Model design and data collection

GENERATIVE AI CONCEPTS



Daniel Tedesco
Data Lead, Google

datacamp

Know how to fill the tank





[1] GM Fairfax Assembly Plant

Developing a model

Model Development Steps

1. Research and design
2. Training data collection
3. Model training
4. Model evaluation

Stable Diffusion's research and development

Example output from Stable Diffusion



Stable Diffusion's R&D

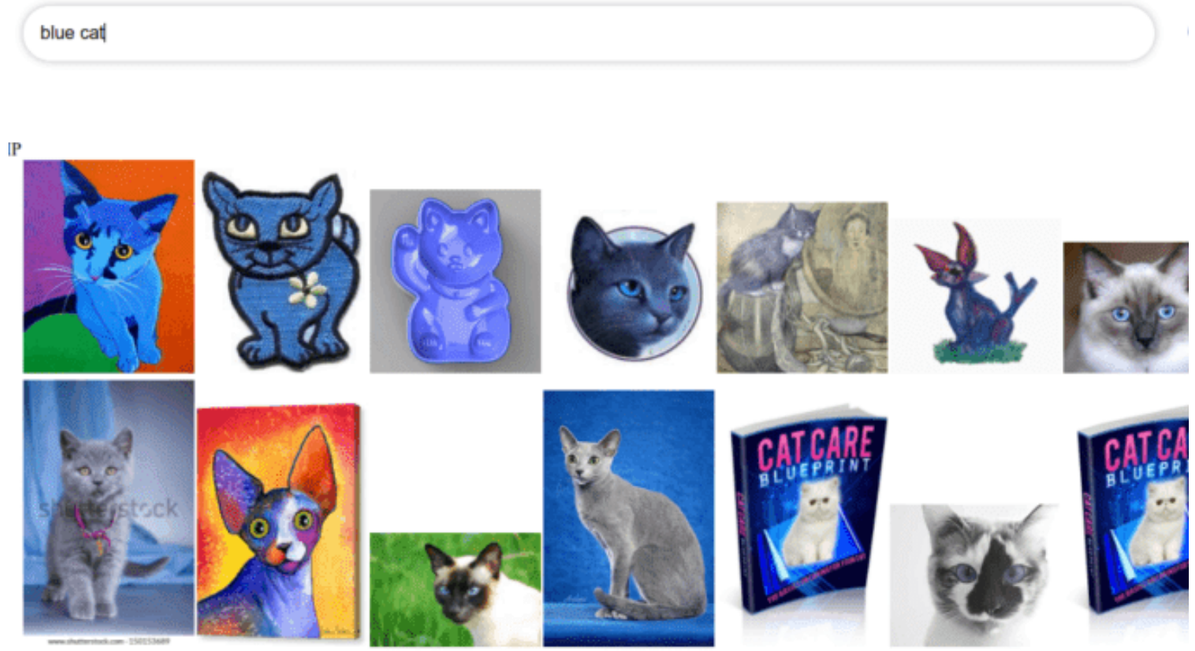
- Purpose: Decide on image generation
- Architecture: Settle on diffusion model
- Resources: 256 GPUs, 150k hours, $600k

[1] Stability AI, Emad Mostaque Twitter post

Data collection: not your typical ML model

Training data preparation

- Massive amounts required
- Diverse, context-rich data
- Requires preprocessing



[1] Laion blog

Data collection: privacy and security are critical

Training data preparation

Personally Identifiable Information (PII)

- Anonymize or aggregate
- Store in secure location with controlled access



Let's practice!

