

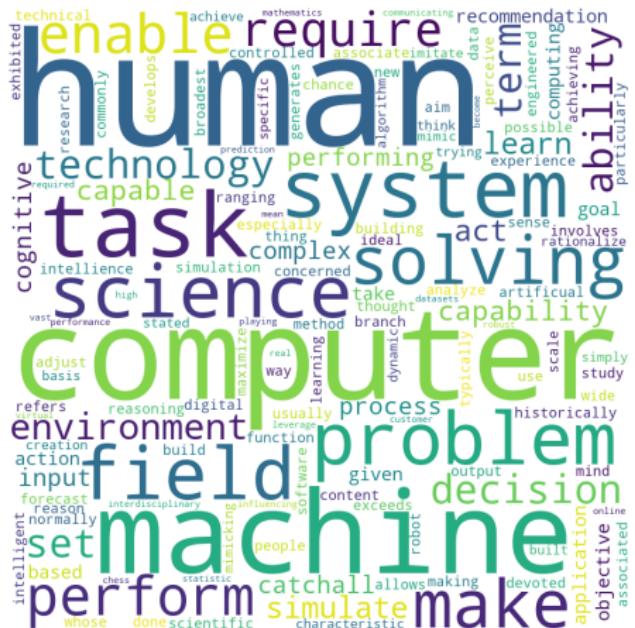
# What is AI?

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# Definitions of AI Word Cloud

- We did an internet search of “What is AI?” and compiled the definitions from the first 16 results into the word cloud below.



# AI According to Technology Companies

- ▶ Google: Artificial intelligence is a field of science concerned with building computers and machines that can reason, learn, and act in such a way that would normally require human intelligence or that involves data whose scale exceeds what humans can analyze<sup>1</sup>.
- ▶ IBM: Artificial intelligence is technology that enables computers and machines to simulate human intelligence and problem-solving capabilities<sup>2</sup>.
- ▶ SAS: Artificial intelligence makes it possible for machines to learn from experience, adjust to new inputs and perform human-like tasks<sup>3</sup>.

## AI According to AI

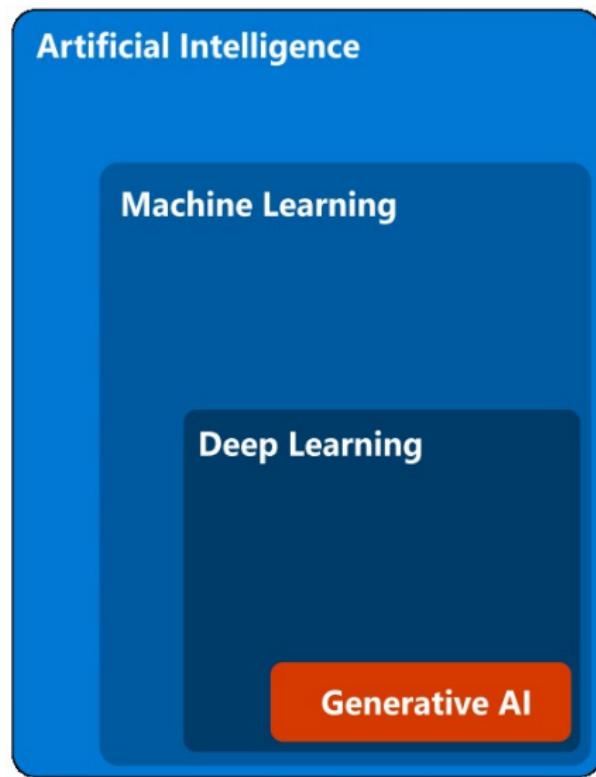
- ▶ ChatGPT: Artificial Intelligence refers to the simulation of human intelligence in machines that are programmed to think, learn, and problem-solve like a human<sup>4</sup>.
- ▶ Copilot: Artificial Intelligence refers to technology that enables computers and machines to simulate human intelligence and problem-solving capabilities<sup>5</sup>.
- ▶ Gemini: Artificial Intelligence is the field of computer science focused on creating intelligent agents, which are systems that can perceive their environment, learn, reason, and take actions to achieve specific goals. In essence, it's about building machines that can mimic human intelligence<sup>6</sup>.

