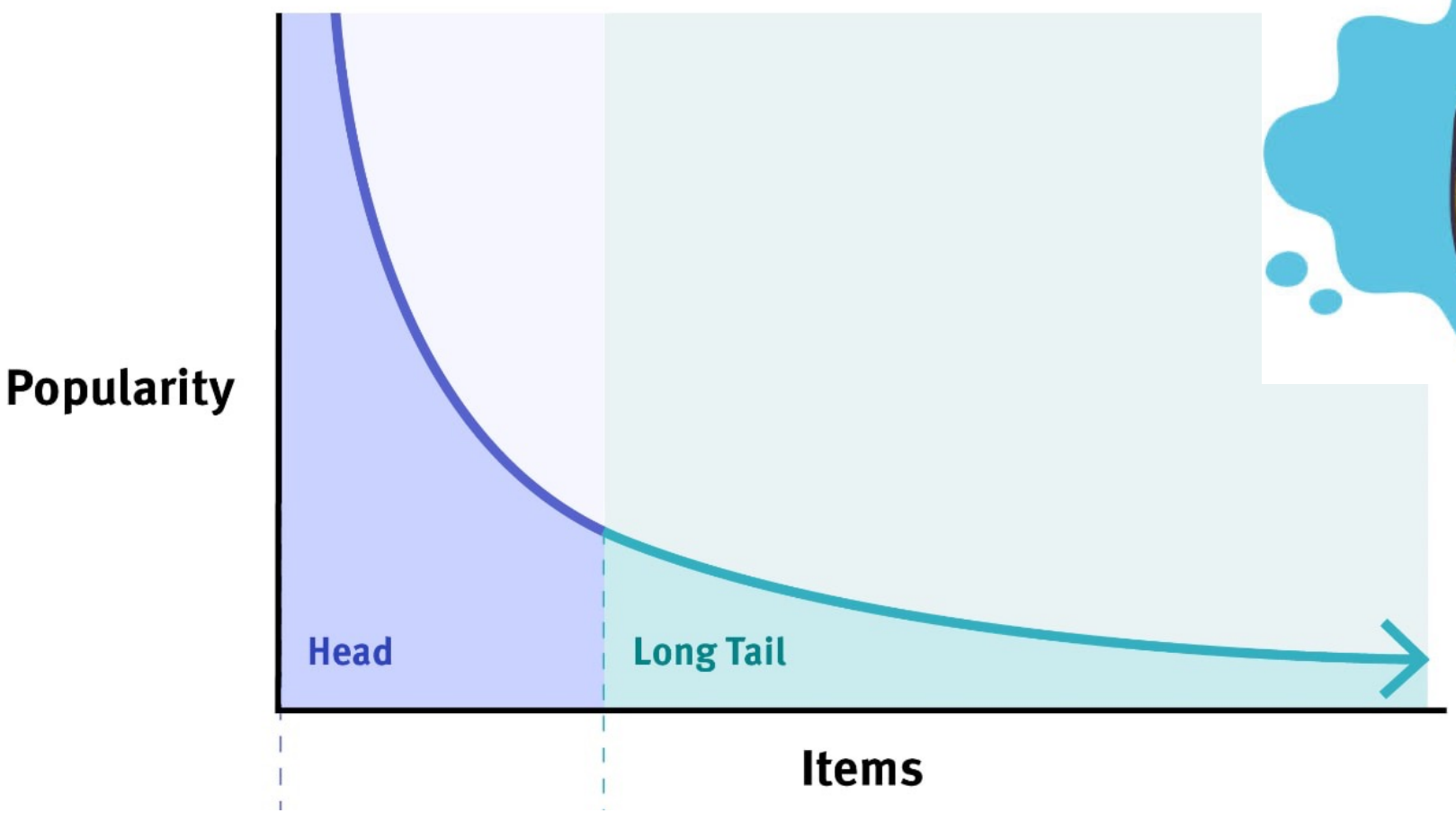

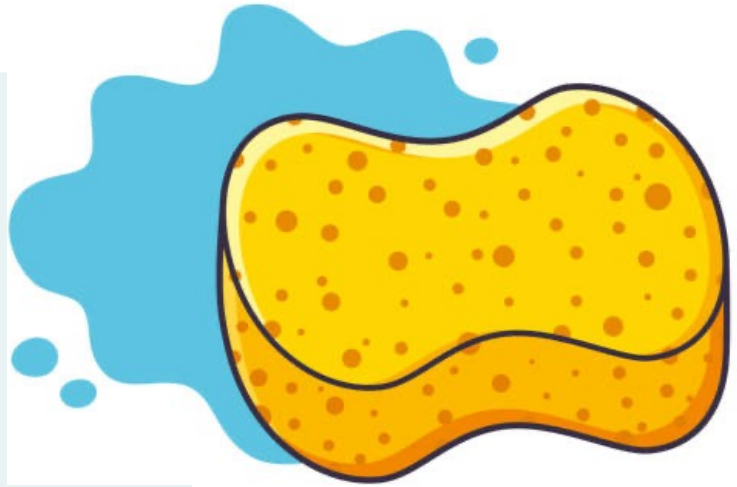