GENERATIVE AI CONCEPTS

Model training

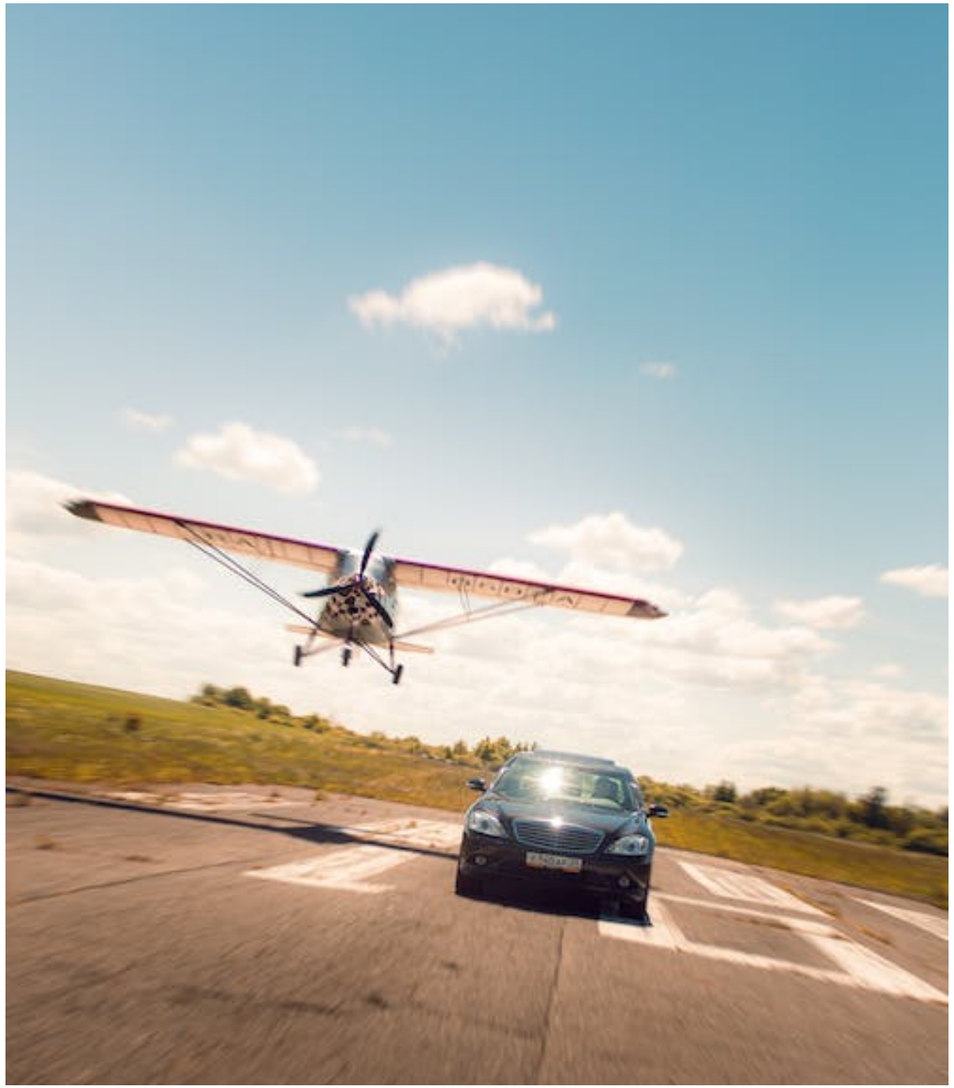
GENERATIVE AI CONCEPTS



Daniel Tedesco
Data Lead, Google

datacamp

Pick your mode of train-sportation



1. Hardware
2. Time
    - Dataset size
    - Model complexity
    - Rounds of training
3. Cost

Graduate to advanced techniques

- Foundation generative AI model is a first step
- Advanced techniques specialize them for specific contexts

Key advanced techniques:

1. Transfer learning and fine-tuning
2. RLHF
3. Custom embeddings



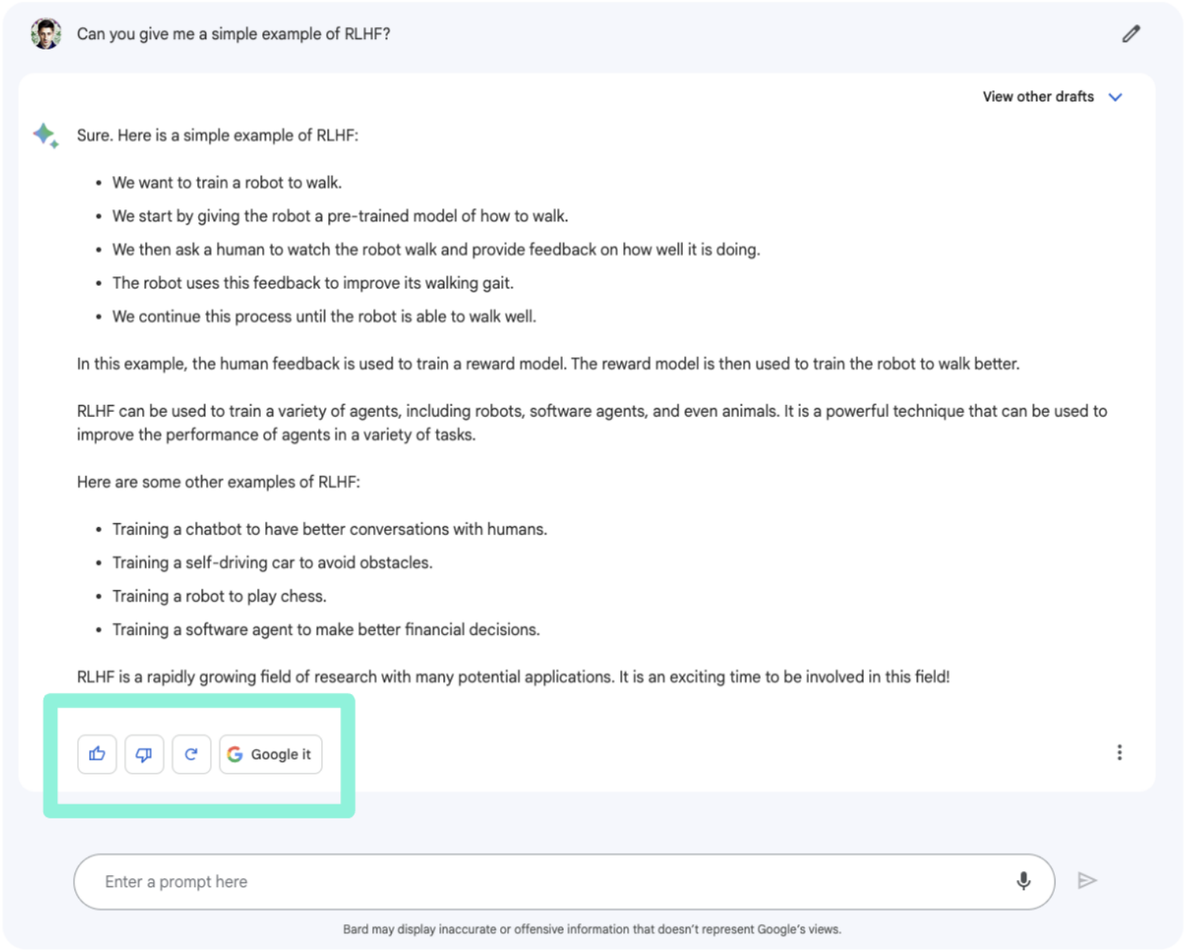
From cats to lions

- Transfer learning transfers knowledge from one task to another
- Fine-tuning is a type of transfer learning for a small dataset



