

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

Google Translate

Sign in

Text

Images

Documents

Websites

Greek - Detected

English

Spanish

French

↔

English

Spanish

Arabic

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

I katastrofí pou échei gínei sti nótia plevrá tis Párnithas eínai polý megáli.

[Look up details](#)

77 / 5,000

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

[Look up details](#)

Send feedback

Generative AI is not a new concept



san f

san francisco weather
san francisco
san francisco giants
san fernando valley
san francisco state university
san francisco hotels
san francisco 49ers
san fernando
san fernando mission
san francisco zip code

Subject

I like to|

> see get be

1 2 3 4 5 6 7 8 9 0
q w e r t y u i o p

a s d f g h j k l

⬆ z x c v b n m ⬆

?123 , 😊 . ↩

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

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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.

● WATCH LIVESTREAM

[Prefer to Listen?](#)

NOW

Squawk on the Street

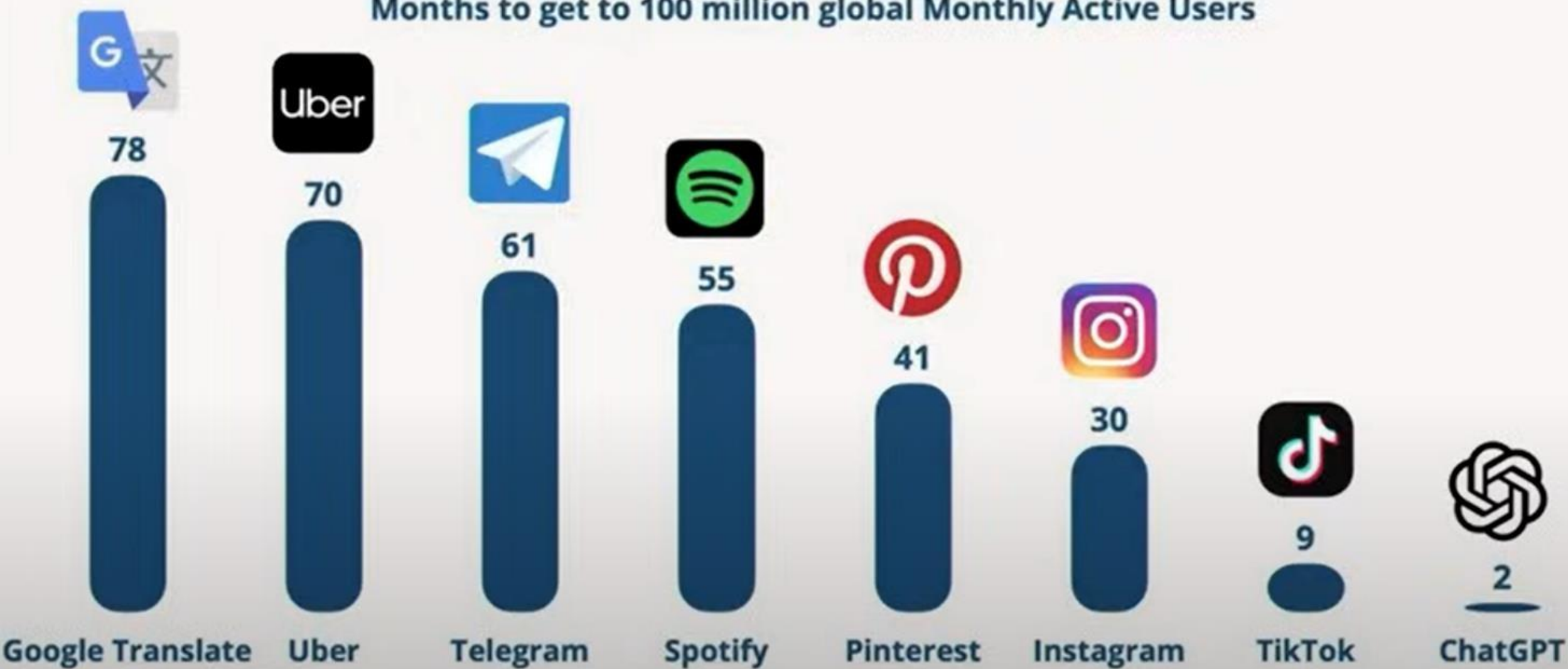
UP NEXT

Money Movers

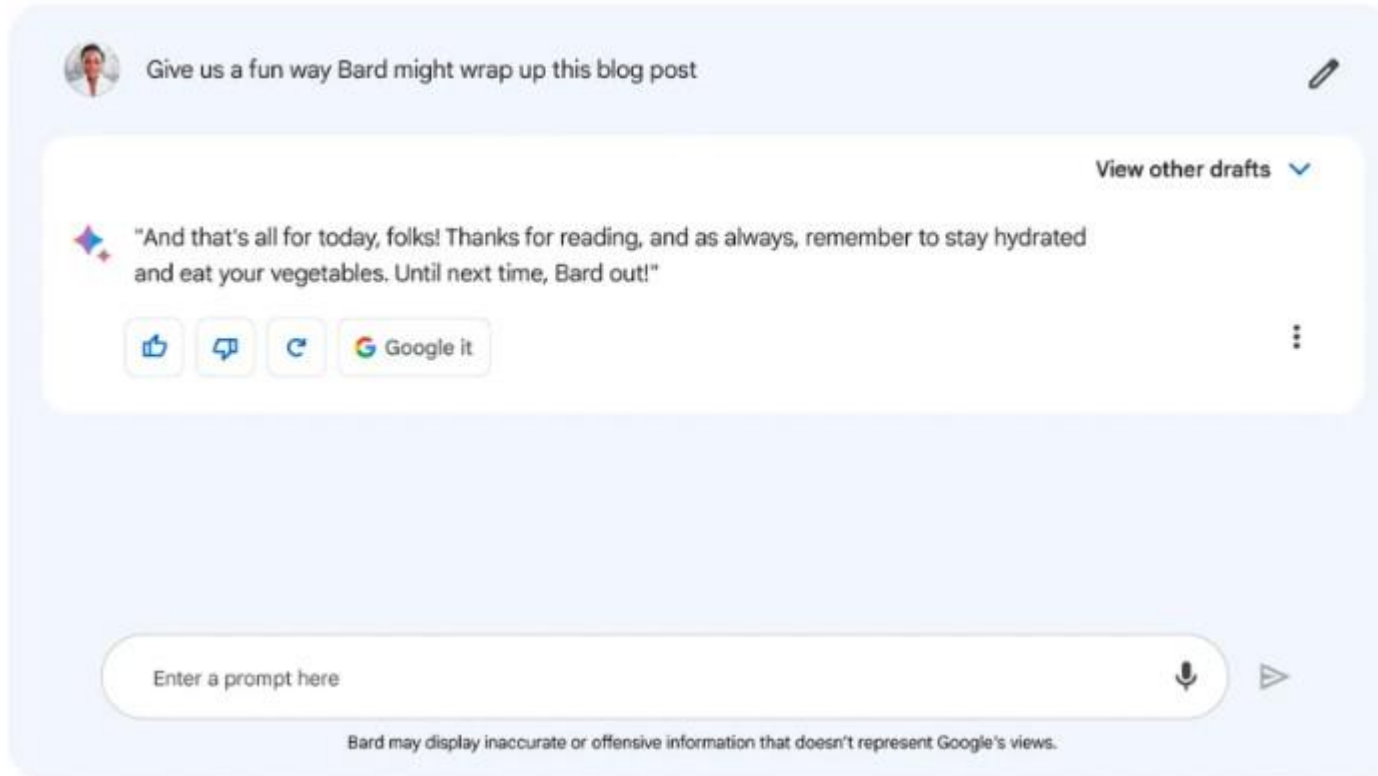
Activate Windows
Go to Settings to activate Windows

