What is generative AI?

GENERATIVE AI CONCEPTS

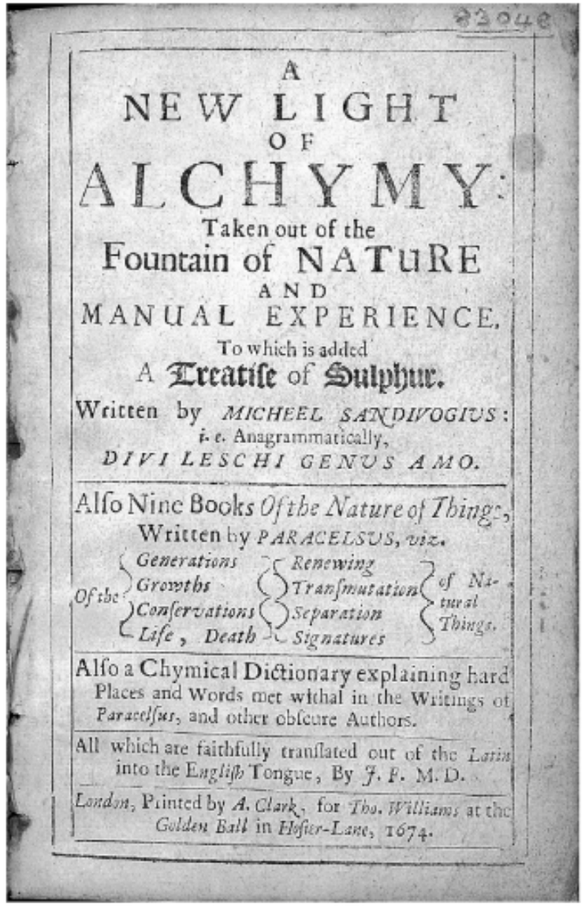


Daniel Tedesco
Data Lead, Google

datacamp

We've long dreamed of tools that can create

In ancient stories...



A
NEW LIGHT
OF
ALCHYMY:
Taken out of the
Fountain of NATURE
AND
MANUAL EXPERIENCE.
To which is added
A Treatise of Sulphur.
Written by MICHEEL SANDIVOGIUS:
i. e. Anagrammatically,
DIVI LESCHI GENUS AMO.

Also Nine Books *Of the Nature of Things*,
Written by PARACELSUS, viz.

Of the { *Generations, Growths, Conservations, Life, Death* } { *Renewing, Transmutation, Separation, Signatures* } *of Natural Things.*

Also a Chymical Dictionary explaining hard Places and Words met withal in the Writings of *Paracelsus*, and other obscure Authors.

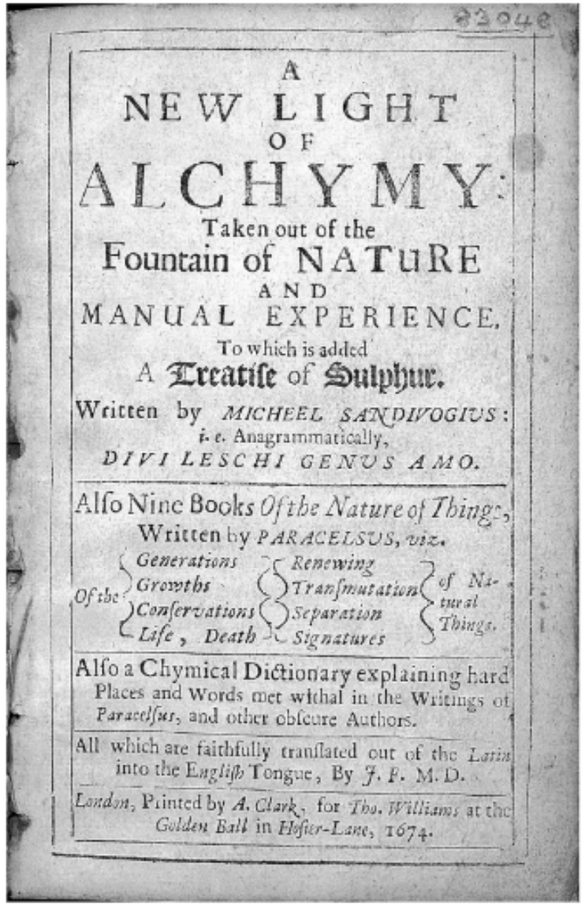
All which are faithfully translated out of the *Latin* into the *English* Tongue, By *J. F.* M. D.

London, Printed by *A. Clark*, for *Tho. Williams* at the *Golden Ball* in *Hosier-Lane*, 1674.



We've long dreamed of tools that can create

In ancient stories...



A
NEW LIGHT
OF
ALCHYMY:
Taken out of the
Fountain of NATURE
AND
MANUAL EXPERIENCE.
To which is added
A Treatise of Sulphur.
Written by MICHEEL SANDIVOGIUS:
i. e. Anagrammatically,
DIVI LESCHI GENUS AMO.

Also Nine Books Of the Nature of Things,
Written by PARACELSUS, viz.
Of the { Generations, Growths, Conservations, Life, Death } { Renewing, Transmutation, Separation, Signatures } of Natural Things.

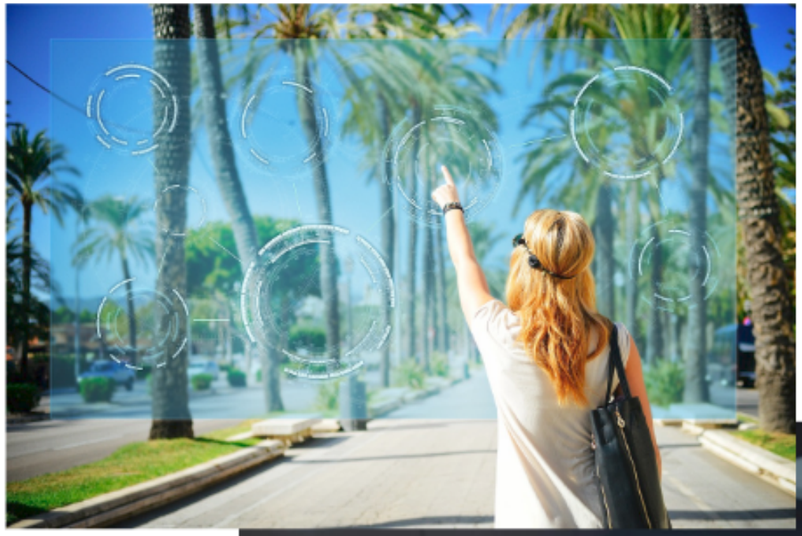
Also a Chymical Dictionary explaining hard Places and Words met withal in the Writings of Paracelsus, and other obscure Authors.

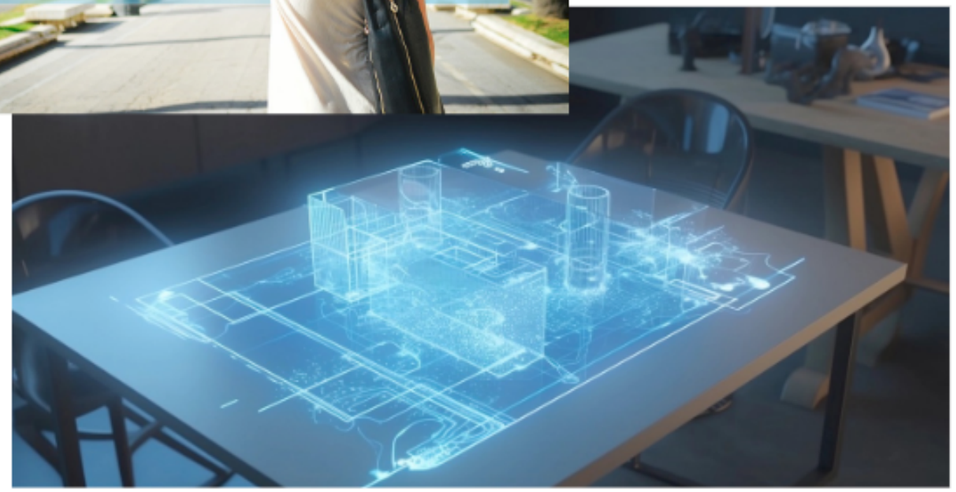
All which are faithfully translated out of the Latin into the English Tongue, By J. F. M. D.

