

# Introduction to Generative AI

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# Introduction

- Generative AI creates new content, such as text, images, or other data types, in response to prompts

Generative

create **new** content  
(audio, code, images, **text**, video)

Artificial Intelligence

automatically  
using a computer program

# Generative AI is not a new concept

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Greek - Detected English Spanish French ↔ English Spanish Arabic ☆

Η καταστροφή που έχει γίνει στη νότια πλευρά της Πάρνηθας είναι πολύ μεγάλη.

I katastrofi pou échei ginei sti nótia plevrá tis Párnihas eínaí polý megáli.

[Look up details](#)

77 / 5,000 edit

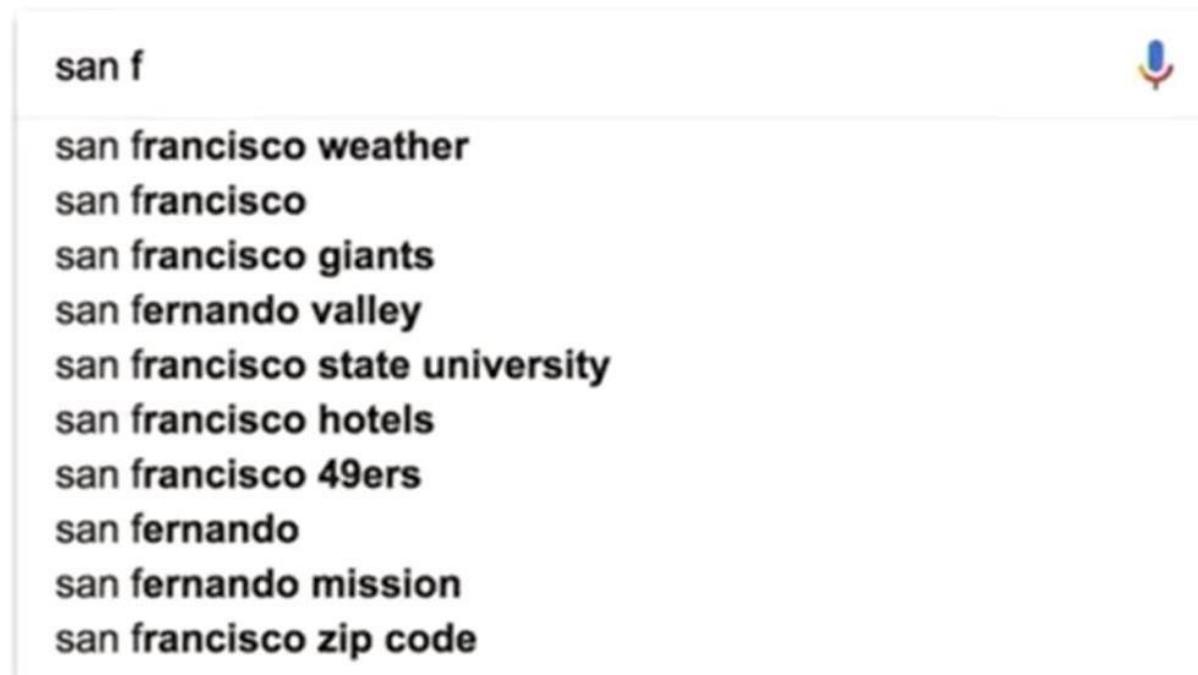
Speaker Speaker Send feedback

The destruction that has occurred on the southern side of Parnitha is very great.

[Look up details](#)

Speaker Send feedback

# Generative AI is not a new concept



# GPT-5's rollout fell flat for consumers, but the AI model is gaining where it matters most

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FUTURES & COMMODITIES

## KEY POINTS

- OpenAI's GPT-5 has more than doubled coding and agent-building activity since its debut and driven an eightfold jump in reasoning workloads.
- Platforms including Cursor, Vercel, JetBrains, Factory, Qodo and GitHub Copilot are rolling GPT-5 into certain default artificial intelligence workflows or public previews.
- OpenAI aims to convert early developer momentum into sustained enterprise AI adoption.