## AI According to Executive Order

- ▶ The term “artificial intelligence” or “AI” has the meaning set forth in 15 U.S.C. 9401(3): a machine-based system that can, for a given set of human-defined objectives, make predictions, recommendations, or decisions influencing real or virtual environments. Artificial intelligence systems use machine- and human-based inputs to perceive real and virtual environments; abstract such perceptions into models through analysis in an automated manner; and use model inference to formulate options for information or action<sup>7</sup>.
- ▶ The term “AI model” means a component of an information system that implements AI technology and uses computational, statistical, or machine-learning techniques to produce outputs from a given set of inputs<sup>7</sup>.

# History of AI

- ▶ In the popular zeitgeist AI is closely associated with Generative AI such as ChatGPT, but that is just a small subset of the AI that exists.



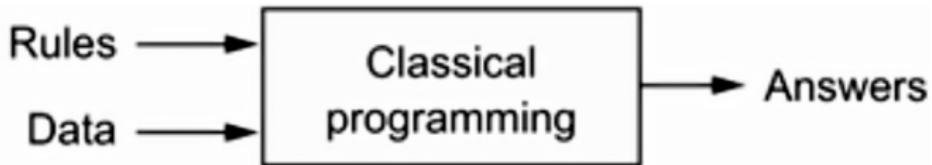
## History of AI: Symbolic AI I

- ▶ The study of AI began in 1956 with early computer scientist John McCarthy, who said of the study the following<sup>8</sup>:

*This study is to proceed on the basis of the conjecture that every aspect of learning or any other feature of intelligence can in principle be so precisely described that a machine can be made to simulate it.*
- ▶ This vision of AI is called “Symbolic AI” because it assumes that all decision making processes, regardless of complexity, can be modeled using mathematical logic.

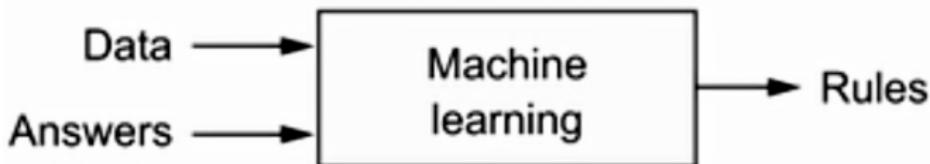
## History of AI: Symbolic AI II

- ▶ John McCarthy's thoughts about symbolic AI were later epitomized in the so-called Expert Systems of the 1980s. These AI attempted to mimic the decision-making process of human experts by encoding their knowledge as rules for computers to follow<sup>9</sup>.
- ▶ Symbolic AI takes in rules and data and outputs answers<sup>8</sup>.



## History of AI: Machine Learning

- ▶ Following the advent of faster hardware and less expensive computing, the 1990s saw the birth of Machine Learning, and to this day these models make up most of the AI in the wild<sup>8</sup>.
- ▶ While Symbolic AI produces answers using deterministic rules, Machine learning takes in data and answers and produces rules<sup>8</sup>.