London, Printed by A. Clark, for Tho. Williams at the Golden Ball in Hester-Lane, 1674.



...and modern virtual worlds



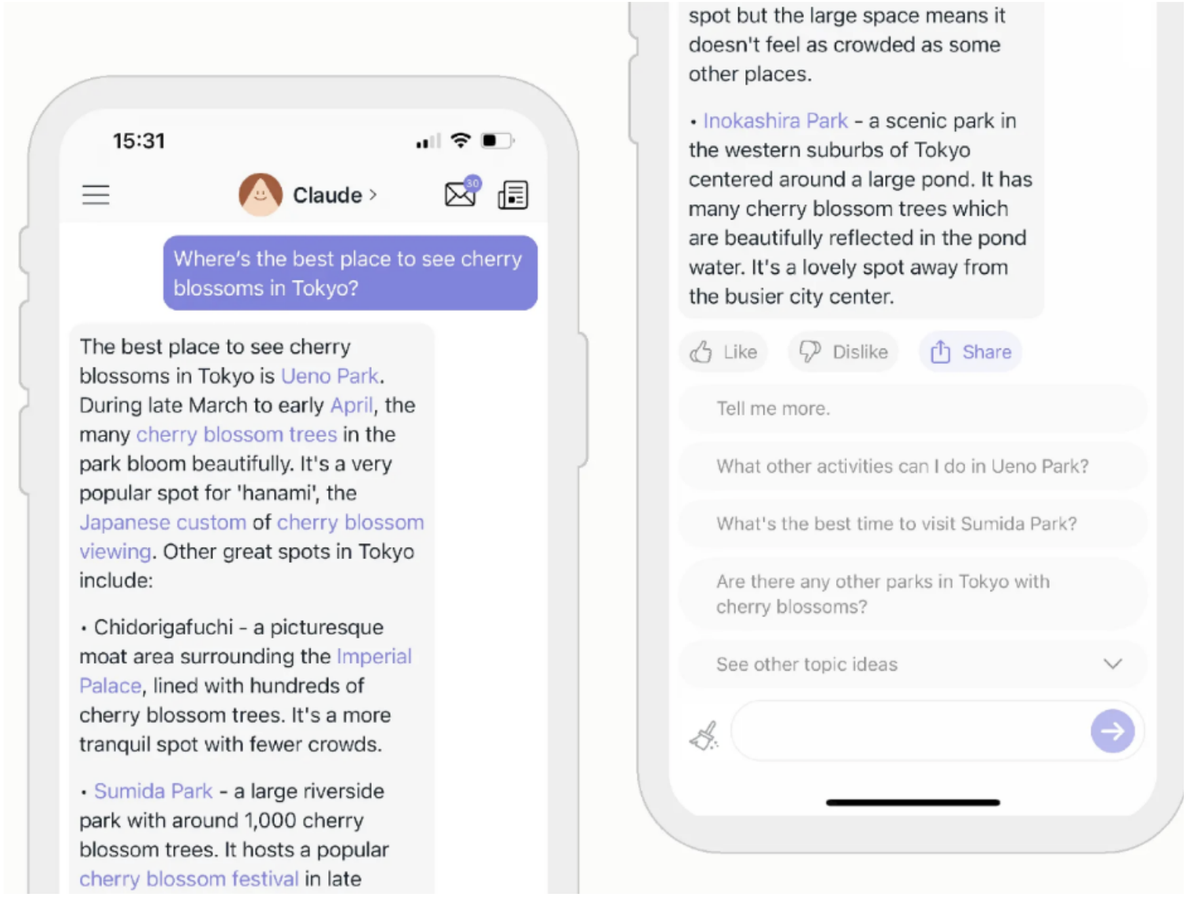


Unparalleled creative tools

AI Images



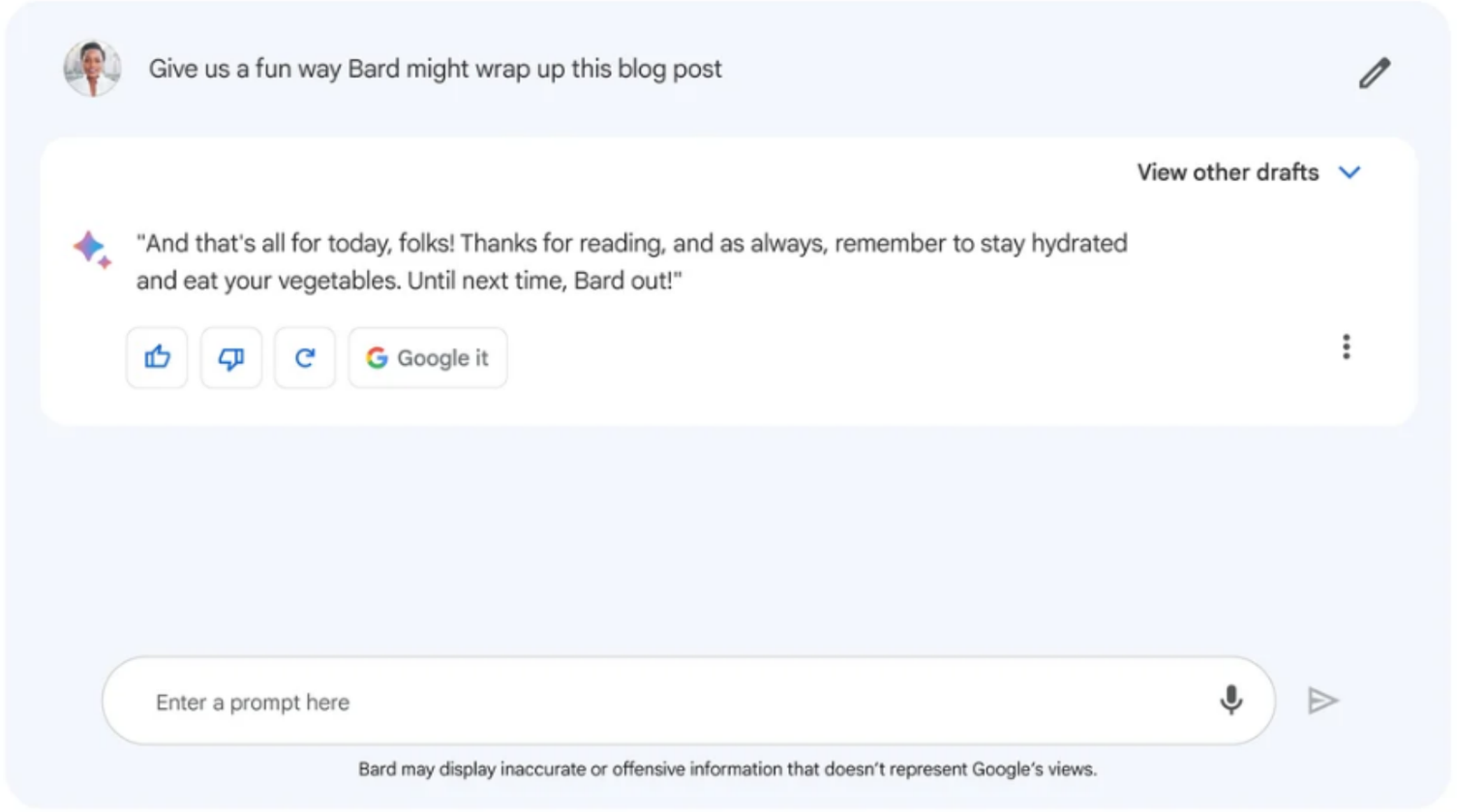
AI Chatbots



[1] Cosmopolitan Magazine, Anthropic PBC

What is generative AI?