FUNDS & ETFS

## • WATCH LIVESTREAM

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NOW

**Squawk on the Street**

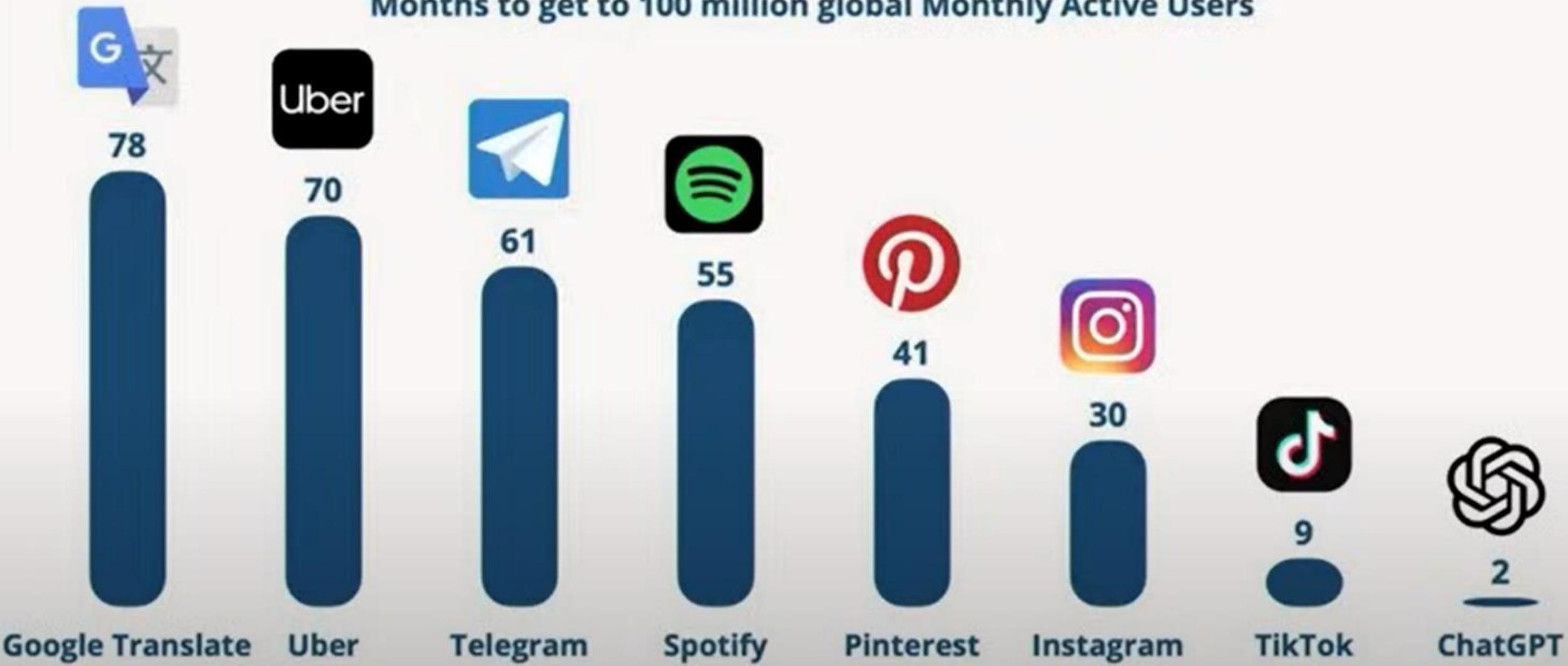
UP NEXT

Money Movers

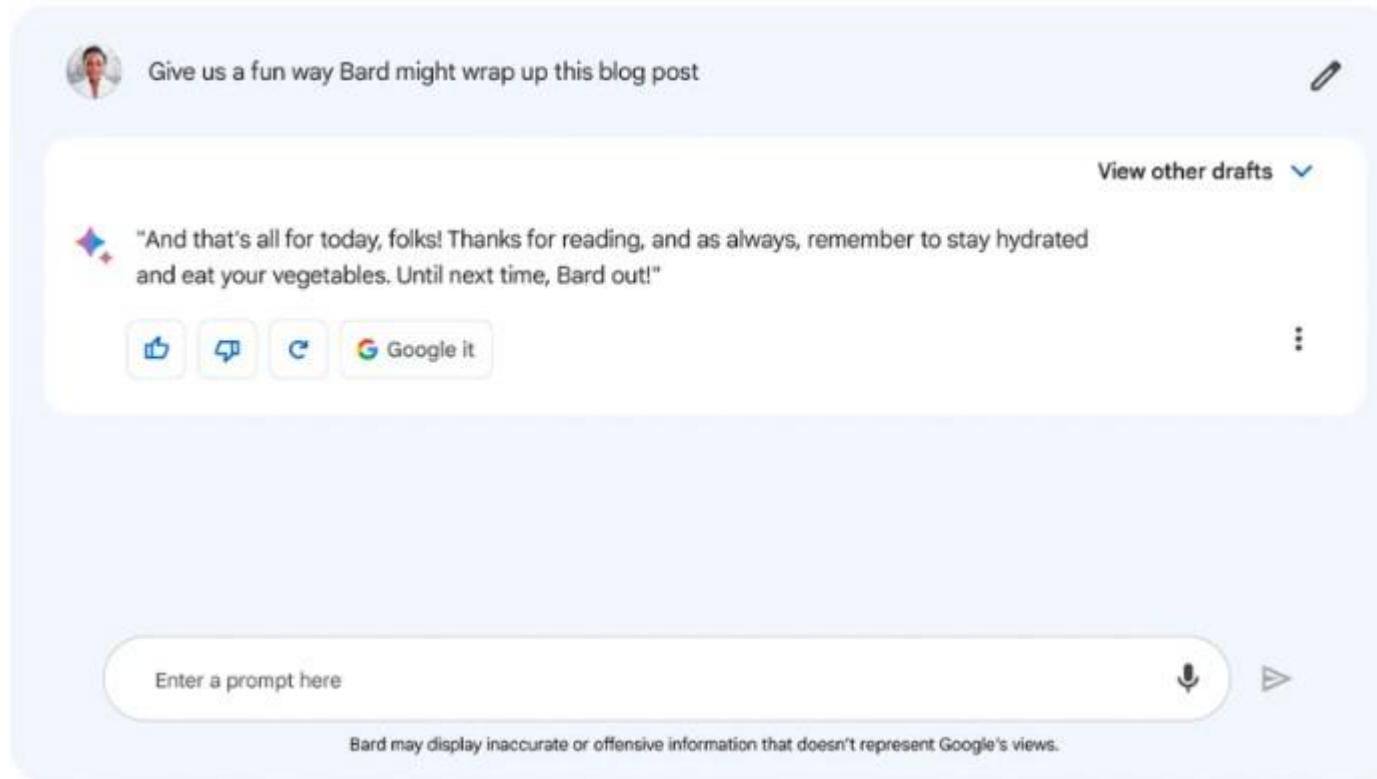
Activate Windows  
Go to Settings to activate Win