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

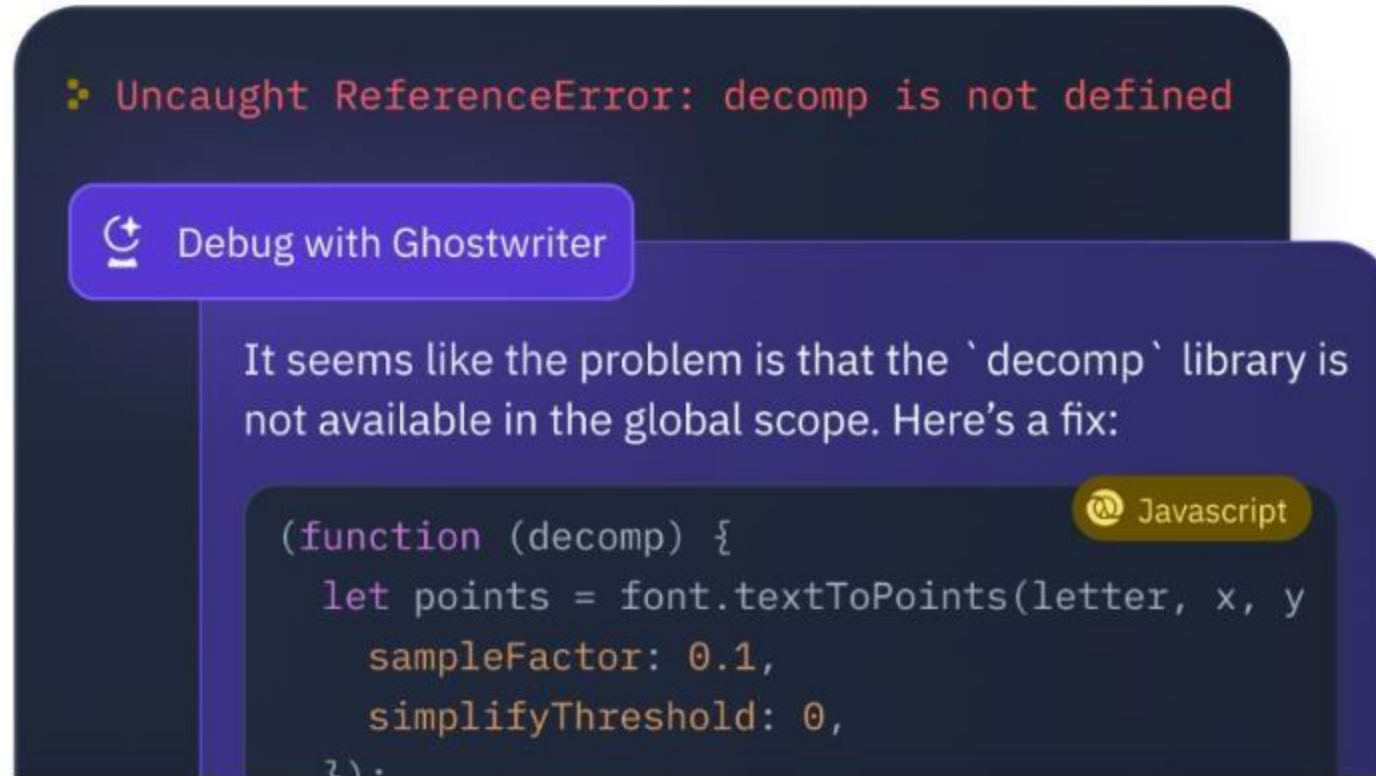
Examples of Generative AI



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

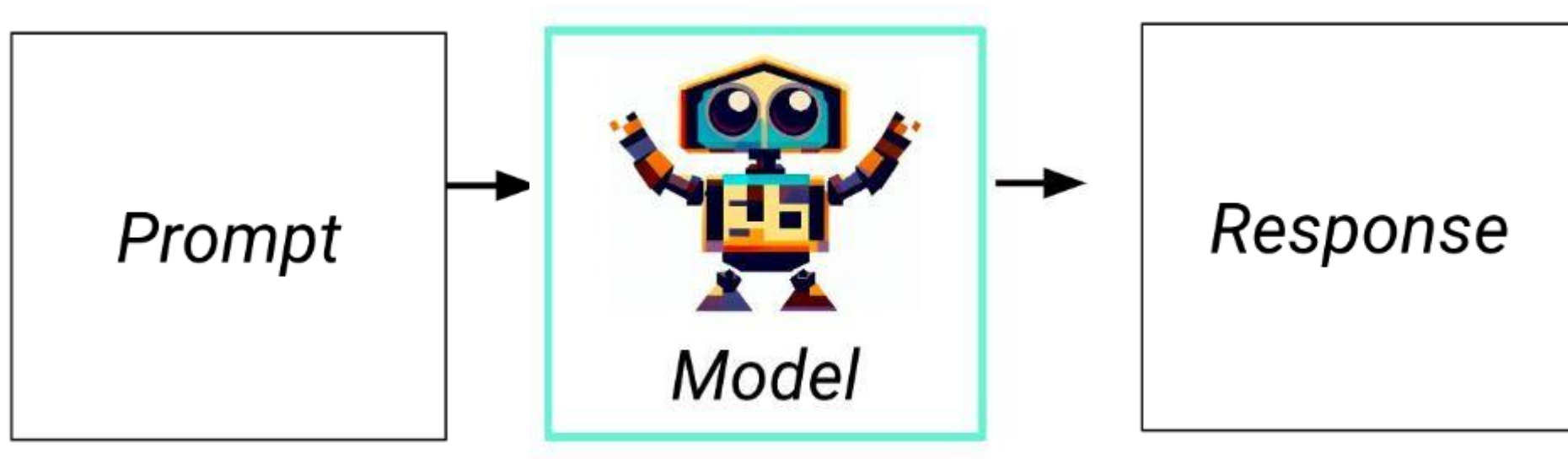