Machine learning models that **generate new content**



[1] Google Bard

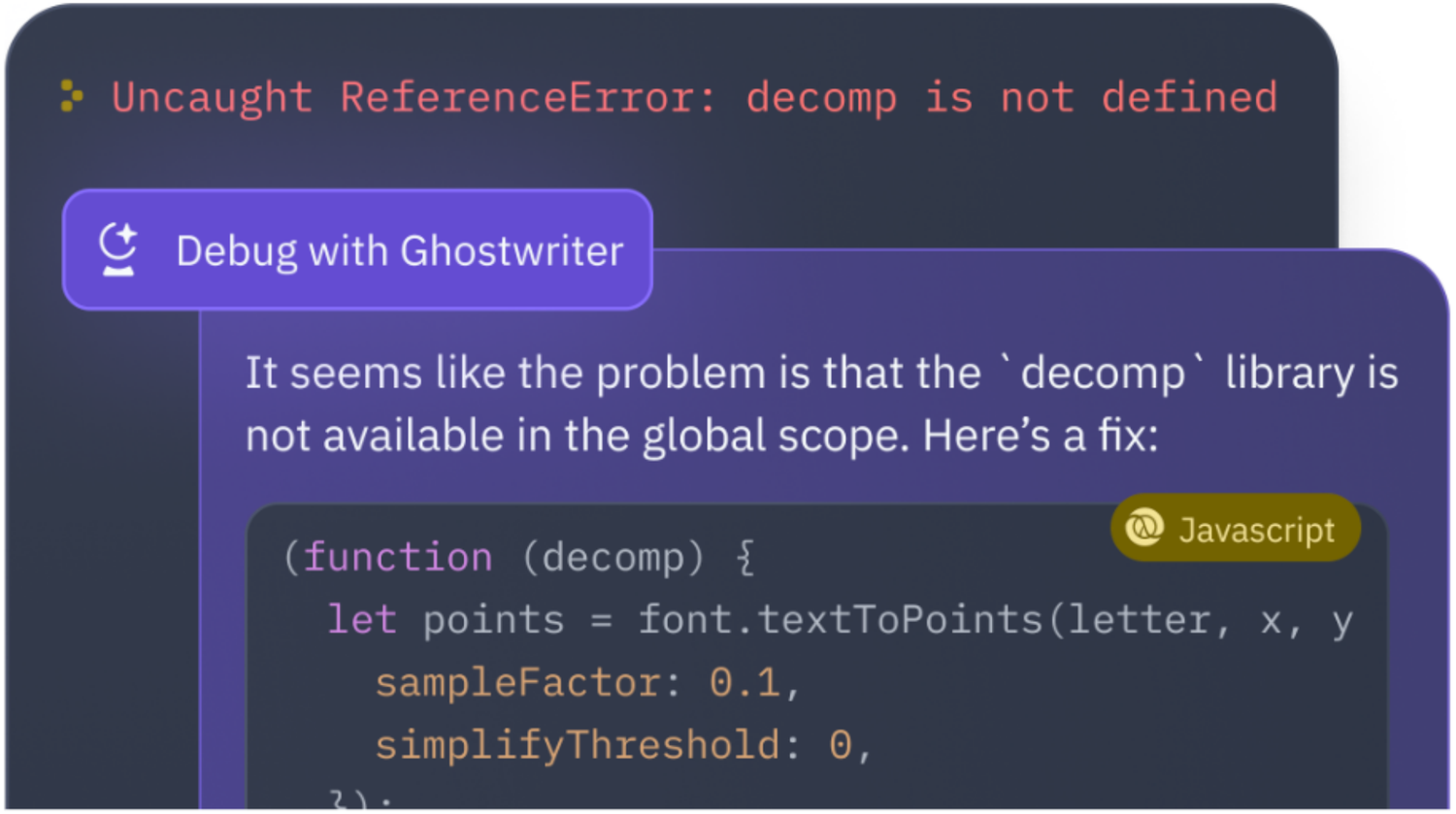
What is generative AI?



(a) A dog wearing a superhero outfit with red cape flying through the sky.

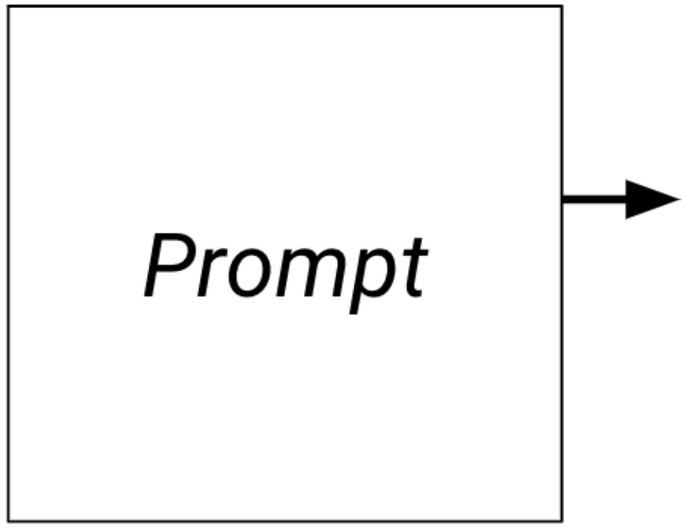
[1] Facebook Make-a-Video

What is generative AI?