# Time to Reach 100M Users

Months to get to 100 million global Monthly Active Users



# Examples of Generative AI



Generate Text in response to User Query

# Examples of Generative AI



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

Generate Video in response to User Query

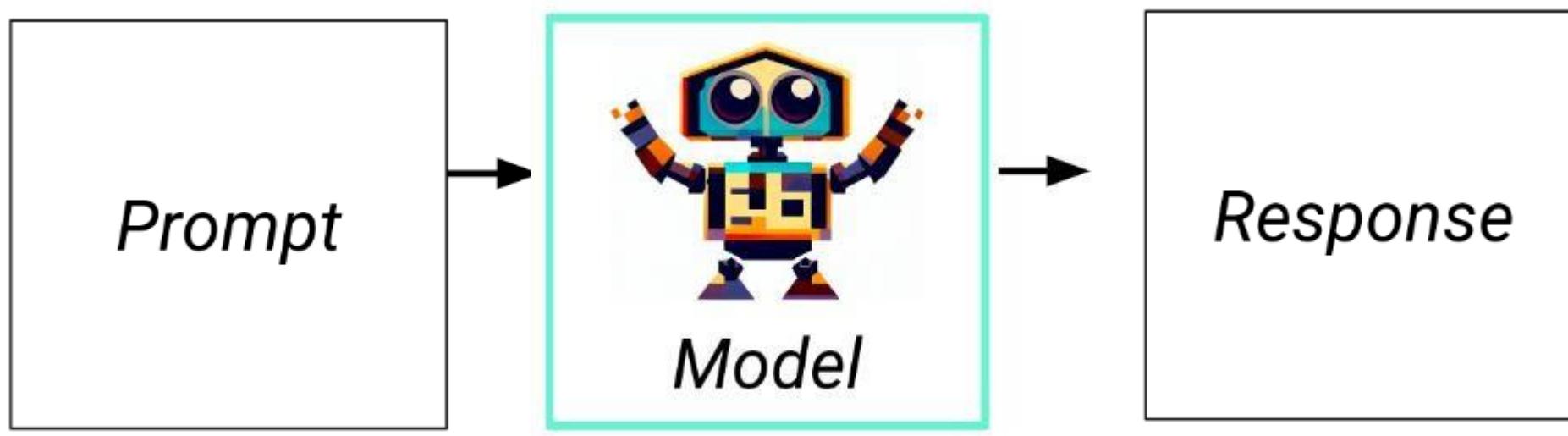
# Examples of Generative AI

A screenshot of a developer tool interface. At the top, there is a red error message: "Uncaught ReferenceError: decomp is not defined". Below it is a purple button labeled "Debug with Ghostwriter". A text area contains a message: "It seems like the problem is that the 'decomp' library is not available in the global scope. Here's a fix:". Below this is a code snippet in a "Javascript" language block:

```
(function (decomp) {  
    let points = font.textToPoints(letter, x, y  
        sampleFactor: 0.1,  
        simplifyThreshold: 0,  
    ).
```

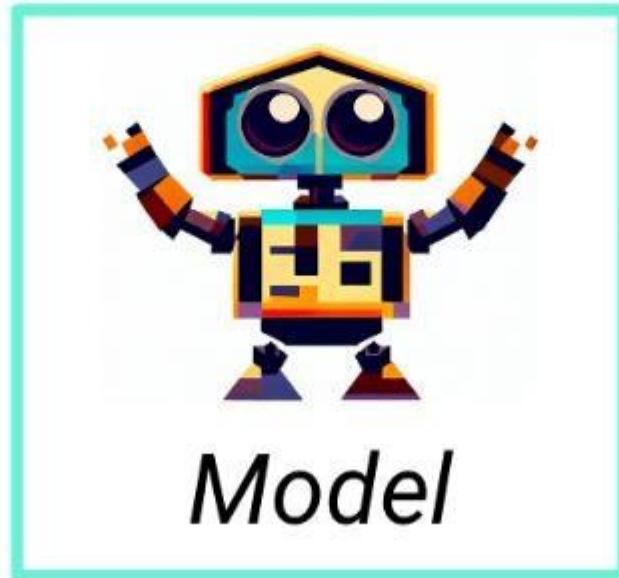
Write Code to help Developers work faster