# History of AI: Deep Learning I

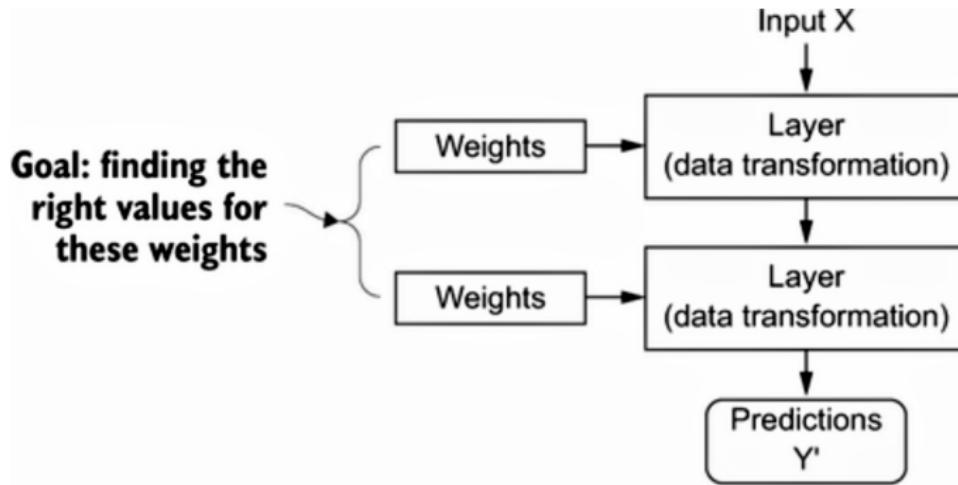
- ▶ The basic theoretical framework for Neural Networks has existed since the 1950s, however, the methodology received little attention until it was successfully applied in 1989 at Bell Labs to automate the reading of ZIP codes on mail envelopes<sup>8</sup>.
- ▶ Around 2010 advancements in data, hardware, and algorithms led to Deep Neural Networks, that is a Machine Learning model that learns increasingly meaningful data representations by Neural Networks<sup>8</sup>.
- ▶ Deep Neural Networks gained prominence in 2012 after they were used to *solve* with a high degree of accuracy many academic image classification contests<sup>8</sup>.

## History of AI: Deep Learning II

- ▶ Most Machine Learning methods assume that there is a single representation of the data that will get us as close as possible to the expected output<sup>8</sup>.
- ▶ Deep Learning uses many successive representations of the data to create depth. These layered representations of the data are learned via models called Neural Networks<sup>8</sup>.

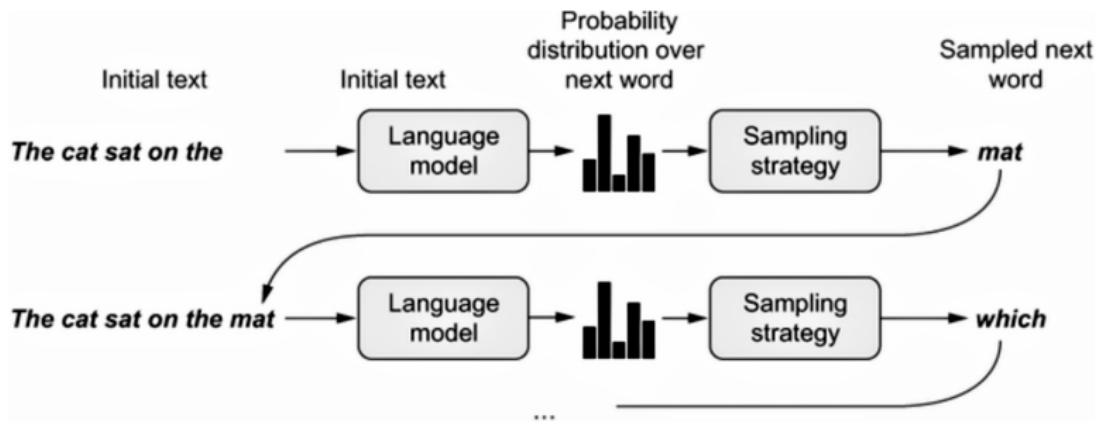
# History of AI: Deep Learning III

- ▶ A Deep Neural Network can be thought of as a information-distillation process where data goes through successive filters and comes out increasingly purified, meaning that each subsequent layer is better than the next at predicting the outcome<sup>8</sup>.



# History of AI: Generative AI

- ▶ Generative AI has existed since 2015 but didn't gain national attention until November 20, 2022 with the release of OpenAI's ChatGPT<sup>8</sup>.
- ▶ Generative AI simulates creative tasks with new written, visual, and auditory content<sup>8</sup>.