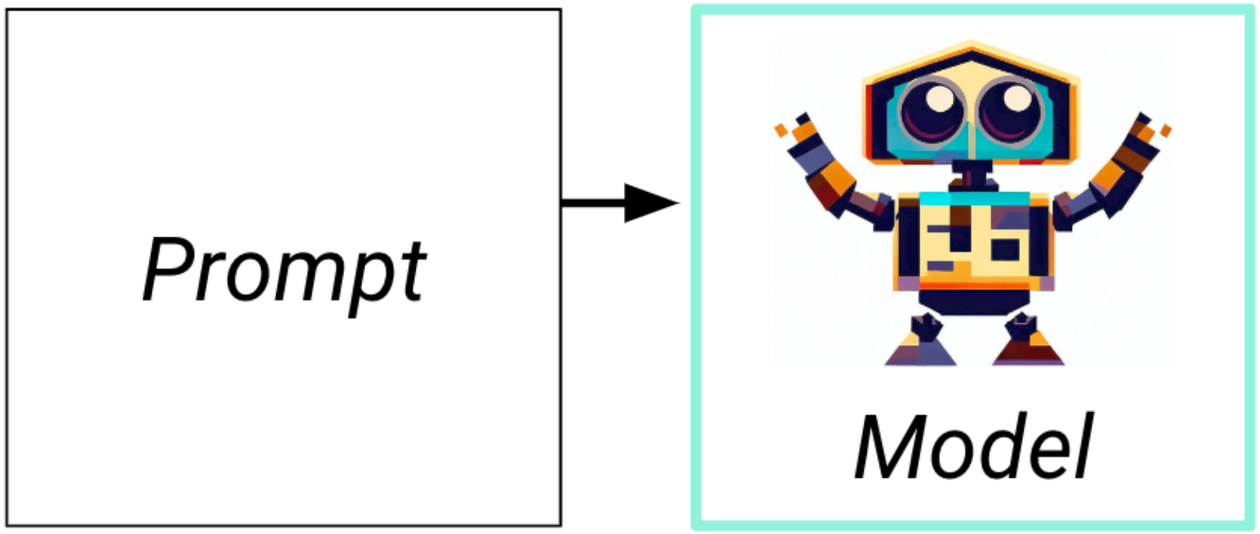


[1] Replit Ghostwriter

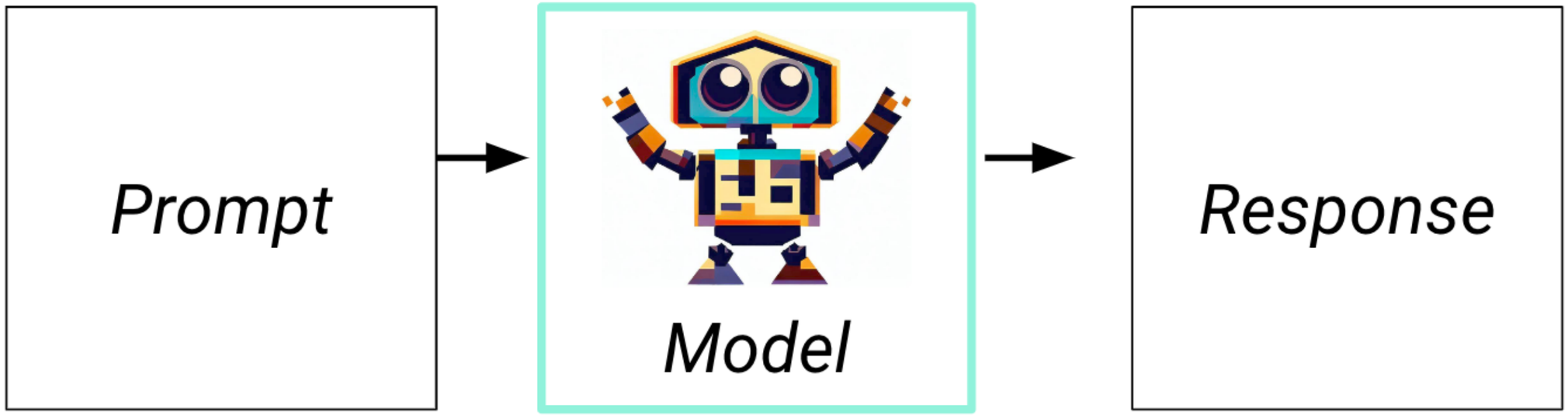
How does it work?



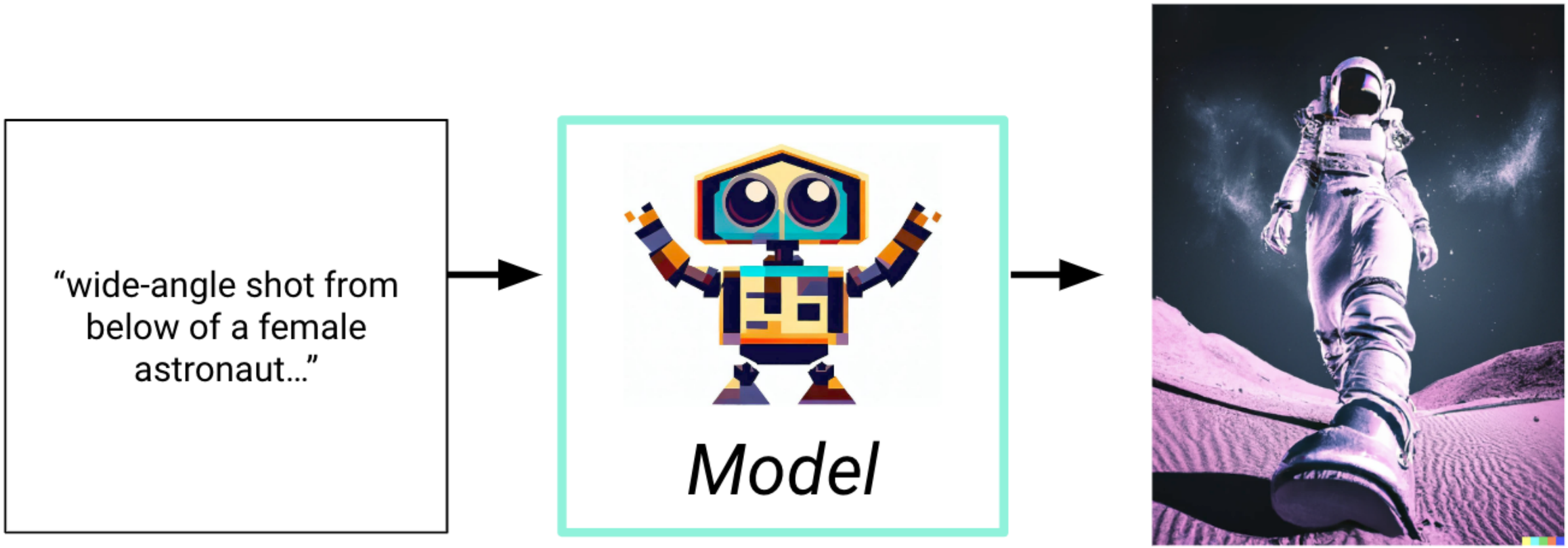
How does it work?



How does it work?

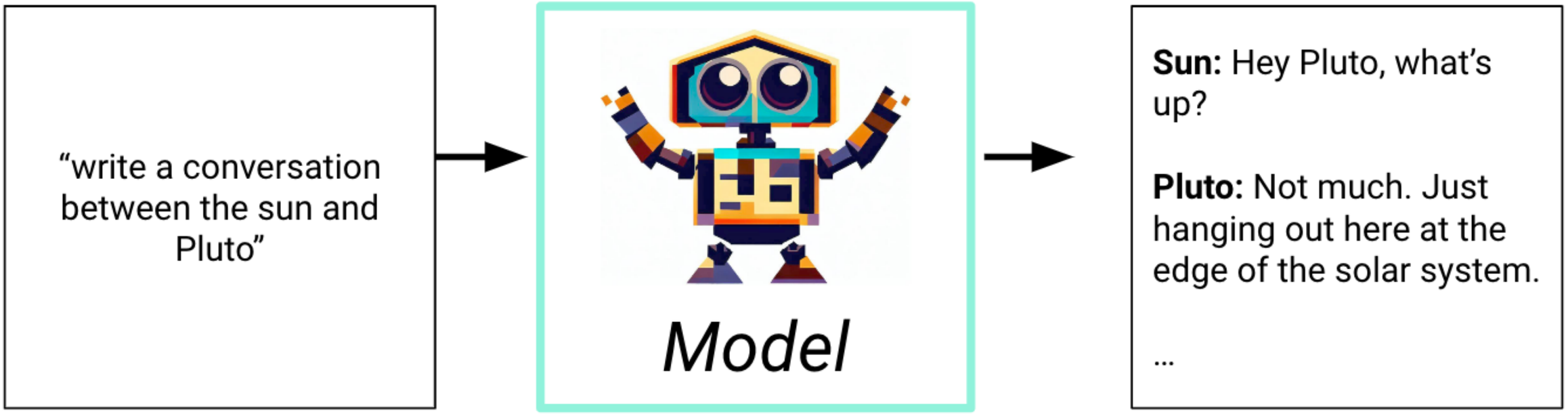


Create images



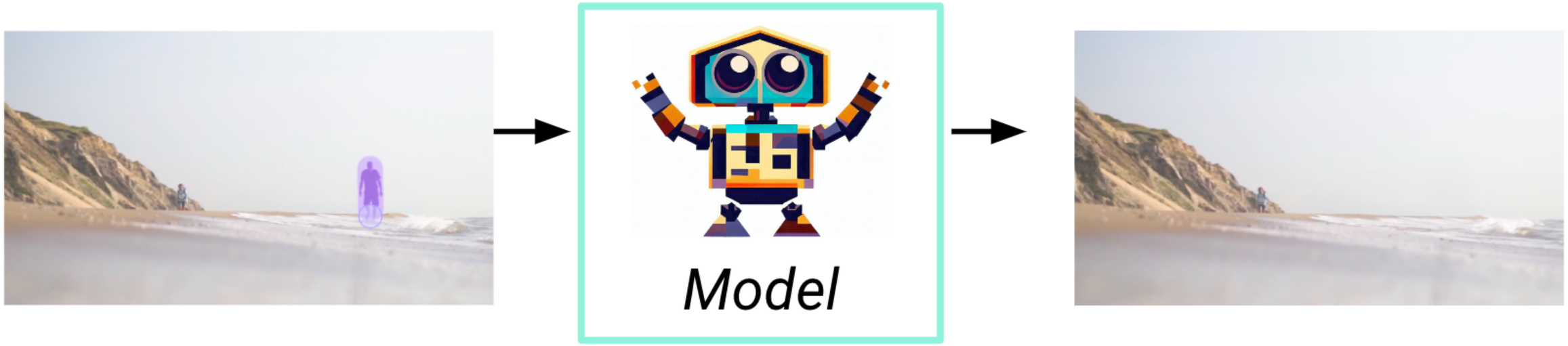
[1] Cosmopolitan Magazine using the Dall-E model

Hold conversations



[1] Facebook's LLaMA model

Input more than text



[1] Runway ML's InPainting Tool, https://runwayml.com/inpainting/

Real-world applications

Generative AI will impact a variety of industries and functions:

- **Sales:** draft sales outreach emails
- **Finance:** analyze financial data
- **Marketing:** generate marketing ads to test
- **Legal:** Simply explain complex regulations
- **Education:** Customize learning for individual students
- **Medical:** Read and analyze medical data
- **Industrial:** Automate repetitive tasks for industrial engineering and design
- **Games & Entertainment:** Create 3D models and scenes

The end of work?