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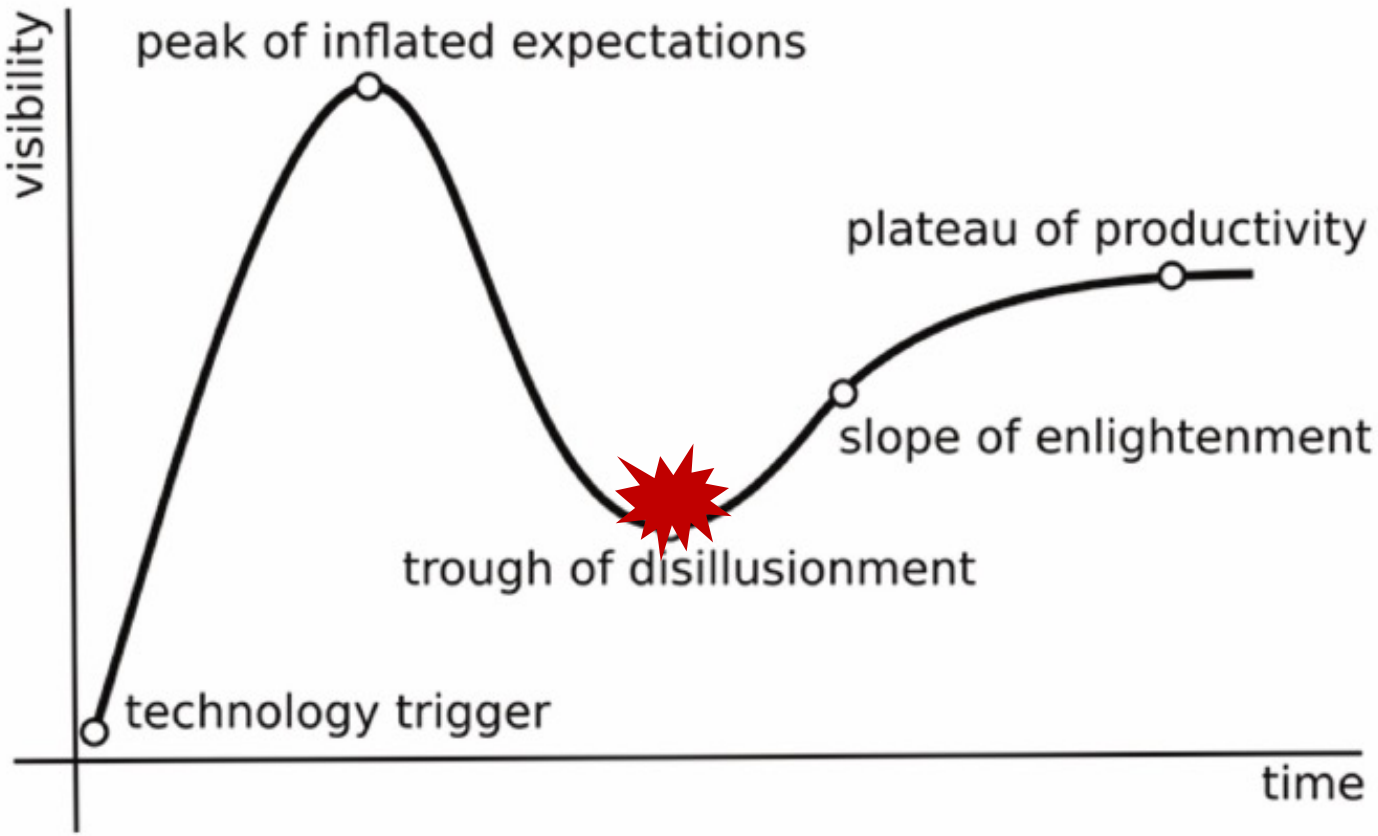
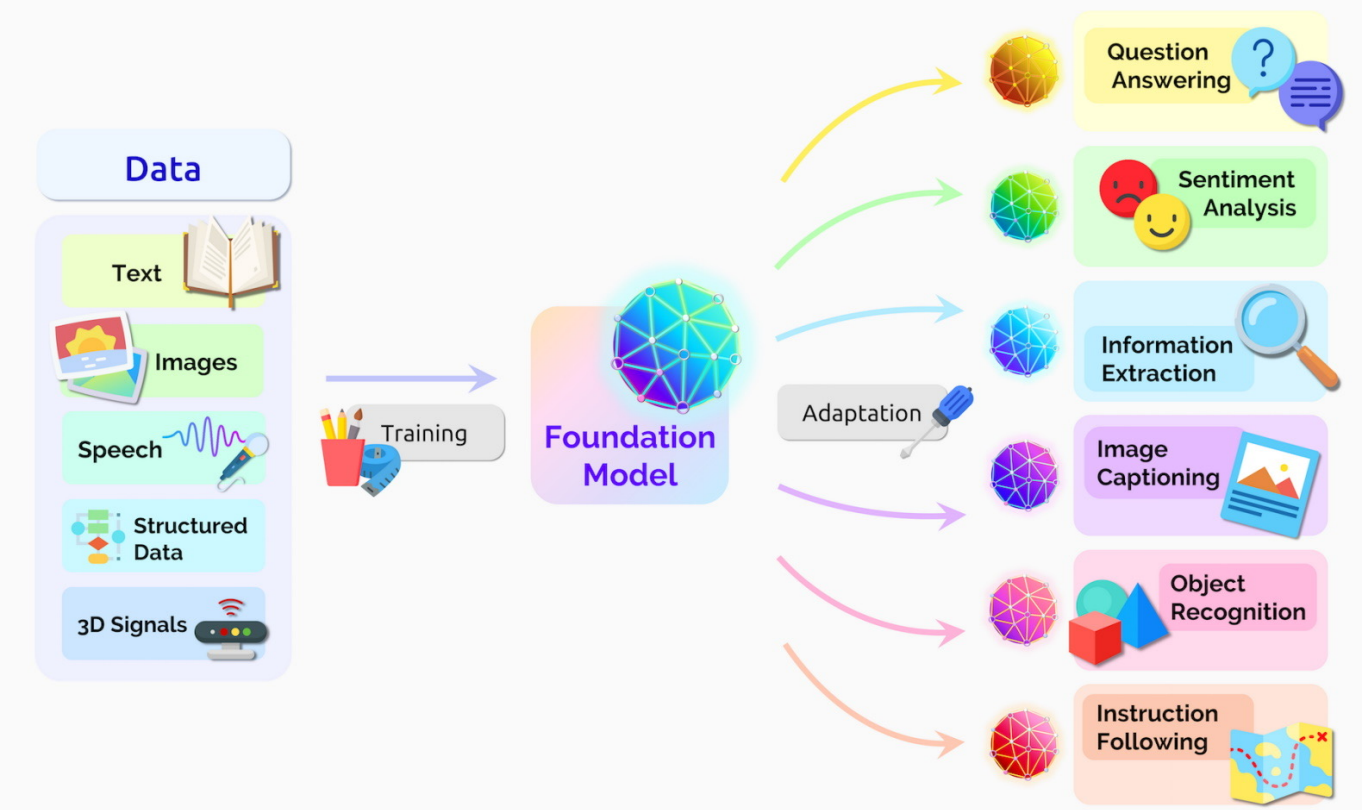