Generate Video in response to User Query

Examples of Generative AI



Write Code to help Developers work faster

How does it work?



Create images

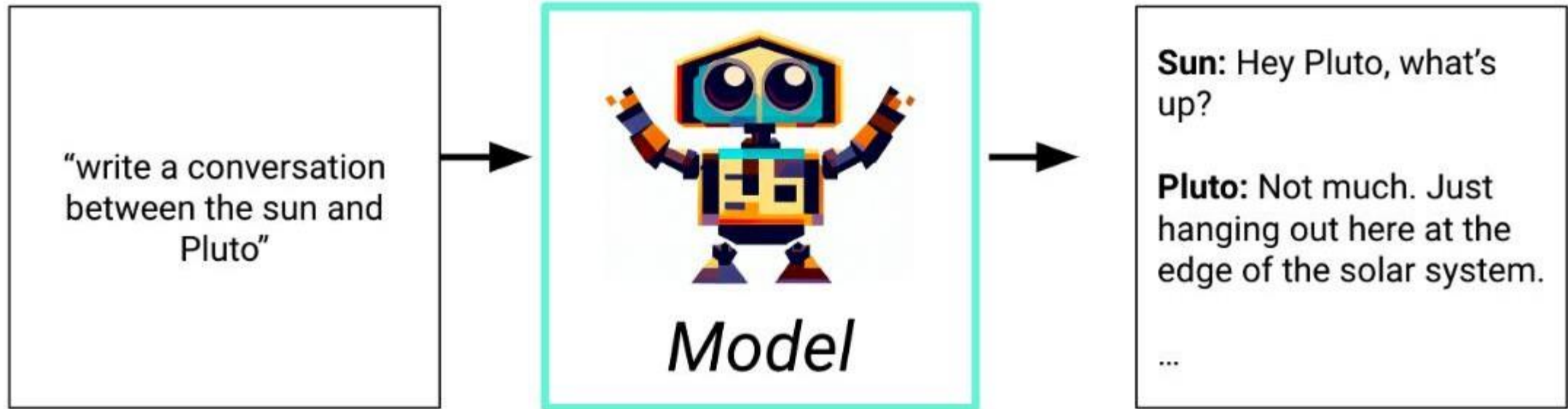
"wide-angle shot from
below of a female
astronaut..."