- Lots of implementation *challenges* and *risks*
- Still, lots of **opportunity** to utilize



Course goals

We'll learn how these models:

- Generate content
- Present new legal and ethical considerations
- Impact society in the coming years

Let's practice!

GENERATIVE AI CONCEPTS

Generative AI in the machine learning landscape

GENERATIVE AI CONCEPTS



Daniel Tedesco
Data Lead, Google

datacamp

Models that analyze

Discriminative models



- Answer closed-ended questions
- Learn from training data
- Guess correct answer or categorize



[1] Wikimedia Commons

Bagels and puppies





Puppy



Puppy



Bagel



Bagel

[1] Wikimedia Commons

Guessing with confidence

Puppy or bagel?





[1] Puppy image from DALL·E 2

Models that imagine

Generative models



- Guess data for a prediction
- Still require training
- Generate new content

[1] Puppy image from Dall-E 2

Mixing for effect

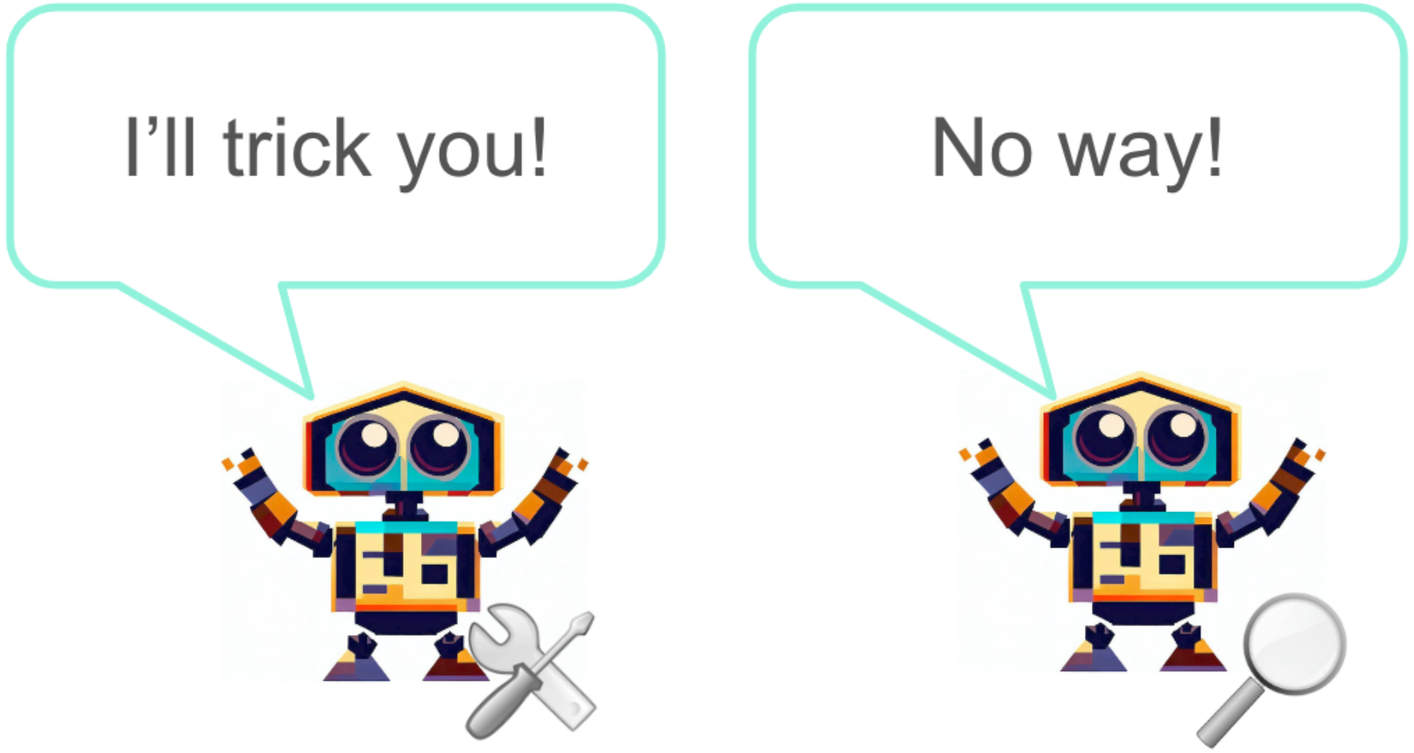
Generative AI:

- Combines generative models with other ML
- Models must work together like parts of a machine
- Produce complex creative work



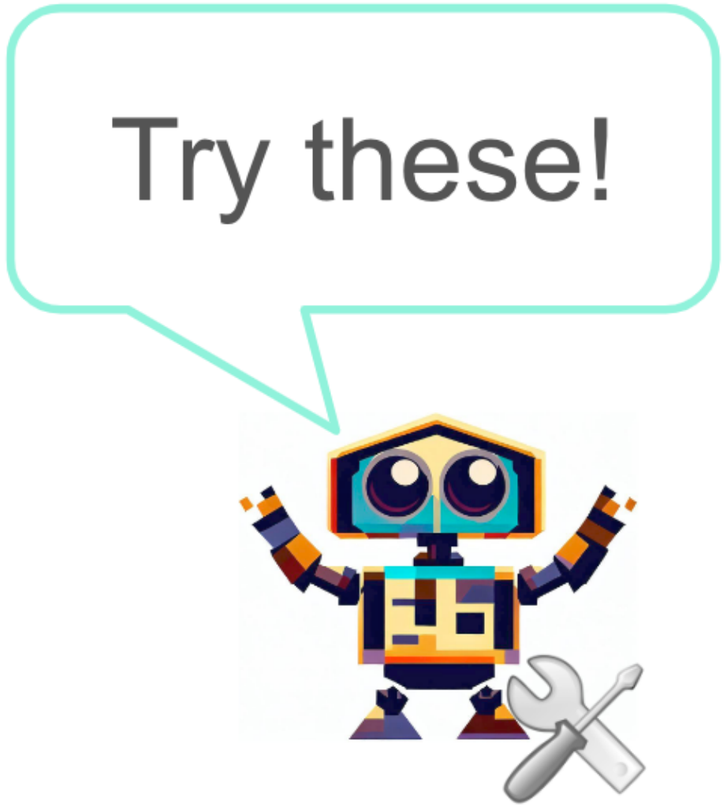
[1] Cosmopolitan Magazine

Generative adversarial networks (GANs)