Short Term: AI as a Tool

Specialized applications allow us to constrain the model to focused use cases and overcome hallucination.

- Just like how calculator or microscope are tools.



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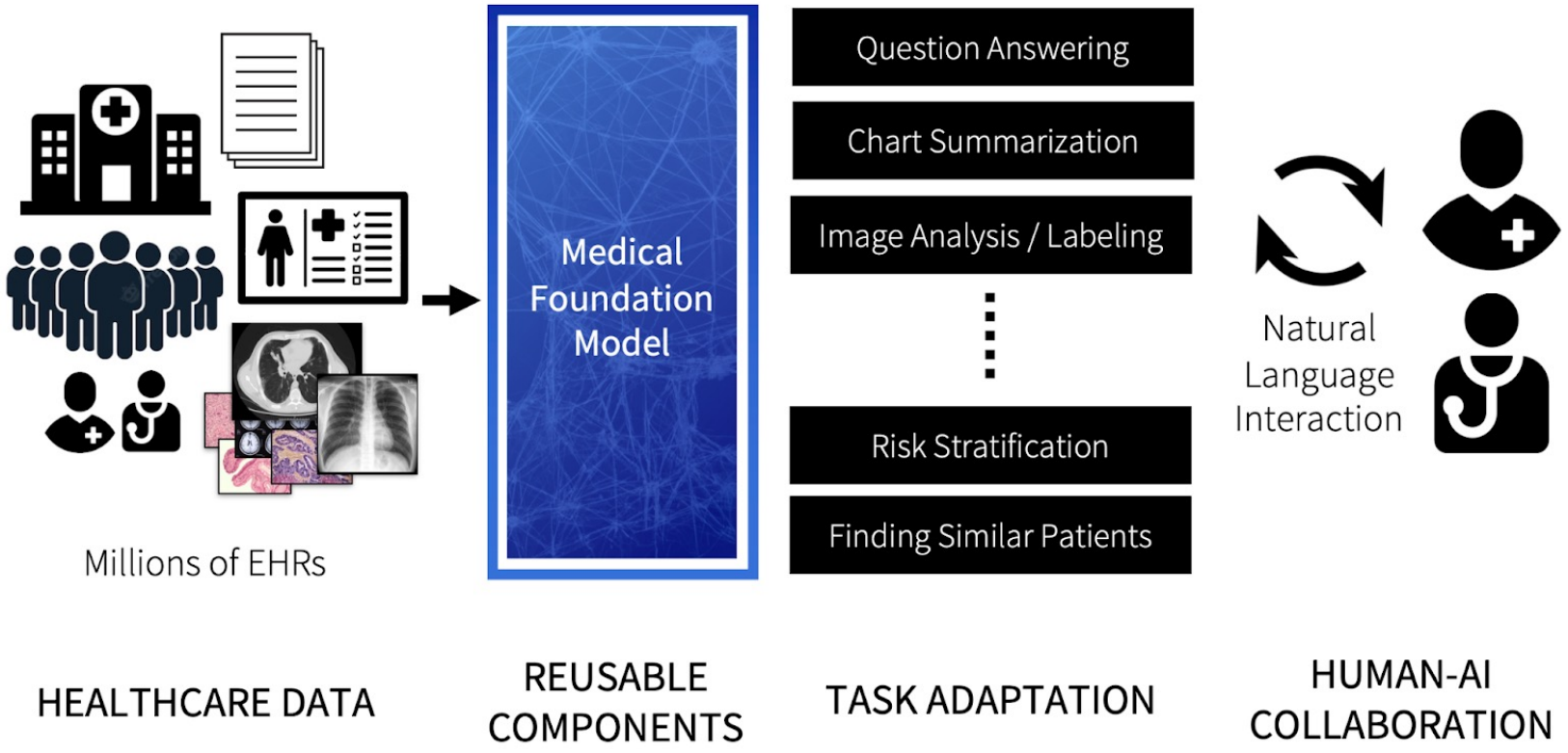
- Similarly in medical applications