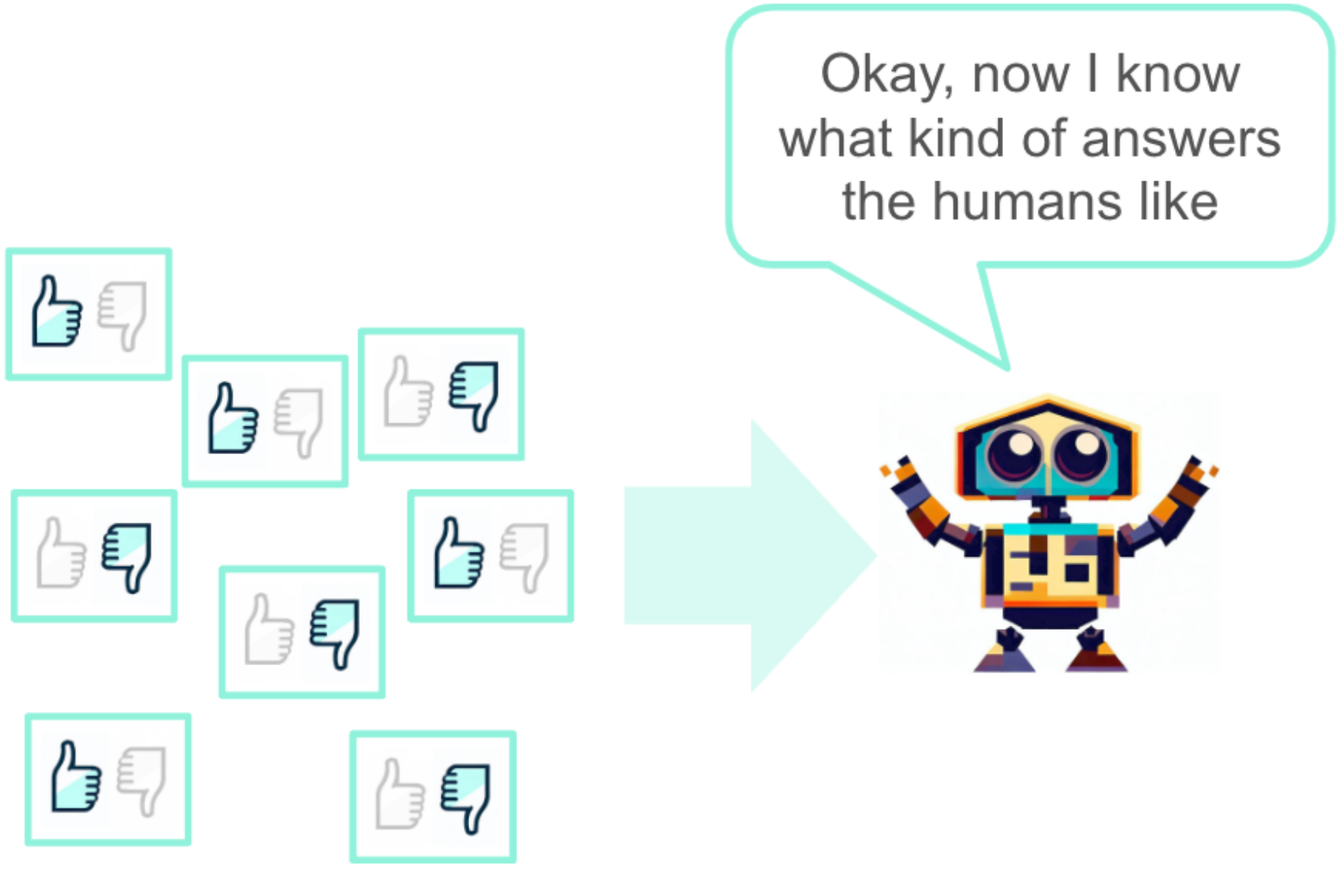
[1] Creative Commons Attribution-Share Alike 4.0, Bing image generator

Where does your feedback go?