# How does it work?

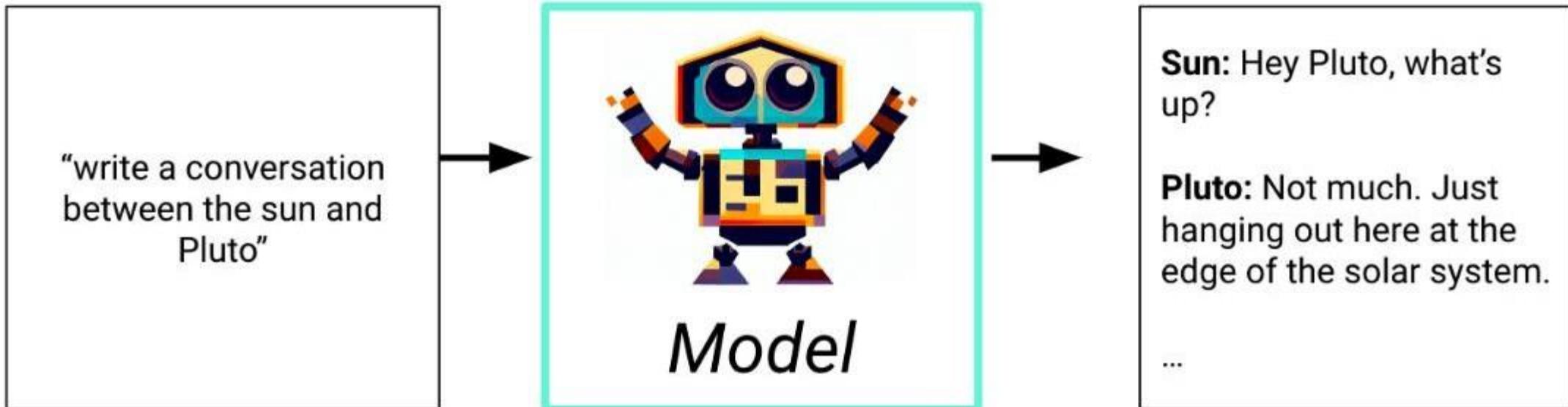


# Create images

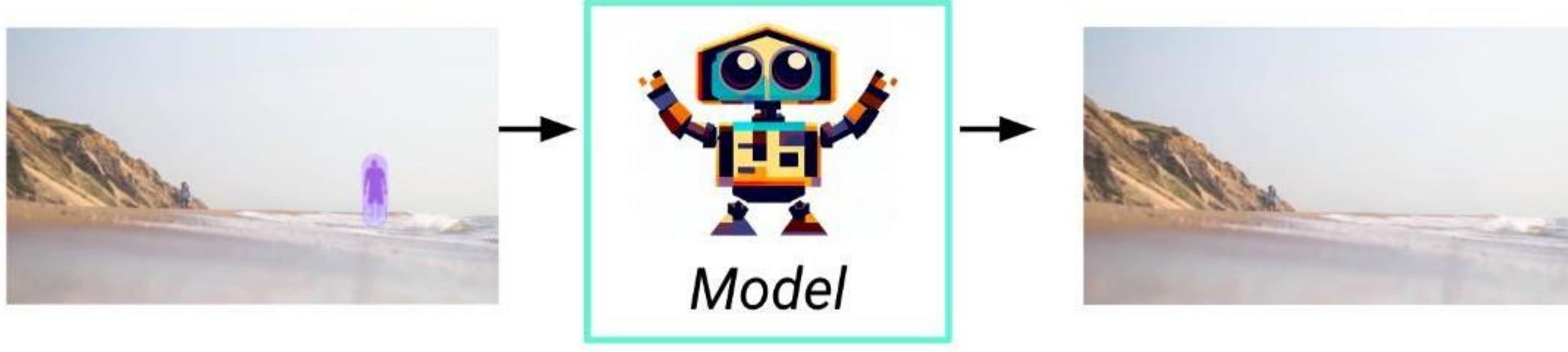
"wide-angle shot from below of a female astronaut..."