https://hai.stanford.edu/news/how-foundation-models-can-advance-ai-healthcare

Highlight: Information Needs in Healthcare

"Evaluation of GPT-3.5 and GPT-4 for supporting real-world information needs in healthcare delivery", March 2023

Highlight: Information Needs in Healthcare

- Can GPT-x can serve medical information needs in a safe and concordant manner?
- **Experiment:** Prompt models with common clinical questions:

  - *"93% of GPT-4 responses are deemed **safe**"*
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"Question about risk of dying following swallowing and ingesting a toothpick."

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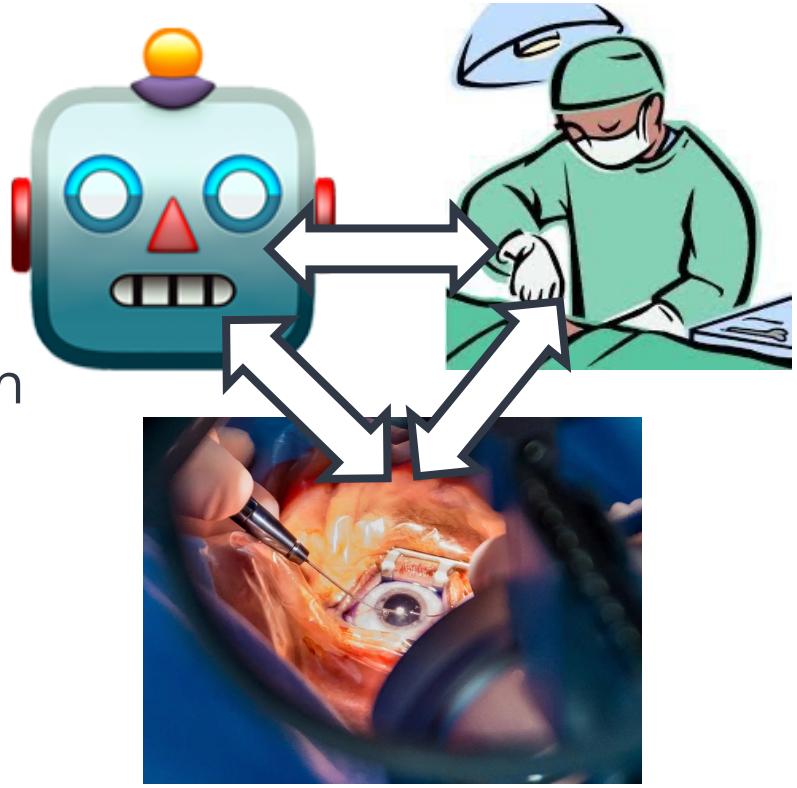
Highlight: Surgery Assistant

- **Goal:** an assistant to surgeon
  - Would provide on their weaknesses
  - Differences with other surgeons
  - Can also be used for bookkeeping in surgery room