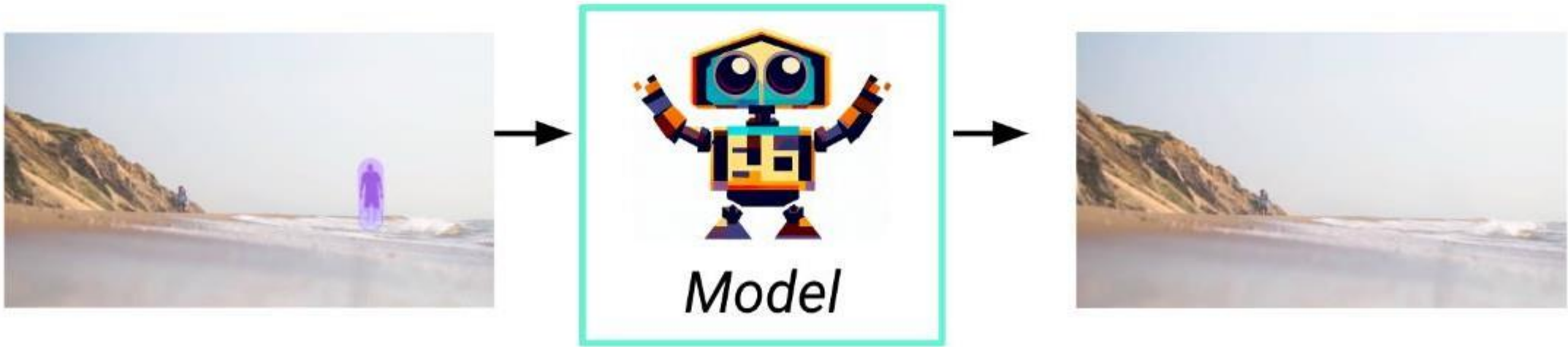
Model



Hold conversations

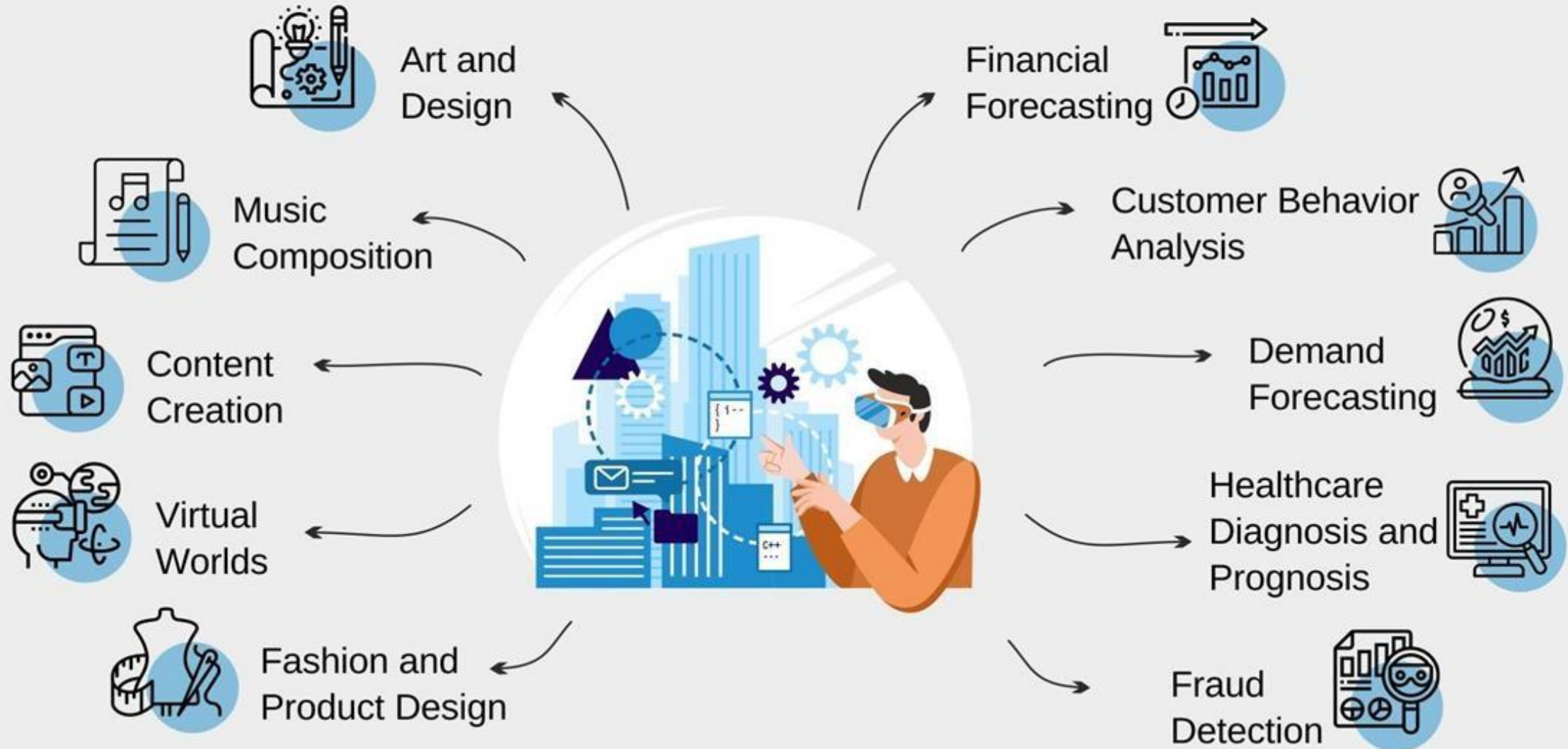


Input more than text

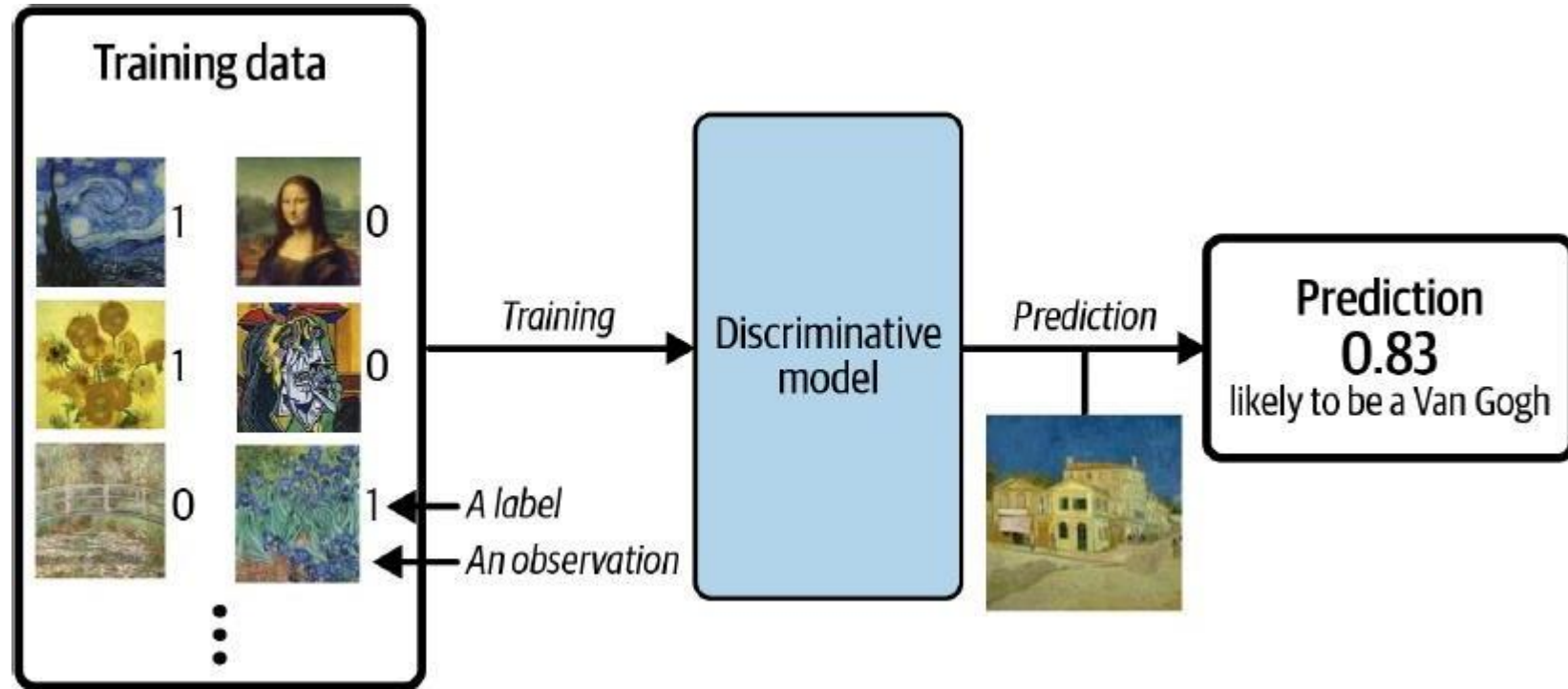


Generative AI Applications

Predictive AI Applications



Generative versus Discriminative Modelling

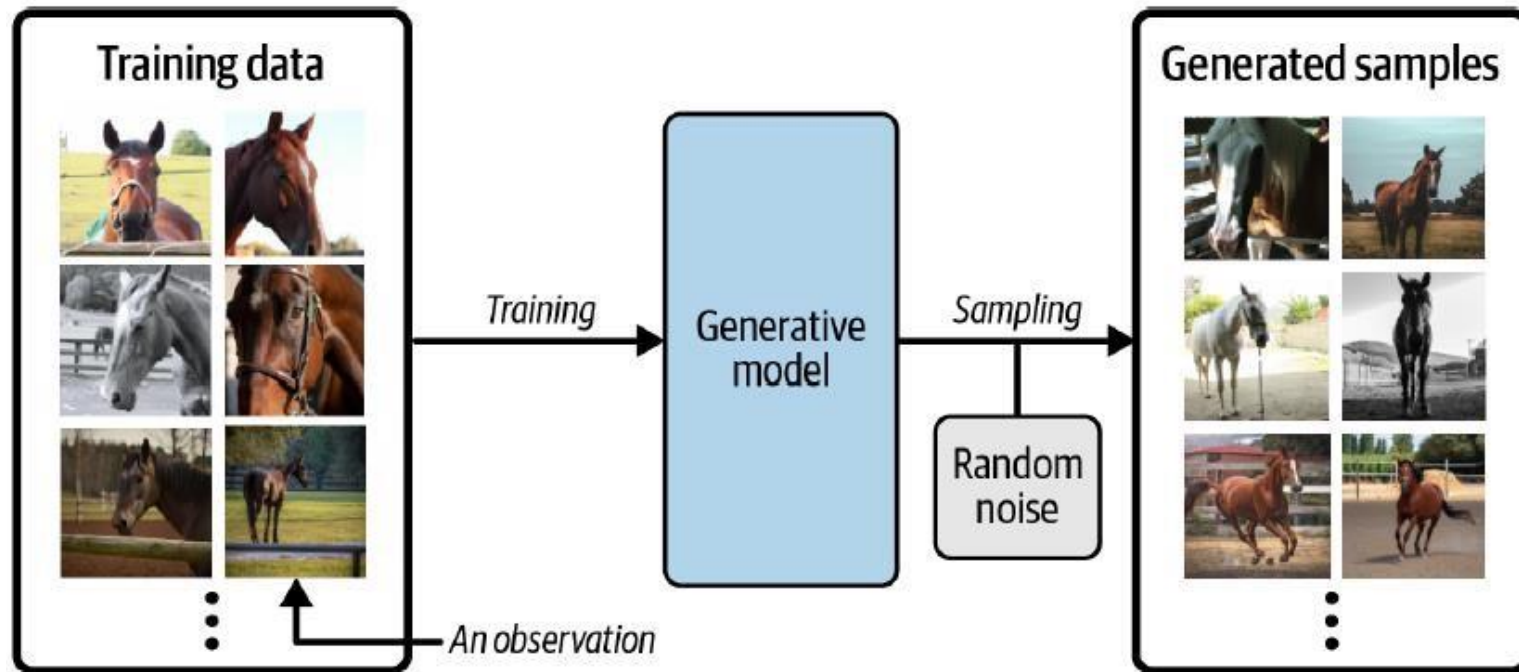


A discriminative model trained to predict if a given image is painted by Van Gogh

Discriminative modeling estimates $p(y|\mathbf{x})$.

That is, discriminative modeling aims to model the probability of a label y given some observation \mathbf{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