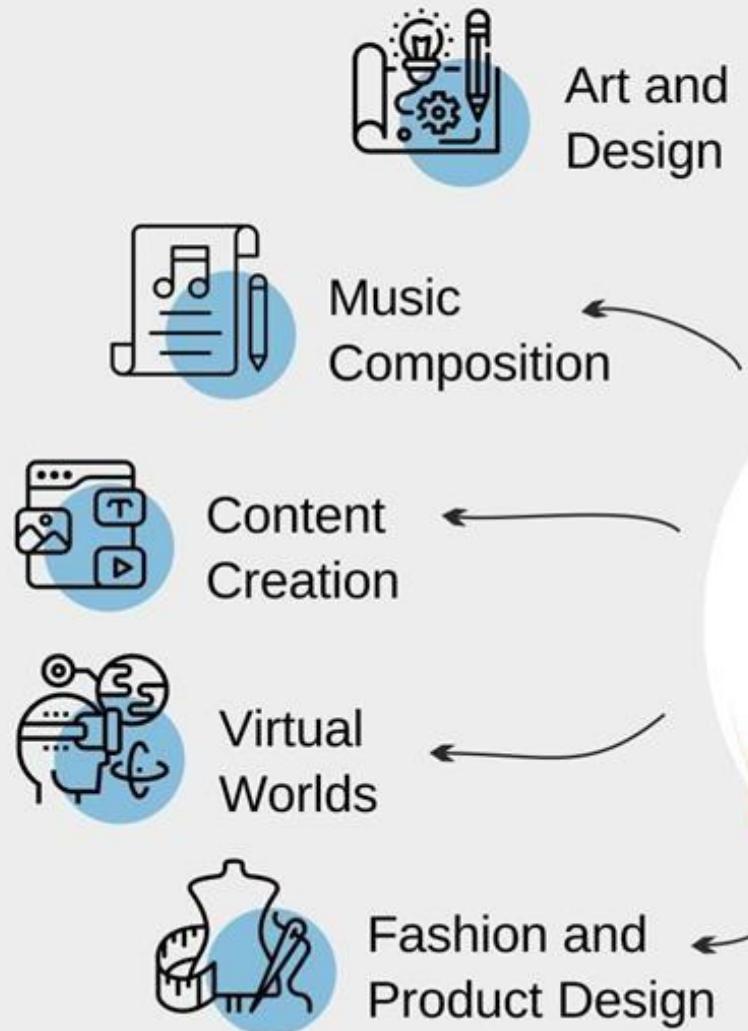
# Hold conversations



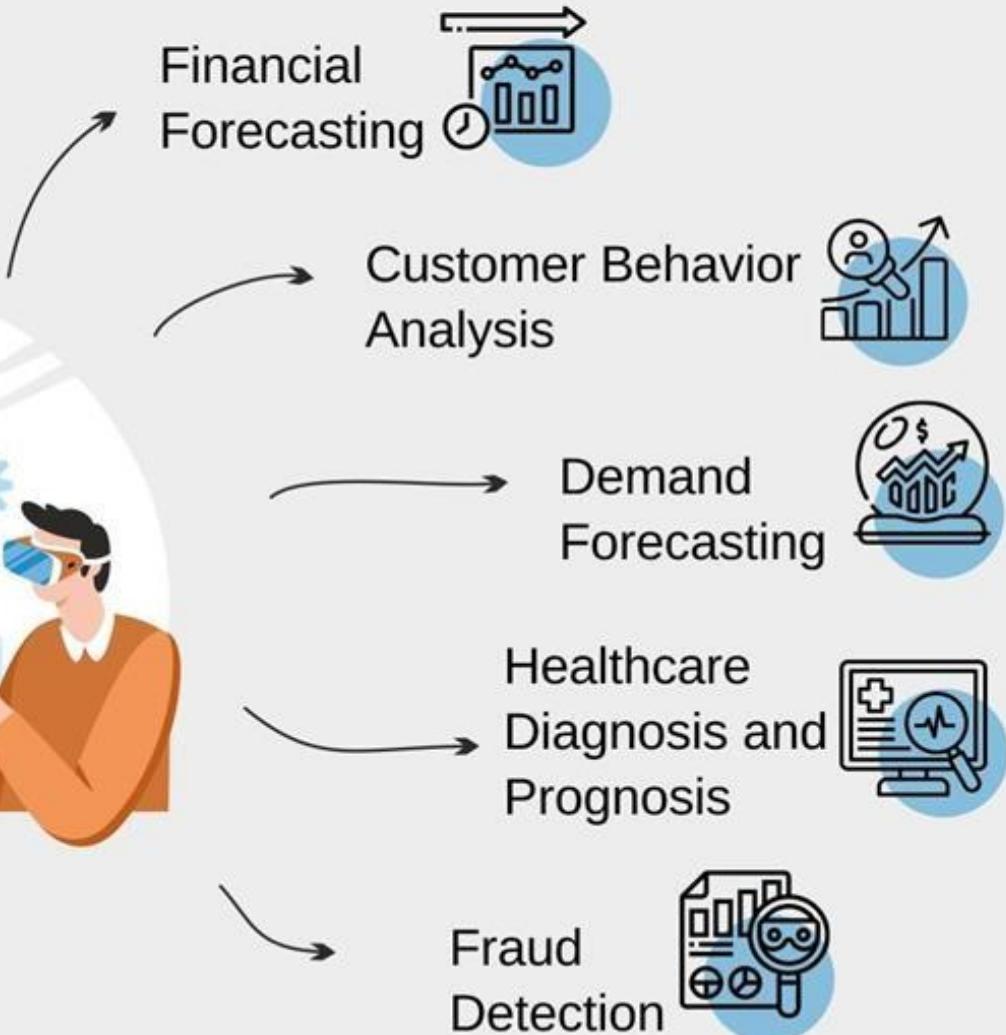
# Input more than text



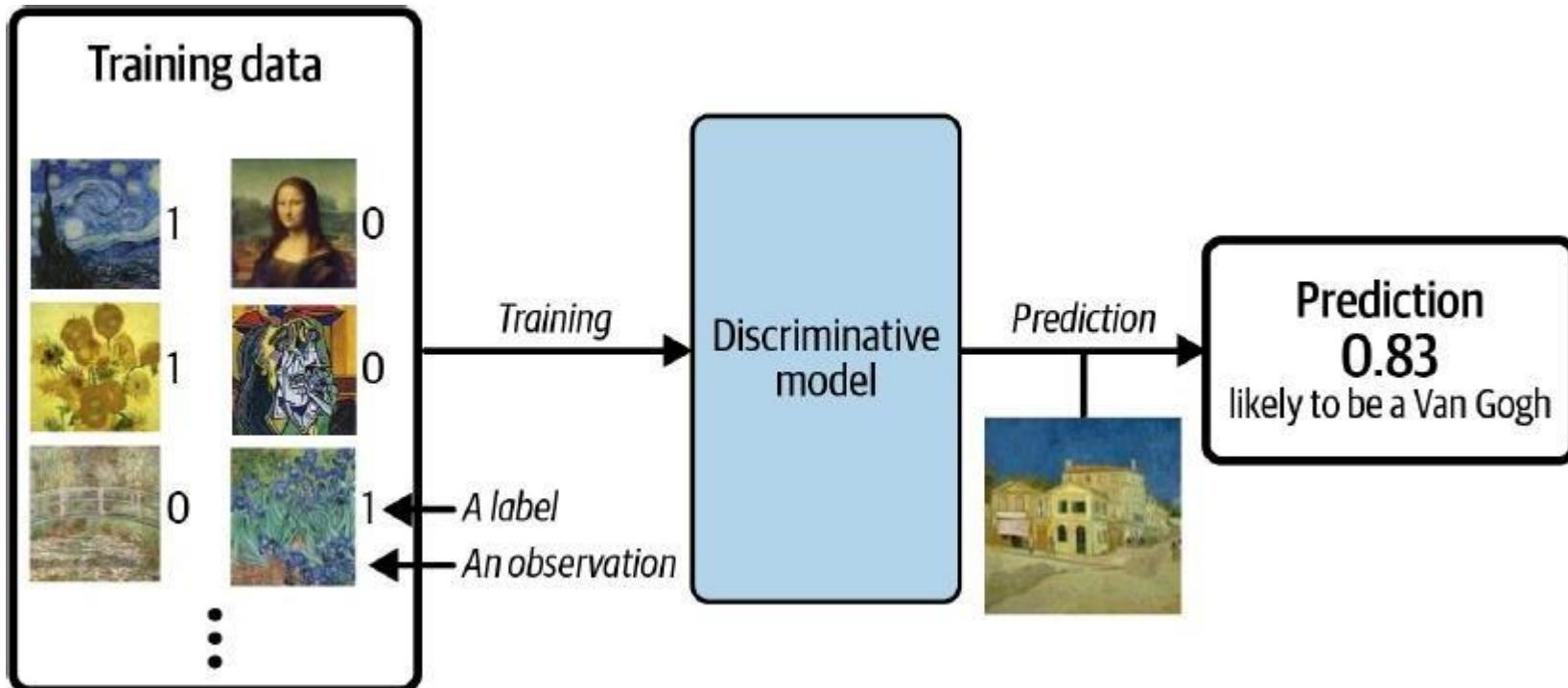
# Generative AI Applications



# Predictive AI Applications



# Generative versus Discriminative Modelling

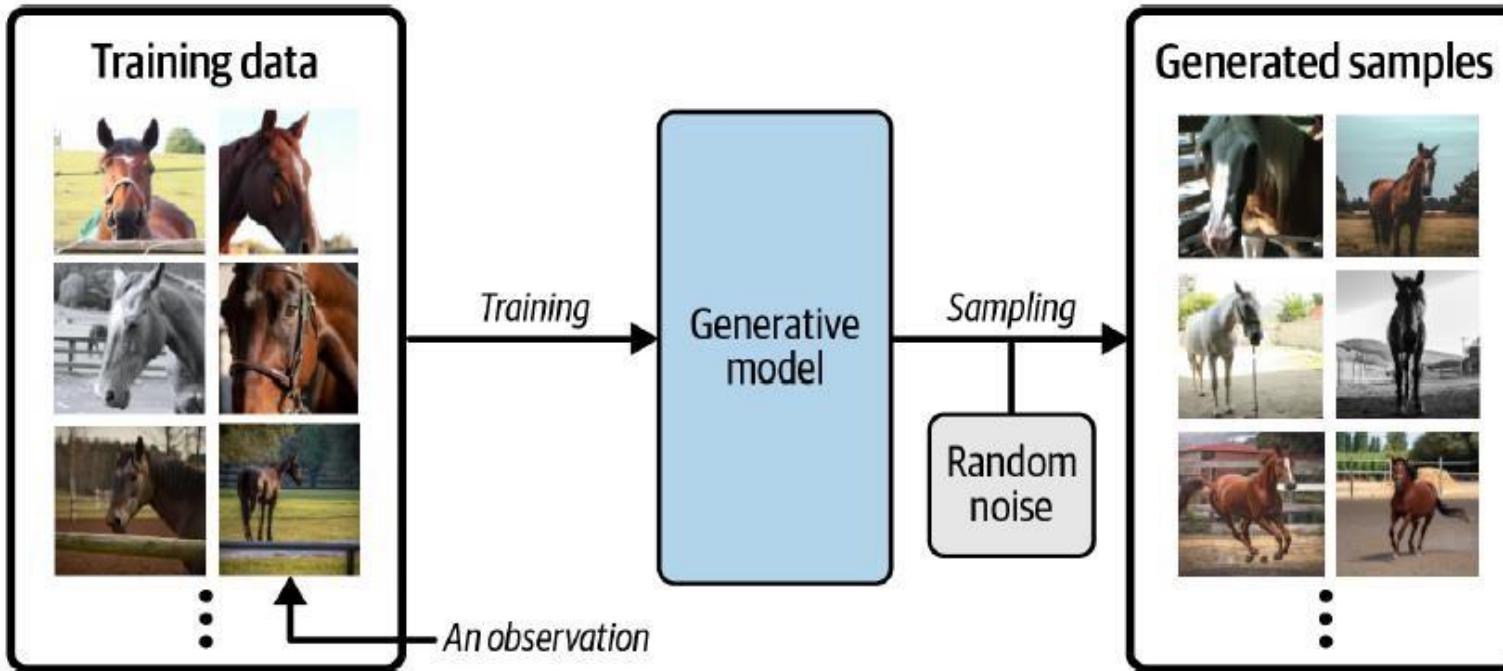


A discriminative model trained to predict if a given image is painted by Van Gogh

*Discriminative modeling* estimates  $p(y|x)$ .

That is, discriminative modeling aims to model the probability of a label  $y$  given some observation  $x$ .

# Generative versus Discriminative Modelling



A generative model trained to generate realistic photos of Horses

*Generative modeling* estimates  $p(\mathbf{x})$ .

That is, generative modeling aims to model the probability of observing an observation  $\mathbf{x}$ . Sampling from this distribution allows us to generate new observations.



## Conditional Generative Models

Note that we can also build a generative model to model the conditional probability  $p(\mathbf{x} | y)$ —the probability of seeing an observation  $\mathbf{x}$  with a specific label  $y$ .

For example, if our dataset contains different types of fruit, we could tell our generative model to specifically generate an image of an apple.