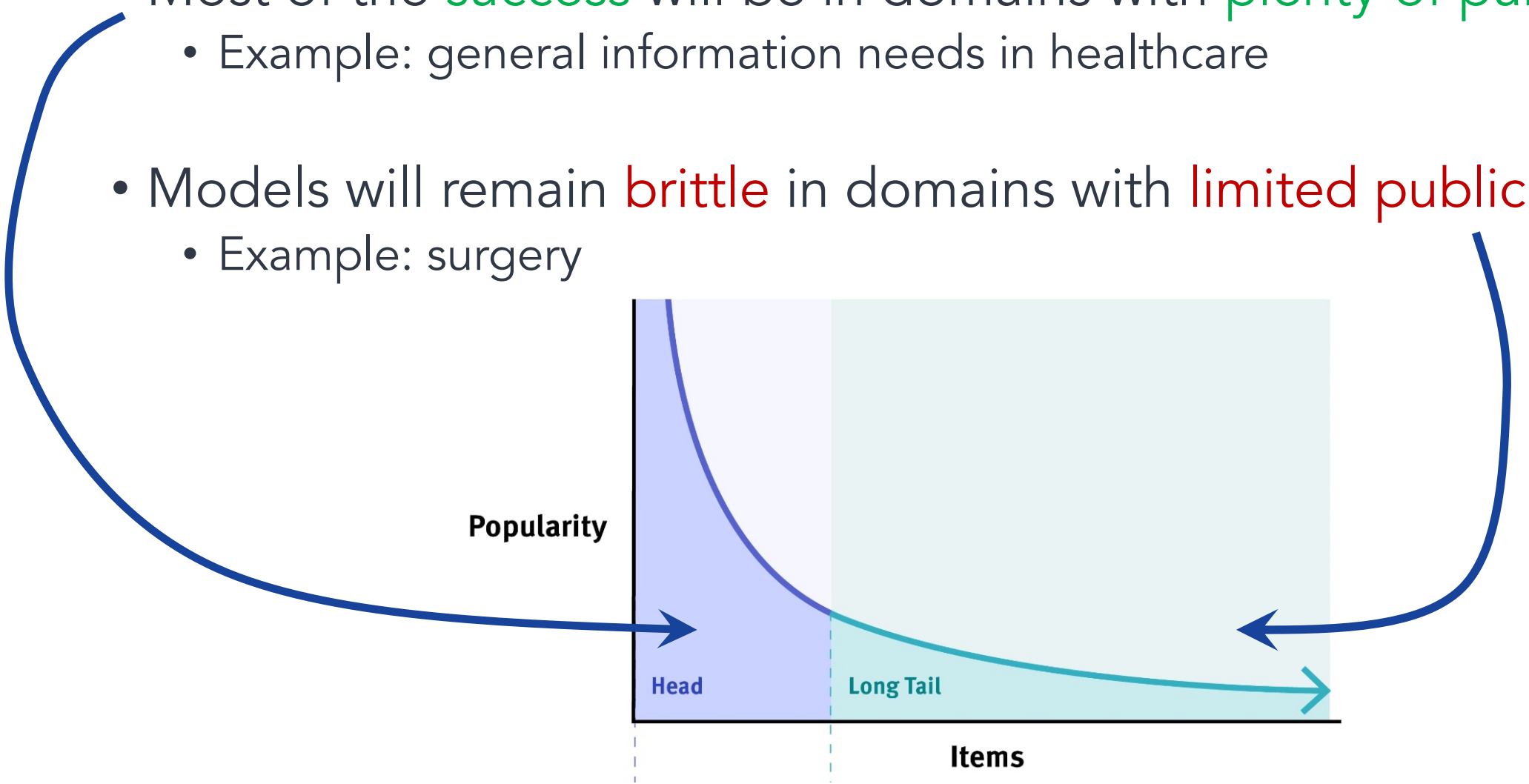
Our focus: eye surgery

- The problem is much more difficult due to limited data

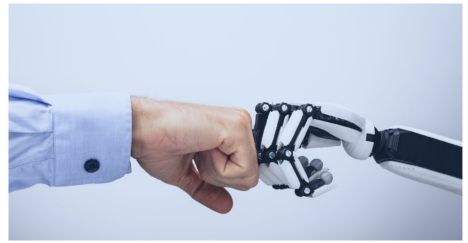
PIs: Swaroop Vedula, Shameema Sikder, Vishal Patel, Greg Hager, …

Going Forward …

- Most of the success will be in domains with plenty of public data.
  - Example: general information needs in healthcare
- Models will remain brittle in domains with limited public data.
  - Example: surgery

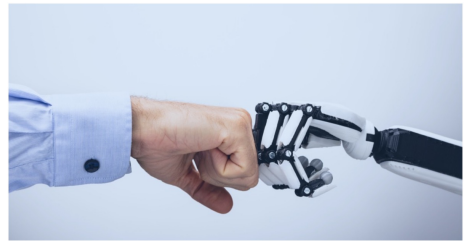


Human-AI Collaboration



Human-machine complementarity will bring opportunities

Human-AI Collaboration



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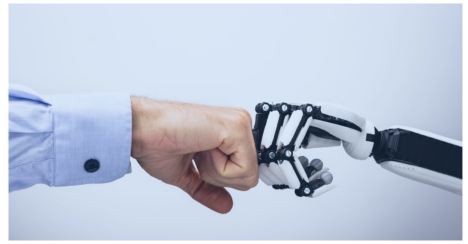
Things easy for humans