[1] Google Bard, 2023

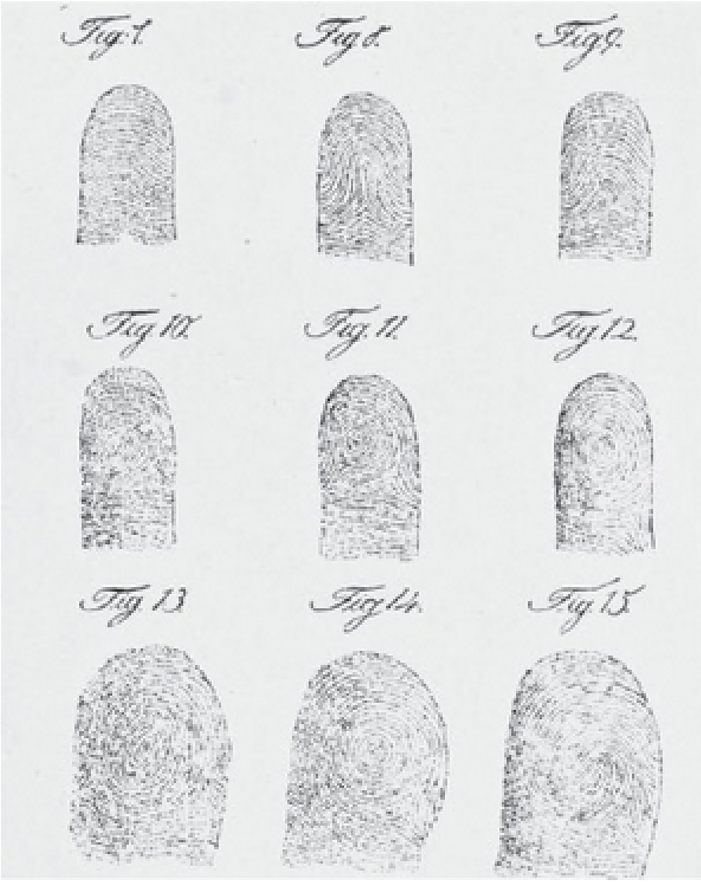
Thumbs up for better responses



[1] Google Bard, 2023

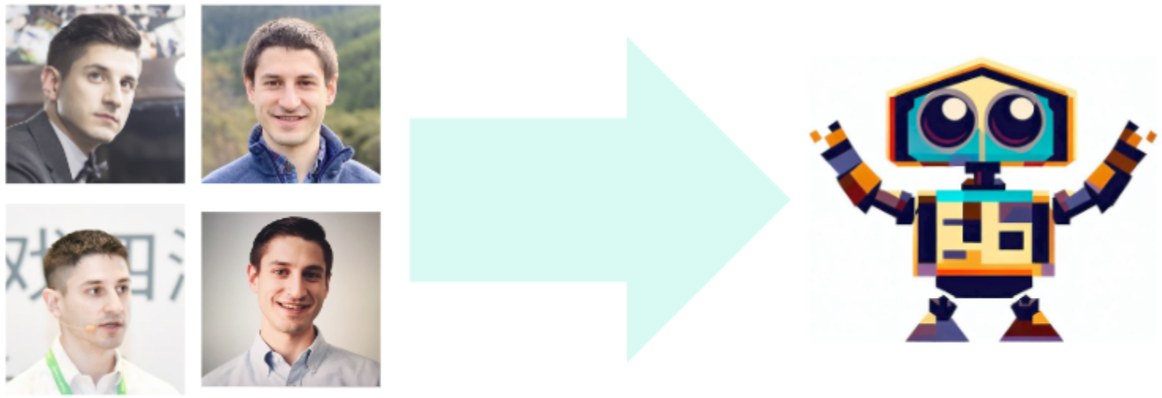
Embeddings as fingerprints

- Similar to recognizing a fingerprint
- Unique representations of data entities
- Capture meaning, context, and relationships in compact form