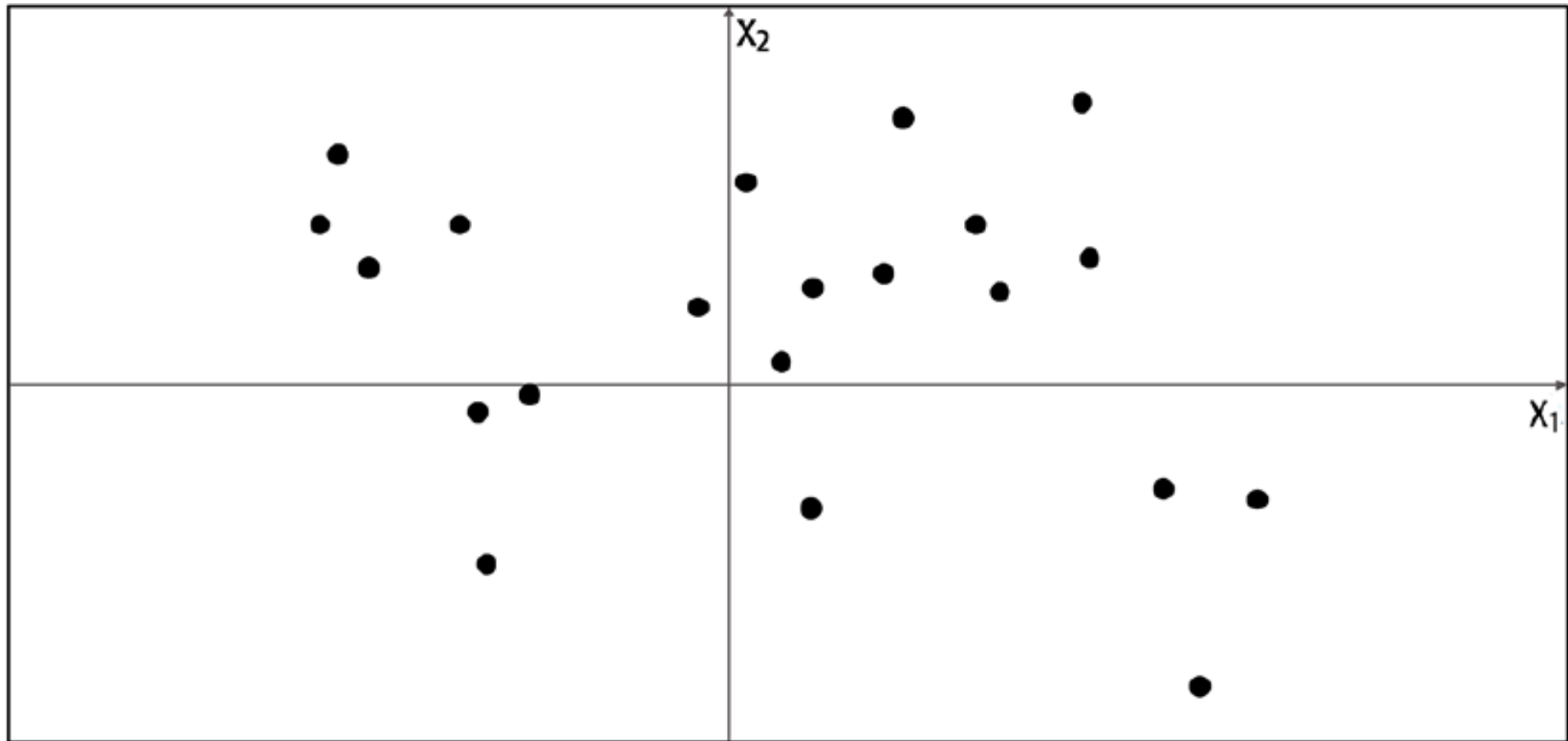
Stages of Artificial Intelligence

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

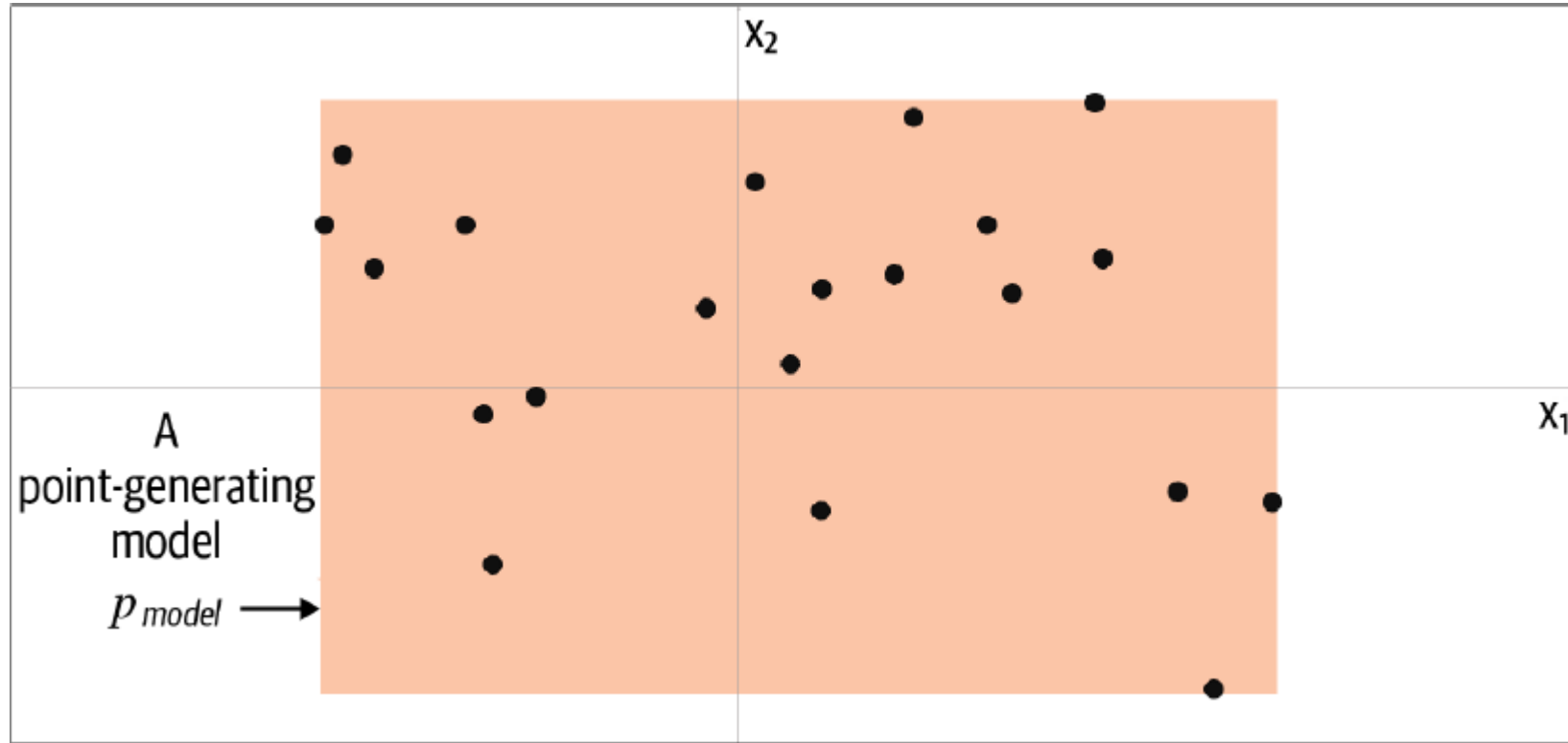


A set of points in two dimensions, generated by an unknown rule p_{data}

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_{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 