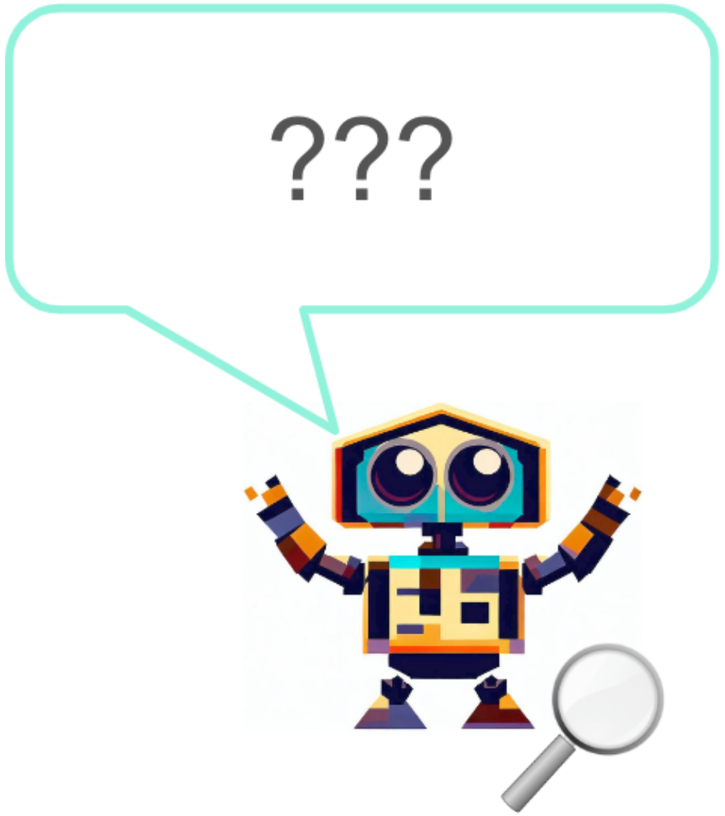


- Generators try to trick discriminators
- Compare notes and get better in multiple rounds

Bagel Puppy GAN







[1] https://twitter.com/teenybiscuit/media

Artificial general intelligence (AGI)

An AI that exhibits intelligence like a human would

- Scope of knowledge
- Reasoning across domains
- Social skills
- Creative thinking
- Other cognitive competencies (vision, language)

Use the right tool for the job

Discriminative Models

- Predict tomorrow's weather
- Categorize books
- Determine if a picture is a puppy or a bagel

Generative AI

- Write code for a website
- Answer unique customer service questions
- Draw a picture of a cat scuba diving

Artificial General Intelligence

- Complete traditionally human jobs

Let's practice!

GENERATIVE AI CONCEPTS

The evolution of generative AI

GENERATIVE AI CONCEPTS



Daniel Tedesco
Data Lead, Google

datacamp

Generative AI burst on the scene in 2023



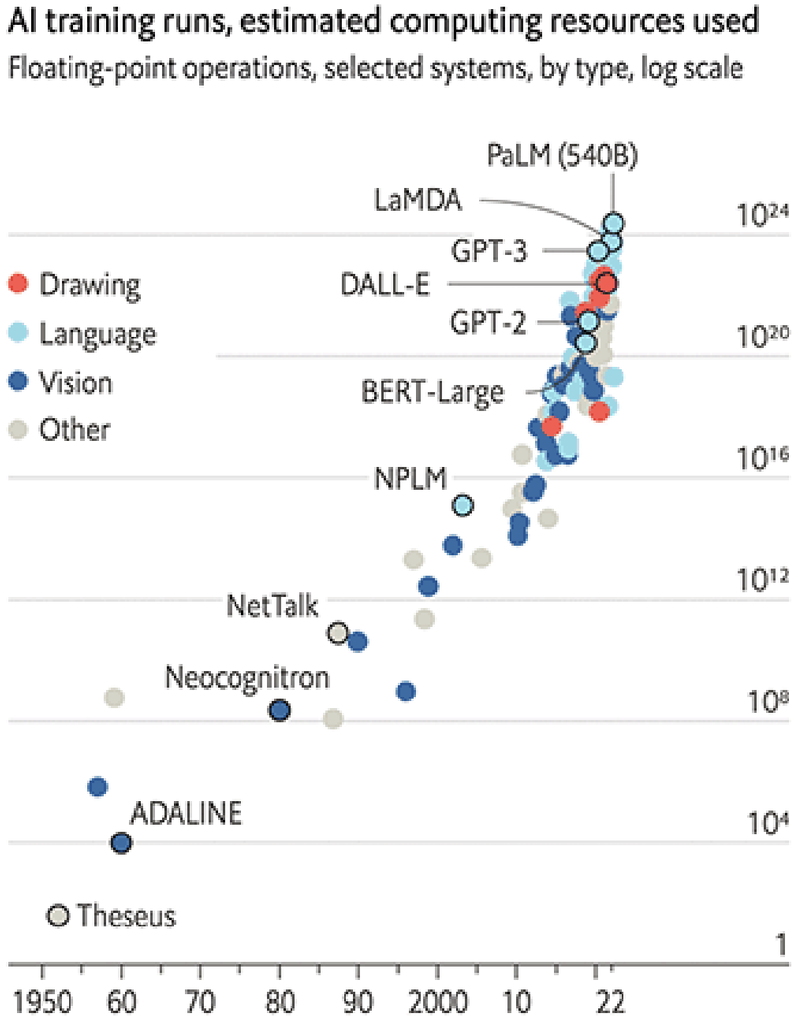
[1] Yahoo Finance

Key factors driving development

Several factors drive generative AI development:

- Computing power
- Dataset availability
- Competitive interests
- Model design

Computational power allowed large models

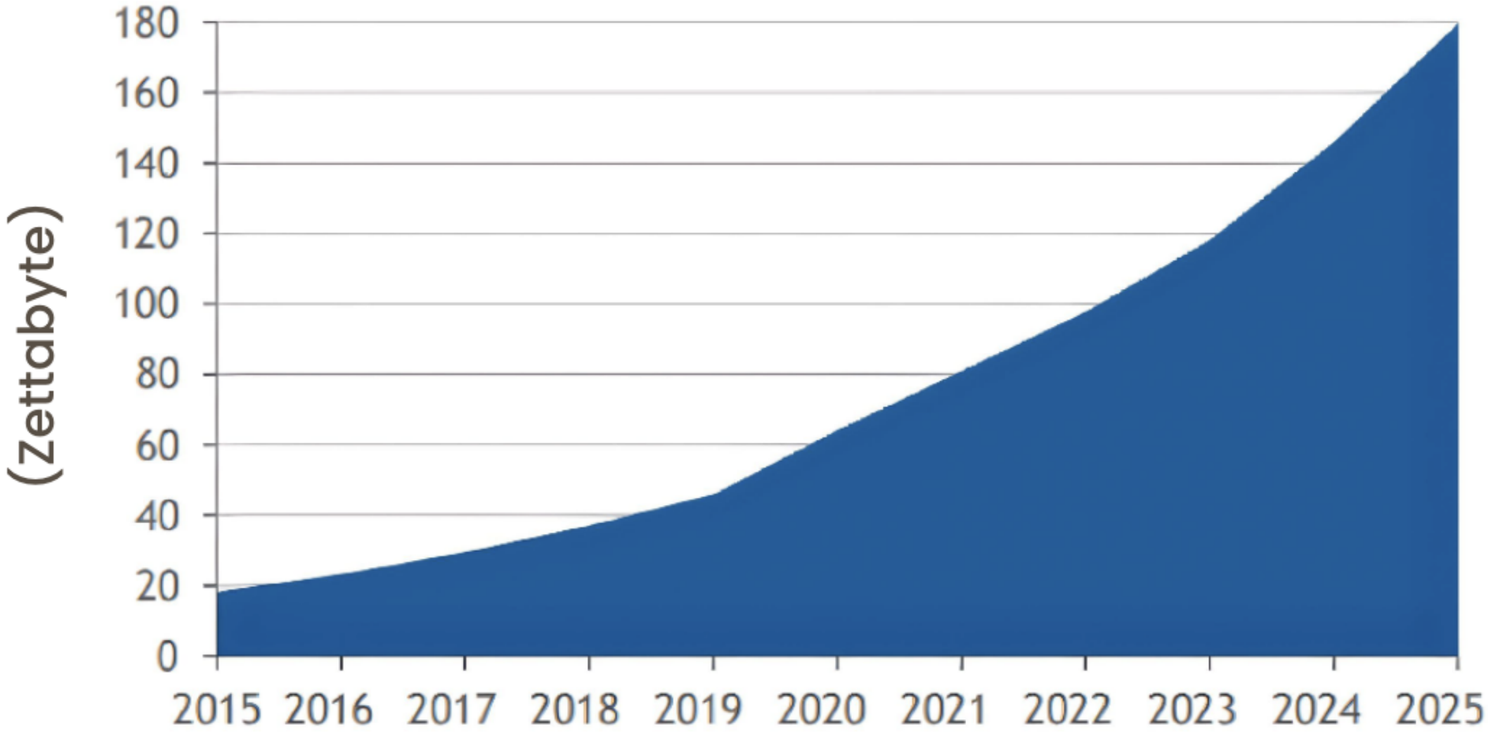


- Parallelization and specialized hardware
  - Graphics Processing Units (GPUs)
  - Tensor Processing Units (TPUs)
- Cloud computing
- Hardware-software optimization