# Advantages of Generative AI

- Generative AI models have diverse applications across various industries
- Generative AI is powered by foundation models (large AI models) that can multi-task and perform out-of-the-box tasks, including summarization, Q&A, classification, and more
- Plus, with minimal training required, foundation models can be adapted for targeted use cases with very little example data

# Disadvantages of Generative AI

- Misuse and Malicious Applications
- Erosion of Human Creativity
- Job Displacement
- Bias and Discrimination
- Dependence on Data Quality
- Ethical Concerns in Content Creation
- Impact on Learning and Skill Development
- Accessibility and Digital Divide
- Security Vulnerabilities
- Environmental Impact

# OpenAI Imagines Our AI Future

## Stages of Artificial Intelligence

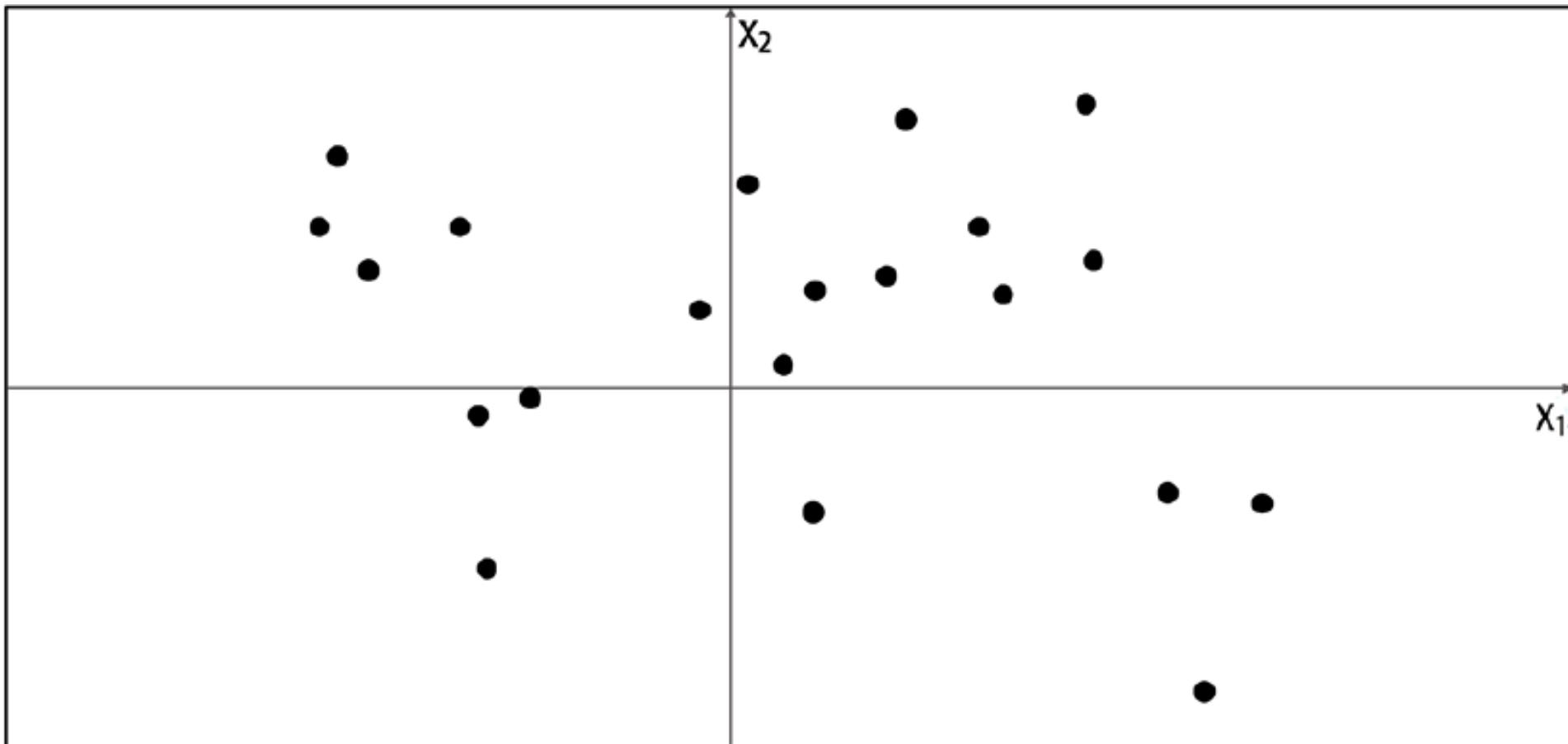
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Level 1	Chatbots, AI with conversational language
Level 2	Reasoners, human-level problem solving
Level 3	Agents, systems that can take actions
Level 4	Innovators, AI that can aid in invention
Level 5	Organizations, AI that can do the work of an organization