p_{model} is low for a generated observation, it should *not* look like it has been drawn from p_{data} .

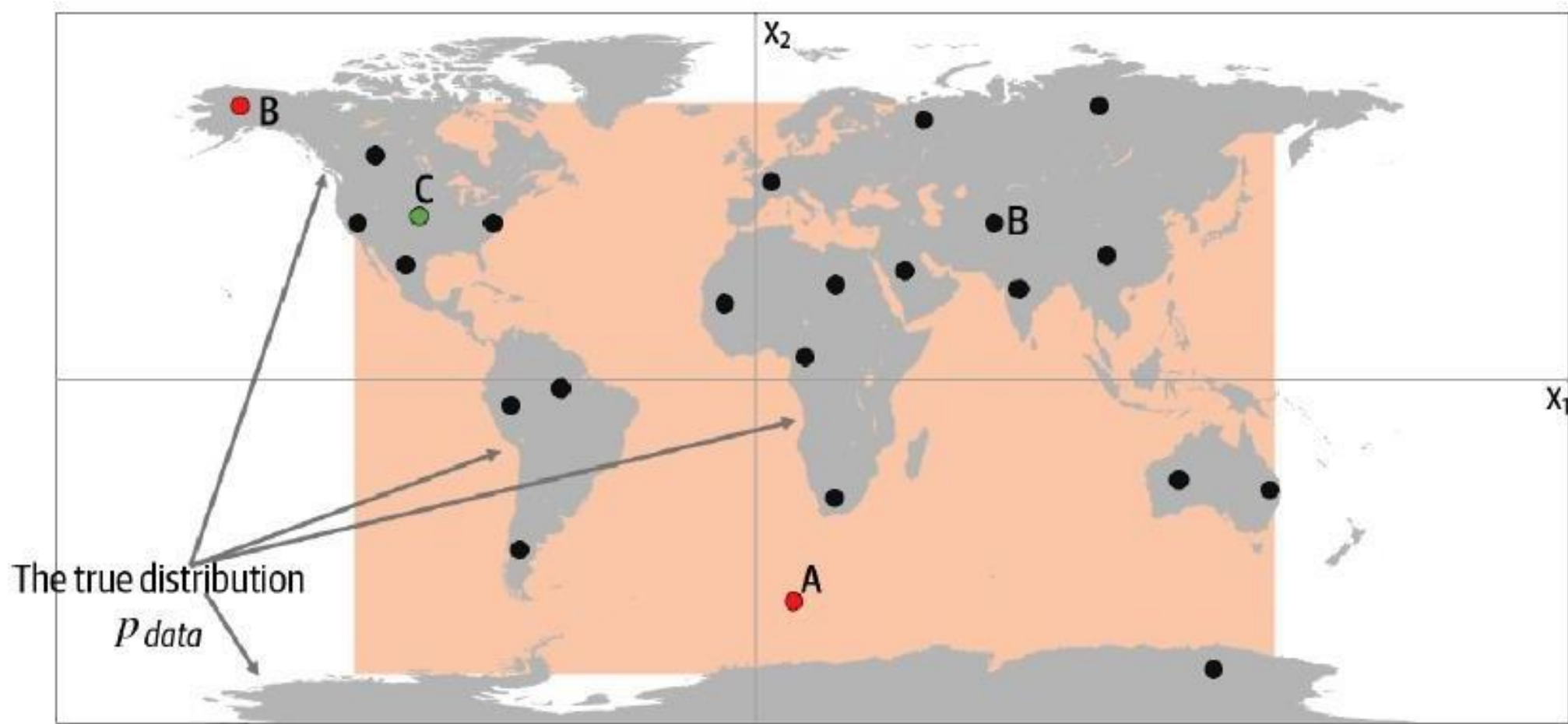
Generation

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

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