Human-AI Collaboration



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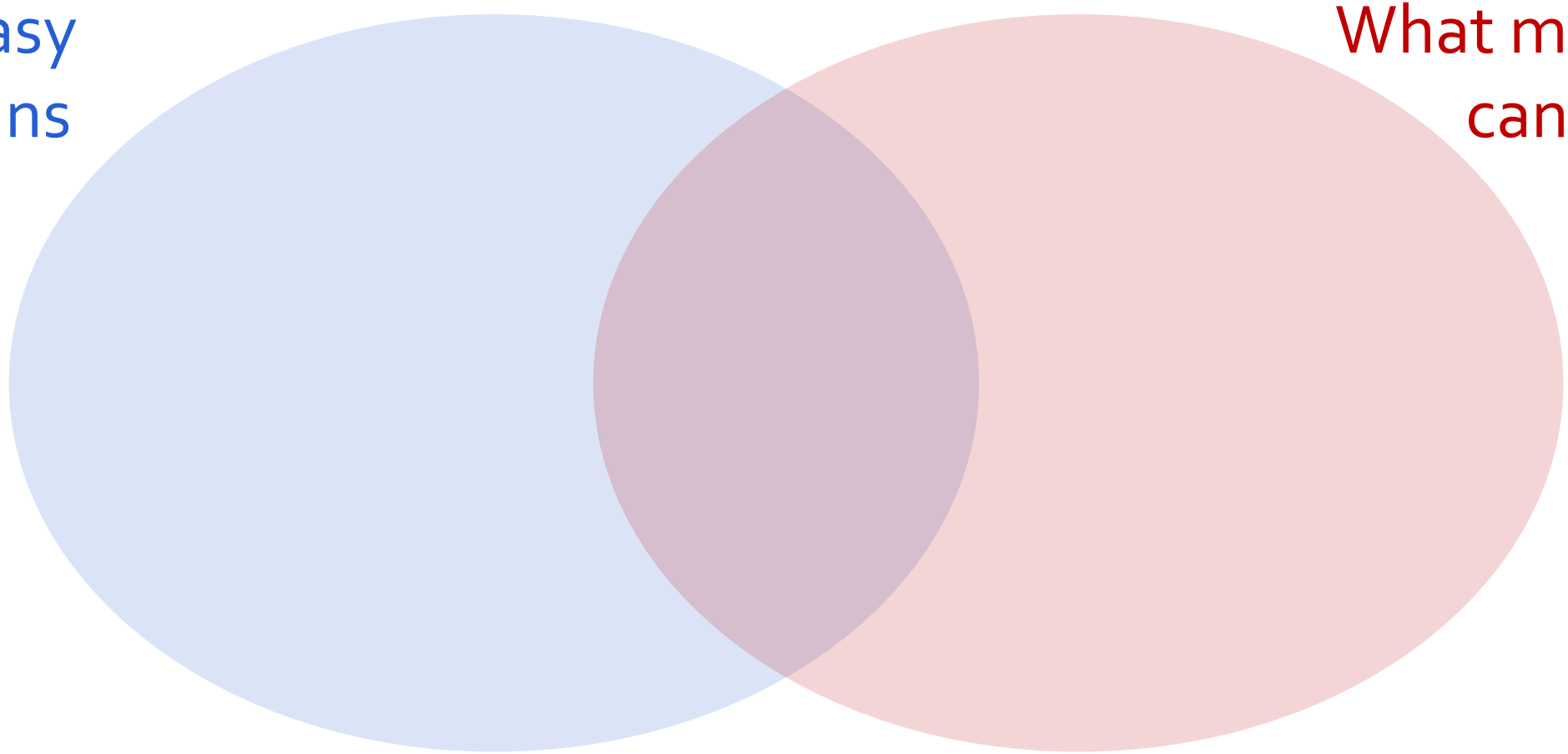

Human-AI Collaboration

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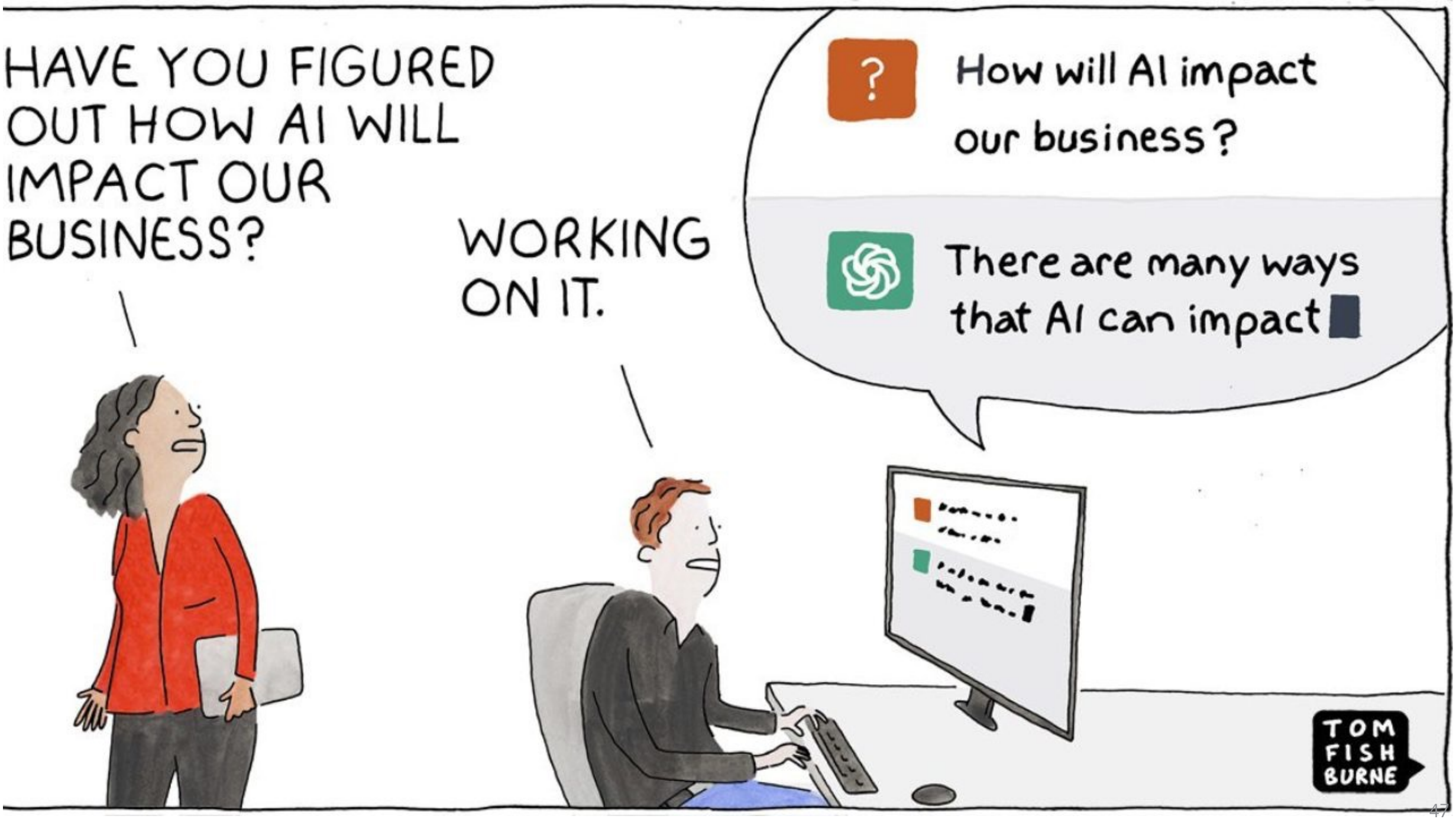
Opportunity for human-AI colab