[1] Compute Trends Across Three Eras of Machine Learning, https://arxiv.org/abs/2202.05924

Models improved with massive datasets

Global Datasphere Growth



[1] IDC's Global DataSphere, 2021

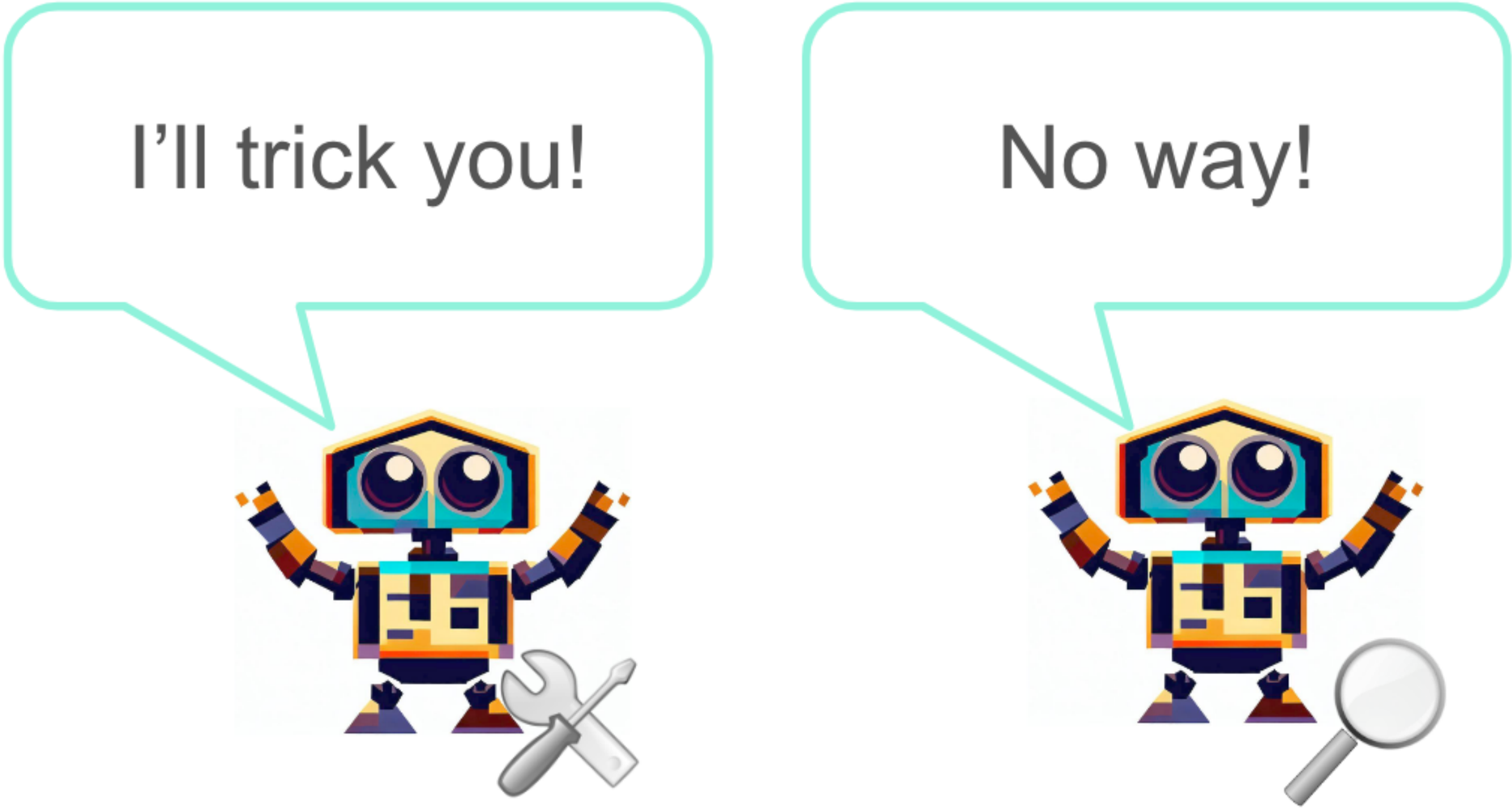
Competitive pressures encouraged faster development