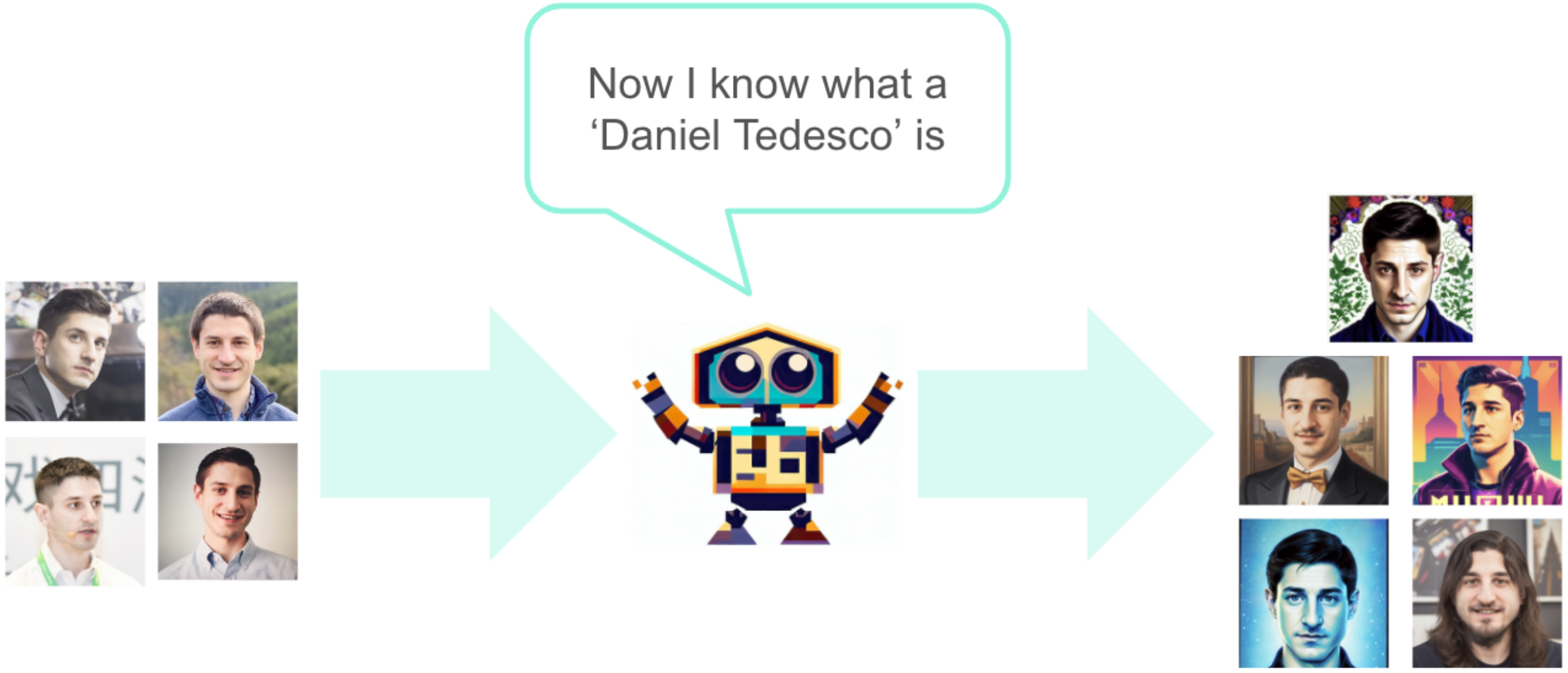
[1] Wikimedia commons

Embedding Dan



[1] Daniel Tedesco, 2023

Embedded Dan



[1] Daniel Tedesco portraits from vana.com

Let's practice!

GENERATIVE AI CONCEPTS

Model evaluation

GENERATIVE AI CONCEPTS



Daniel Tedesco
Data Lead, Google

datacamp

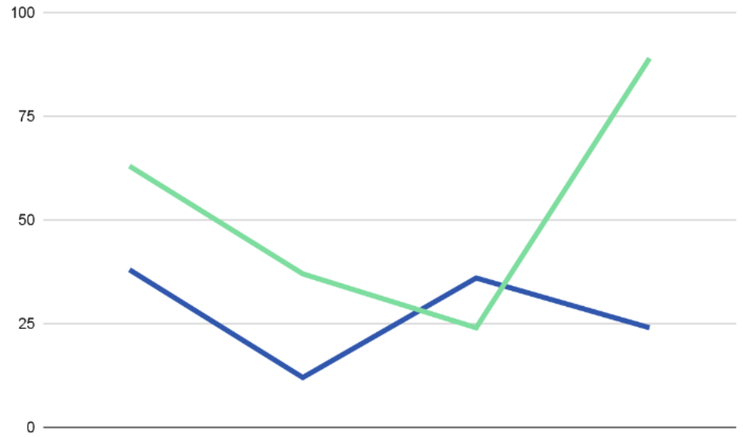
Why evaluate anyway?

Assess performance and effectiveness of a model:

- Measure progress
- Rigorous model comparison
- Benchmark human performance

Evaluating generative AIs

Quantitative Metrics



- Discriminative model evaluation metrics
- Generative model-specific metrics

Human-centric Metrics



- Human performance comparison
- Intelligent evaluation

Discriminative model evaluation techniques

Measure performance on well-defined tasks

Pros:

- Widely accepted and understood
- Easy to calculate and compare

Cons:

- Do not capture subjective nature of generated content



Generative model-specific metrics

Customized for particular generative tasks

Pros:

- Nuanced criteria, like realism, diversity, and novelty
- Many well-known metrics

Cons:

- Cannot capture many subjective elements
- Often do not generalize



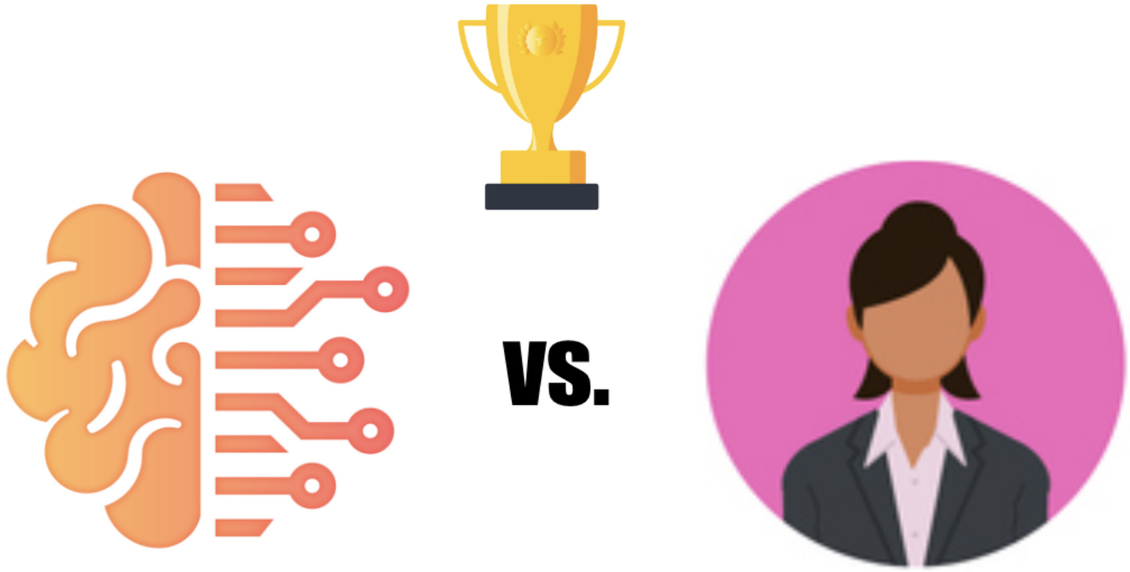
Human performance comparison

Pros:

- Benchmarks against human abilities
- Demonstrates practical applicability

Cons:

- Unfair comparison

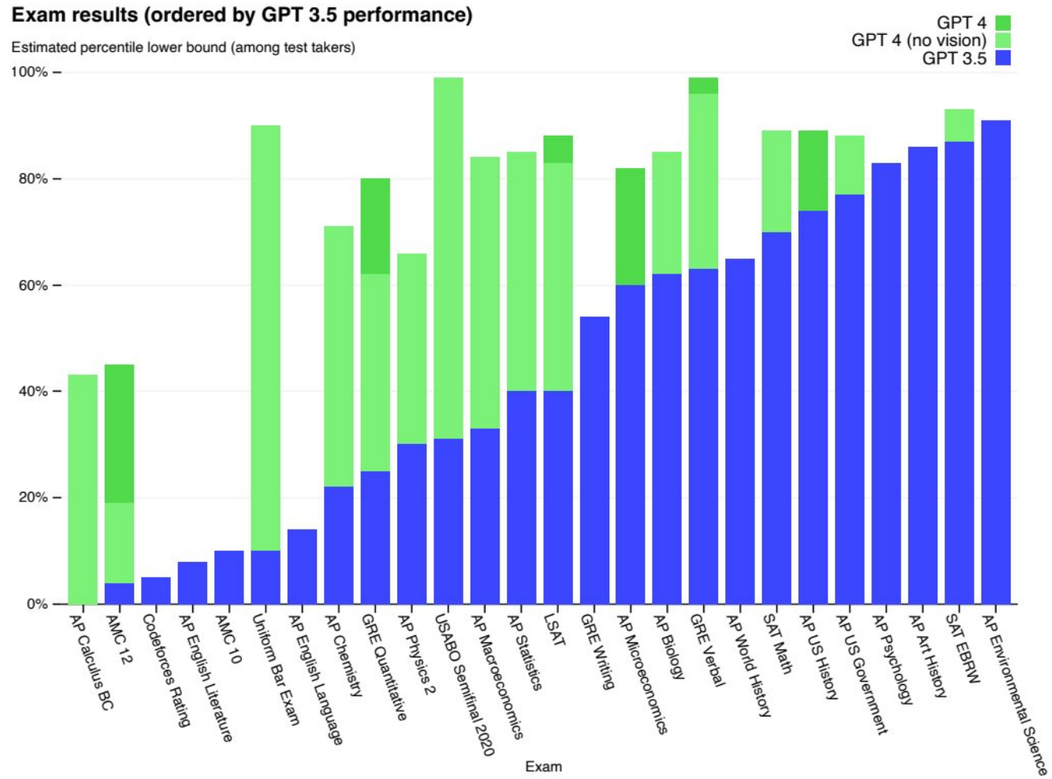


Award-winning AIs

Human Competitions



Human Standardized Tests



[1] https://twitter.com/colostatefair/status/1565486317839863809, OpenAI

The gold standard

Intelligent evaluation by humans or other AIs

Pros:

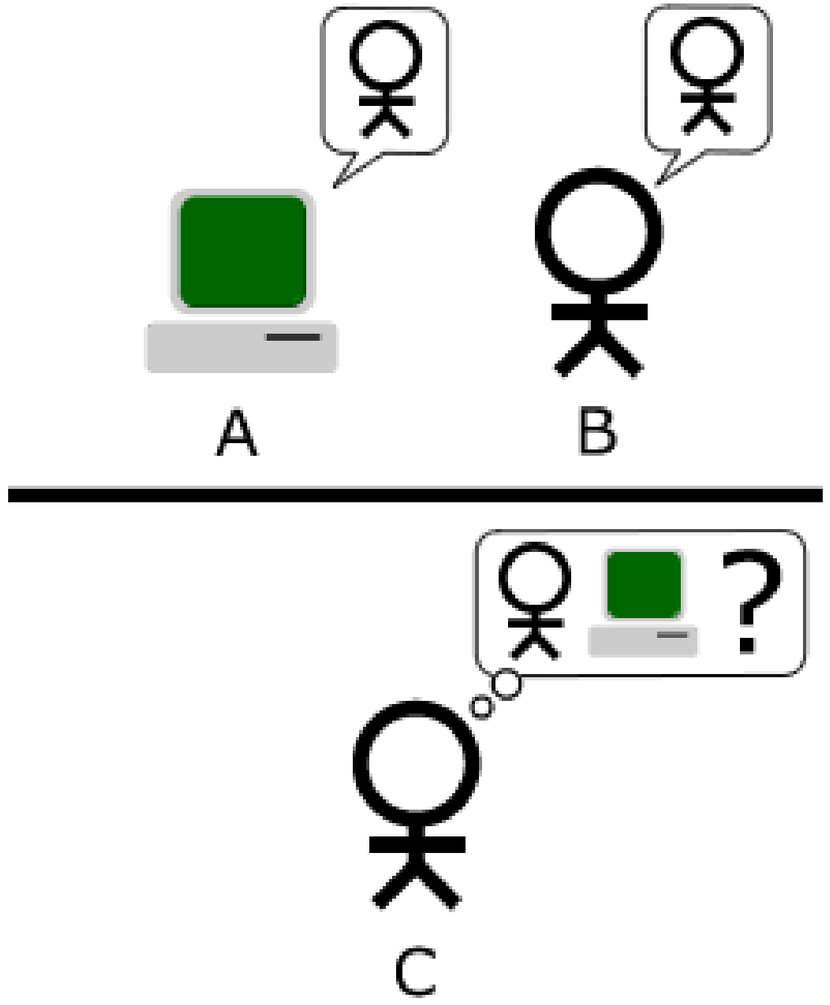
- Captures subjective aspects

Cons:

- Slow, costly, and difficult to standardize
- Subject to human biases and irregularity

Turing's classic test

- Proposed by computer scientist Alan Turing
- Human evaluator judges AI-generated content
- Passes if evaluator cannot distinguish AI from human
- But human behavior is not always the right standard



Let's practice!

GENERATIVE AI CONCEPTS