Source: Bloomberg reporting

# Our First Generative Model (Hello World)

- Let's start by playing a generative modeling game in just two dimensions

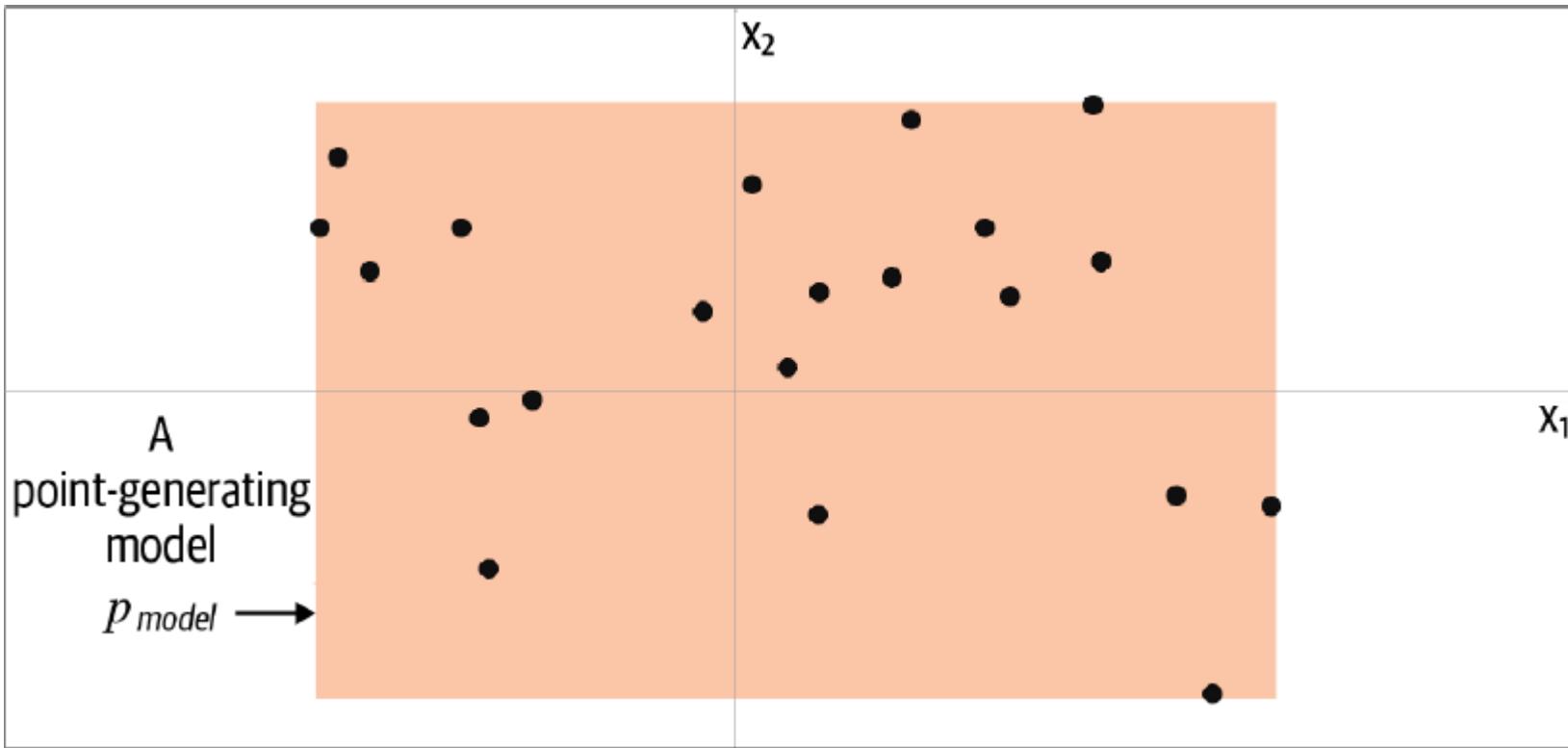


*A set of points in two dimensions, generated by an unknown rule  $p_{data}$*

# Our First Generative Model (Hello World)

- Your challenge is to choose a different point  $(x_1, x_2)$  in the space that looks like it has been generated by the same rule
- Where did you choose?
- You probably used your knowledge of the existing data points to construct a mental model,  $P_{model}$ , of whereabouts in the space the point is more likely to be found
- In this respect,  $P_{model}$  is an estimate of  $P_{data}$

# Our First Generative Model (Hello World)



The orange box,  $p_{model}$ , is an estimate of the true data-generating distribution,  $p_{data}$ .