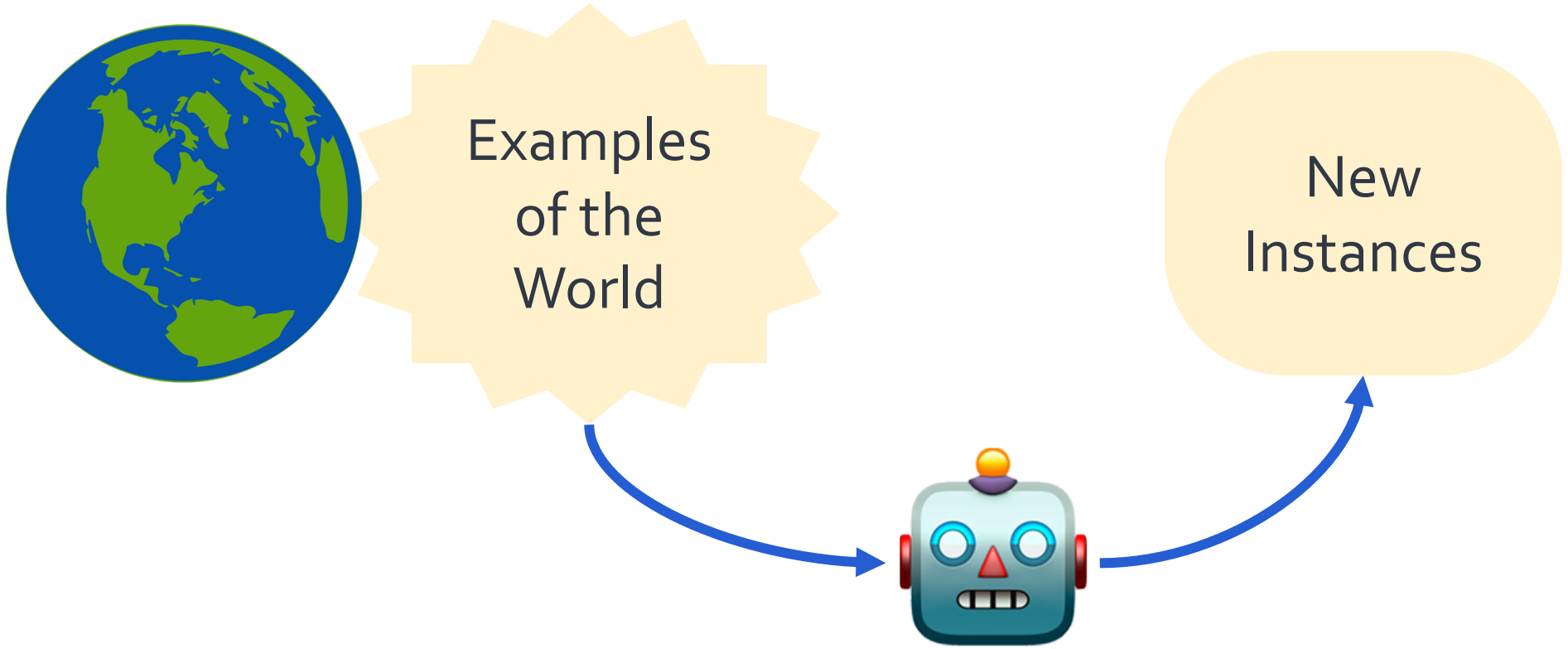
things that humans are slow at


HAVE YOU FIGURED OUT HOW AI WILL IMPACT OUR BUSINESS?
WORKING ON IT.
How will AI impact our business?
There are many ways that AI can impact
TOM FISH BURNE

Let’s talk about
concerns …

Danger: Web-Scale Poisoning

- Remember we said, most of the success will be in domains with plenty of public data.