Commercial

Political

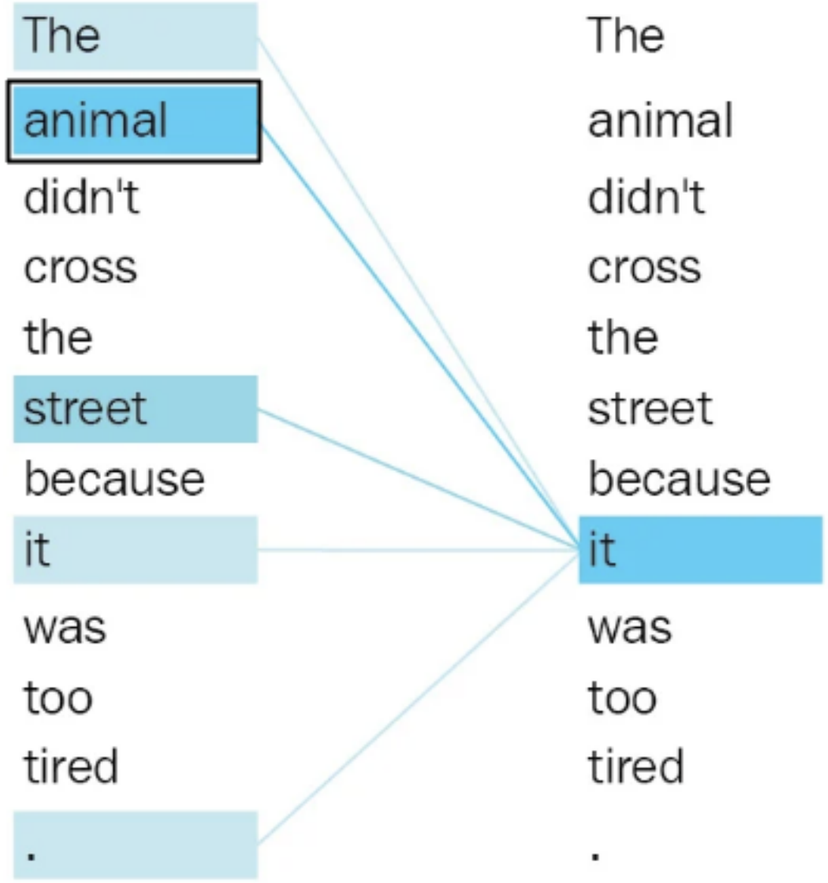


GANs unleashed high quality generation

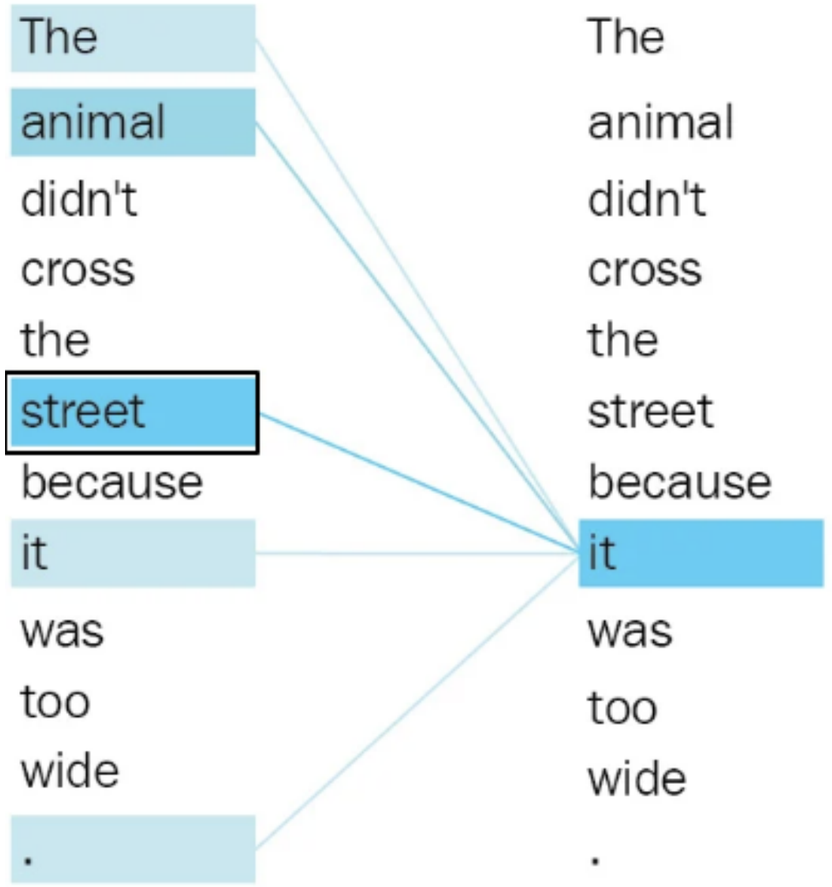


Transformers brought context and coherence

'it' refers to 'animal'



'it' refers to 'street'



[1] https://ai.googleblog.com/2017/08/transformer-novel-neural-network.html

Transformers brought context and coherence

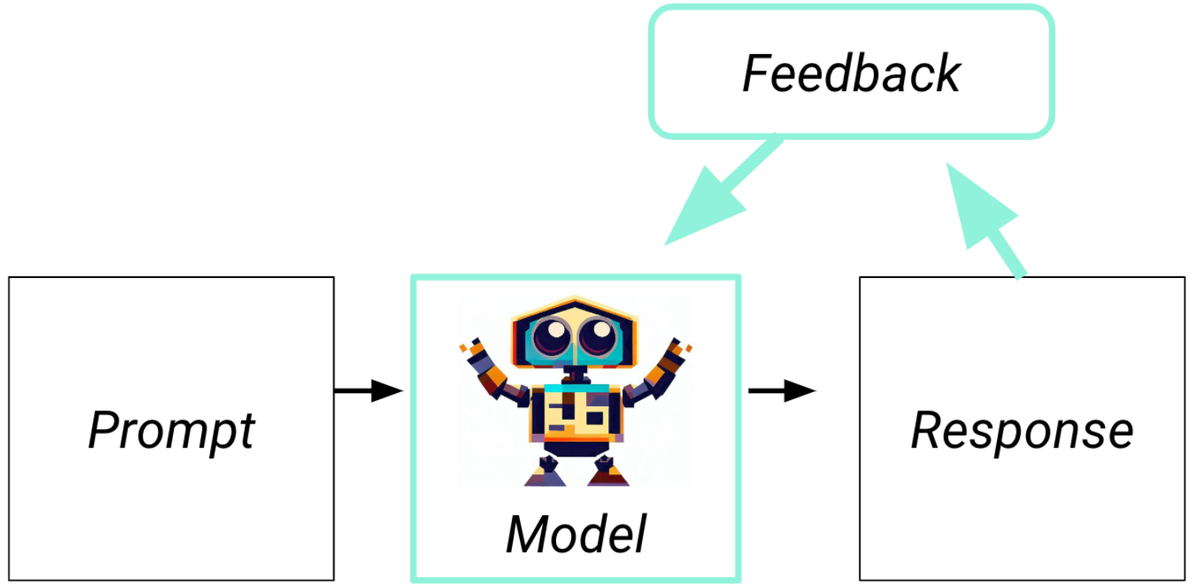
Transformers:

- Grasp the context of a given text
- Analyze relationships between words
- Generate responses that feel natural and informative

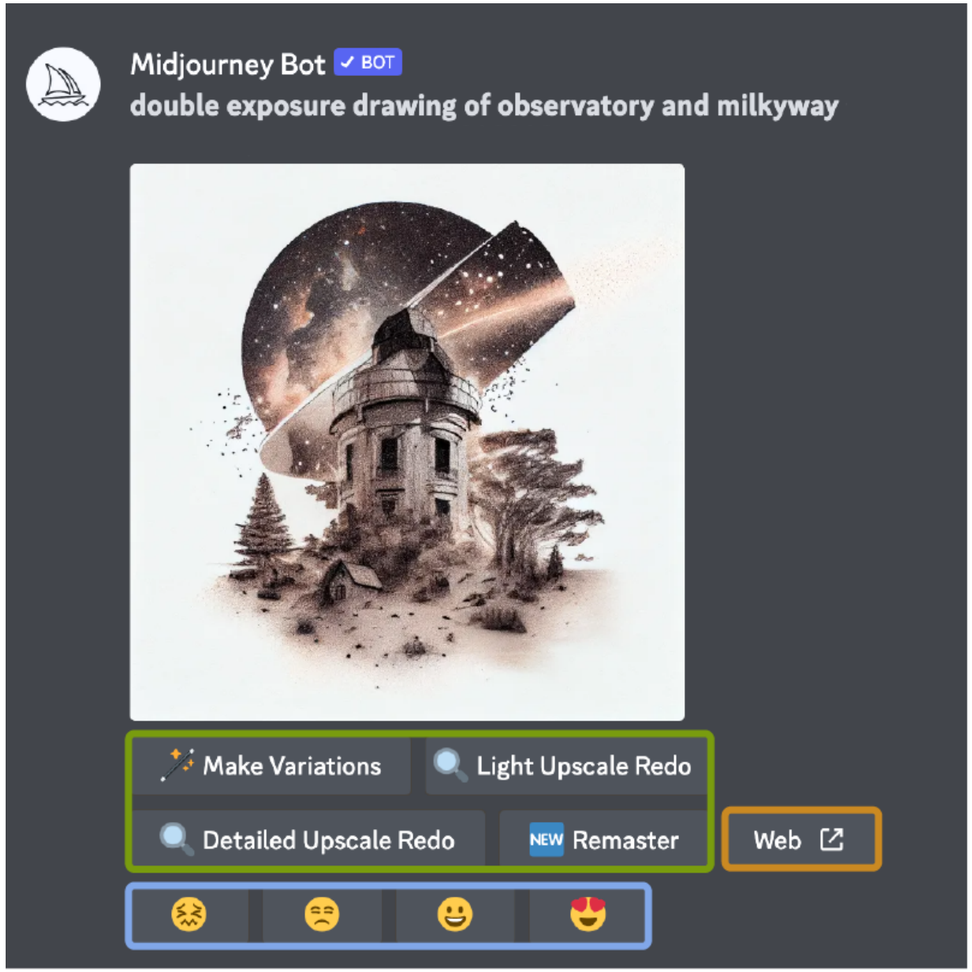
RLHF engaged user feedback

Reinforcement Learning with Human Feedback (**RLHF**):

- Reinforcement learning trains models through trial-and-error
- Human feedback comes from users scoring model responses



RLHF engaged user feedback



[1] Midjourney

Let's practice!

GENERATIVE AI CONCEPTS