# Our First Generative Model (Hello World)

- To generate a new observation, you can simply choose a point at random within the box, or more formally, sample from the distribution  $P_{\text{model}}$
- Congratulations, you have just built your first generative model!
- You have used the training data (the black points) to construct a model (the orange region) that you can easily sample from to generate other points that appear to belong to the training set

## The Generative Modeling Framework

- We have a dataset of observations  $\mathbf{X}$ .
- We assume that the observations have been generated according to some unknown distribution,  $p_{data}$ .
- We want to build a generative model  $p_{model}$  that mimics  $p_{data}$ . If we achieve this goal, we can sample from  $p_{model}$  to generate observations that appear to have been drawn from  $p_{data}$ .
- Therefore, the desirable properties of  $p_{model}$  are:

# Our First Generative Model

## *Accuracy*

If  $p_{model}$  is high for a generated observation, it should look like it has been drawn from  $p_{data}$ . If  $\backslash(p_{model}\backslash)$  is low for a generated observation, it should *not* look like it has been drawn from  $p_{data}$ .

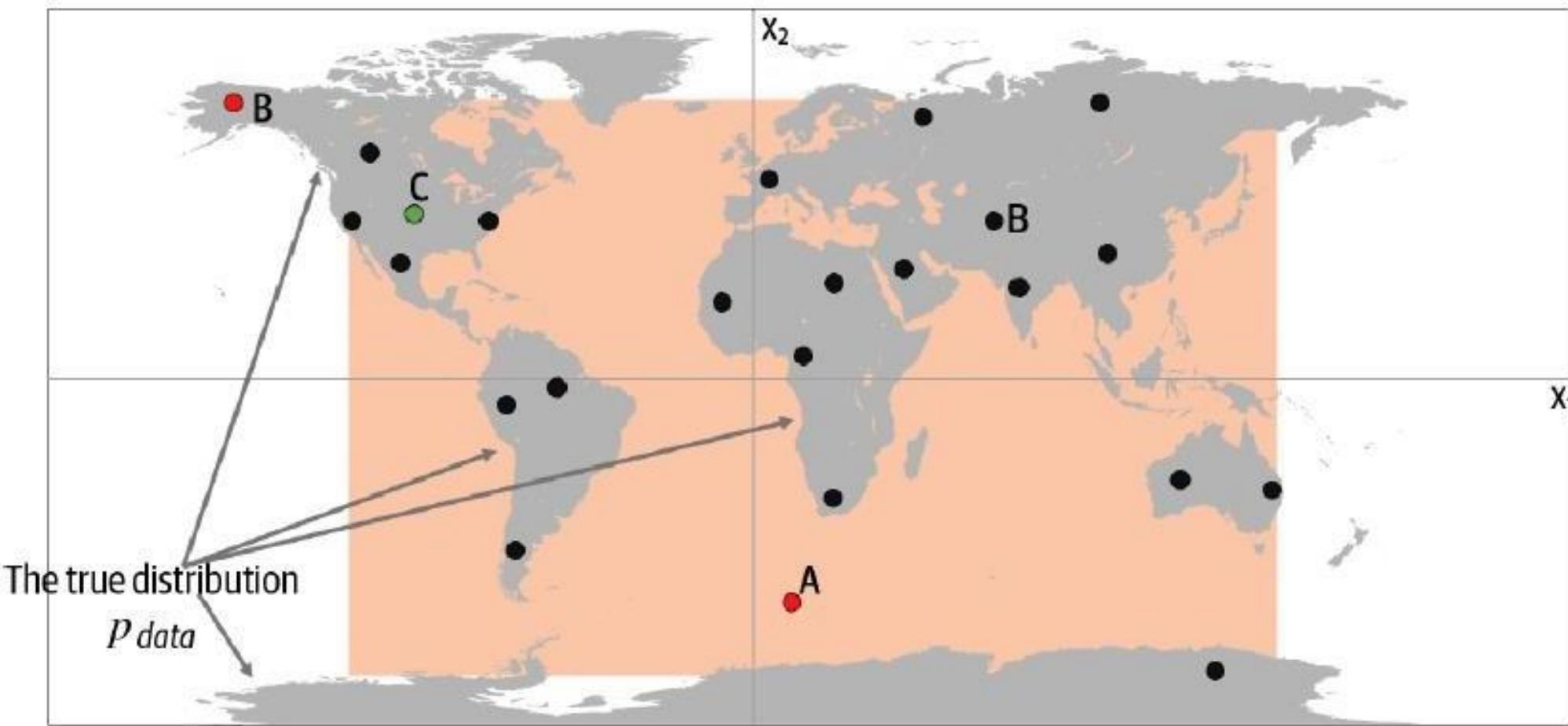
## *Generation*

It should be possible to easily sample a new observation from  $p_{model}$ .

## *Representation*

It should be possible to understand how different high-level features in the data are represented by  $p_{model}$ .

# True Data Generating Distribution



# True Data Generating Distribution

Clearly, our model,  $p_{model}$ , is an oversimplification of  $p_{data}$ . We can inspect points A, B, and C to understand the successes and failures of our model in terms of how accurately it mimics  $p_{data}$ :

- Point A is an observation that is generated by our model but does not appear to have been generated by  $p_{data}$  as it's in the middle of the sea.
- Point B could never have been generated by  $p_{model}$  as it sits outside the orange box. Therefore, our model has some gaps in its ability to produce observations across the entire range of potential possibilities.
- Point C is an observation that could be generated by  $p_{model}$  and also by  $p_{data}$ .

# True Data Generating Distribution

- Despite its shortcomings, the model is easy to sample from, because it is simply a uniform distribution over the orange box. We can easily choose a point at random from inside this box, in order to sample from it
- Also, we can certainly say that our model is a simple representation of the underlying complex distribution that captures some of the underlying high-level features
- The true distribution is separated into areas with lots of land mass (continents) and those with no land mass (the sea). This is a high-level feature that is also true of our model, except we have one large continent, rather than many

# References

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