"Poisoning Web-Scale Training Datasets is Practical", 2023

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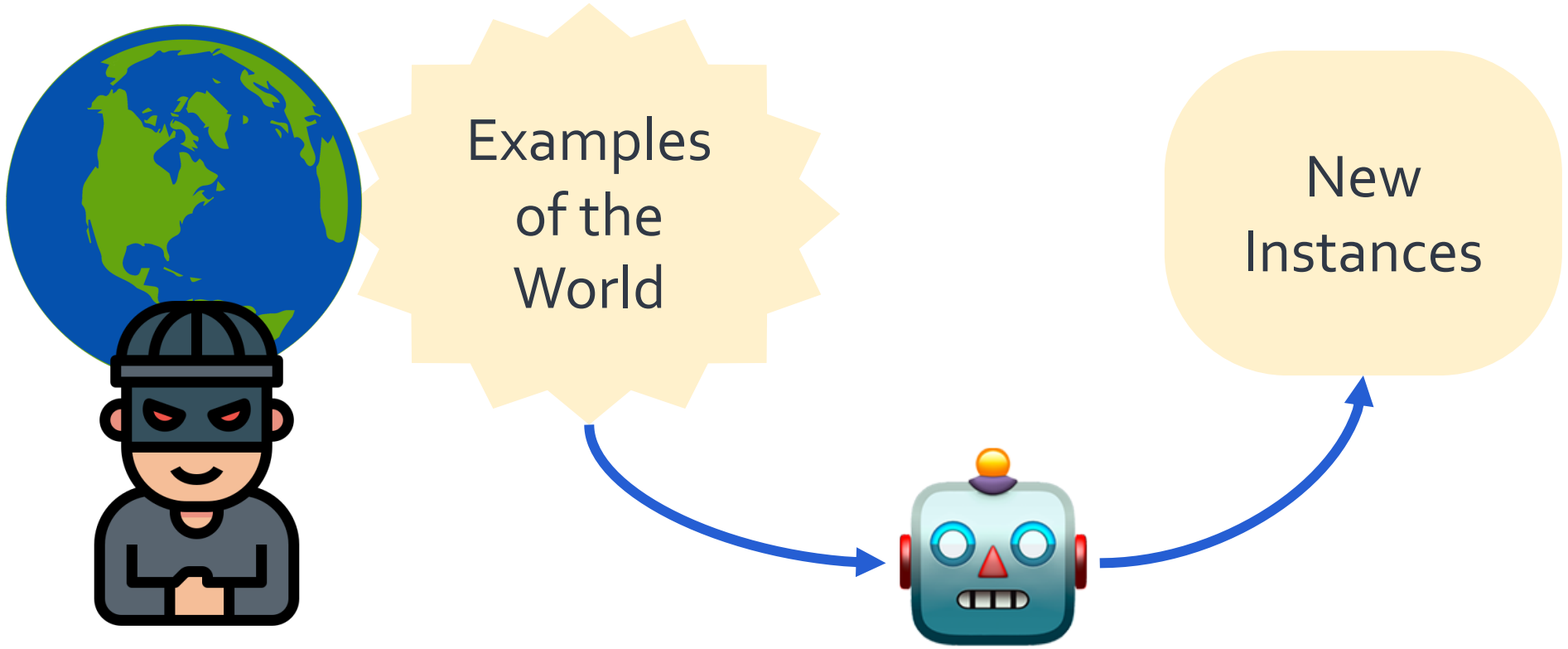

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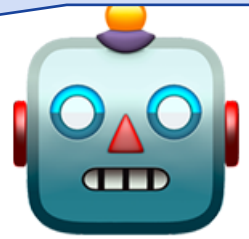
A wide range of options for "poisoning":

- Adding incorrect information
- Changing the distribution of the factual data
- Adding or modifying the URLs
- …



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- Age-old question, but now:
  1. More hunger for data
  2. Traces of data has become less conspicuous.

- Easy answer: Ultimately the choice should be with the person who is giving up the data.
  - But do the users know what they're giving up?

Danger: Giving up Too Much + Sudden Change

- Gradually we are giving up more of our autonomy.
- There is a future where AI systems will be making more society-level decisions by optimizing various proxy objectives.
- On most days, things will work just fine.
- From time-to-time AI systems may fail catastrophically
  - Various society-level distributional drifts, such as a conflict between states, a natural disaster, a serious cyberattack, etc.

"What failure looks like", Paul Christiano 2019

Putting it Together

- I am excited and nervous.

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- The opportunity to make many jobs more efficient is exciting.

- With expansion of digital society, there is increasing room for malicious activities in cyber space.

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- Copyright policy
  - My take: things won't change unless something bad happens.

- Over-optimizing for market.
  - Example: snapchat AI
  - Quite concerning.

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- Copyright policy
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- Over-optimizing for market.
  - Example: snapchat AI
  - Quite concerning.
- Job market:
  - My take: real concern, but I am optimistic.
  - Change will be slower than people think.
- Concerns about super-intelligence
  - I am concerned.

Room for Collaborations

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- We understand the technical tools and challenges.
- You understand the policy/application landscape.
- Dream team? 😉

Thanks!