## Example: Dog Breed Classifier I

The following AI from Hugging Face takes an image of a dog and classifies its breed<sup>10</sup>:



## Example: Dog Breed Classifier II

```
from transformers import (
    AutoImageProcessor, AutoModelForImageClassification)
import PIL
import requests

image_processor = AutoImageProcessor.from_pretrained(
    "wesleyacheng/dog-breeds-multiclass-image-classification-with-vit")
model = AutoModelForImageClassification.from_pretrained(
    "wesleyacheng/dog-breeds-multiclass-image-classification-with-vit")

image = PIL.Image.open("./images/ein_original.jpeg")
inputs = image_processor(images=image, return_tensors="pt")

outputs = model(**inputs)
logits = outputs.logits

predicted_class_idx = logits.argmax(-1).item()
print("Predicted class:", model.config.id2label[predicted_class_idx])
```

- ▶ Predicted class: pembroke

## Example: AI Image Generation I

The following AI from Hugging Face takes a prompt and outputs an image<sup>11</sup>:

```
import torch
from diffusers import FluxPipeline

pipe = FluxPipeline.from_pretrained(
    "black-forest-labs/FLUX.1-dev",
    torch_dtype=torch.bfloat16)

prompt = "A corgie in a sherlock holmes costume"
image = pipe(
    prompt,
    height=600,
    width=600,
    guidance_scale=3.5,
    num_inference_steps=50,
    max_sequence_length=512,
    generator=torch.Generator("cpu").manual_seed(0)
).images[0]
image.save("./images/sherlock_corgie.png")
```

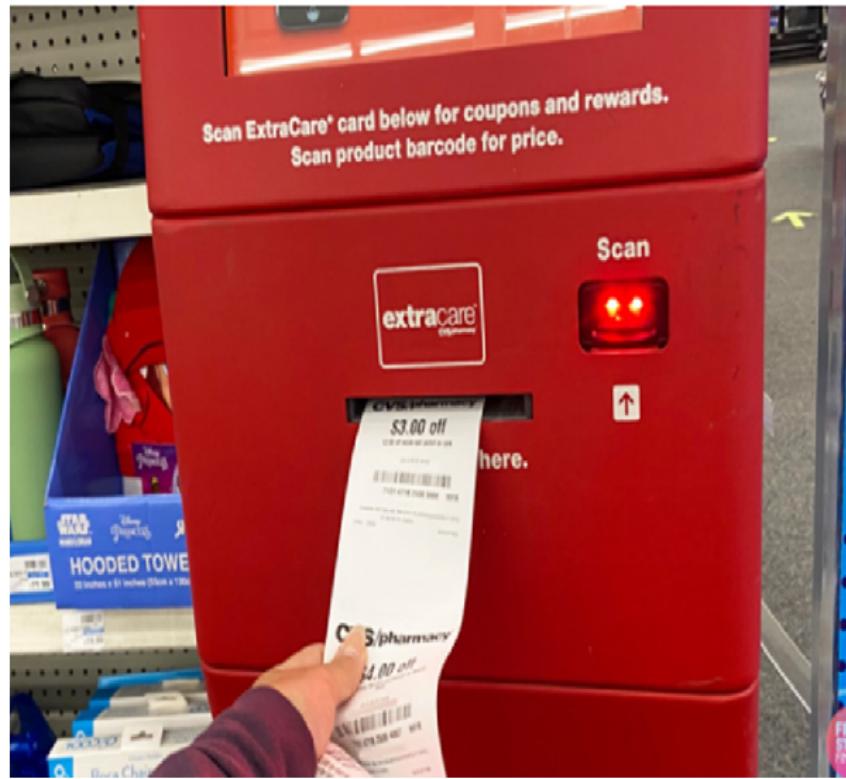
## Example: AI Image Generation II



## Example: AI or Not AI : Automatic Door



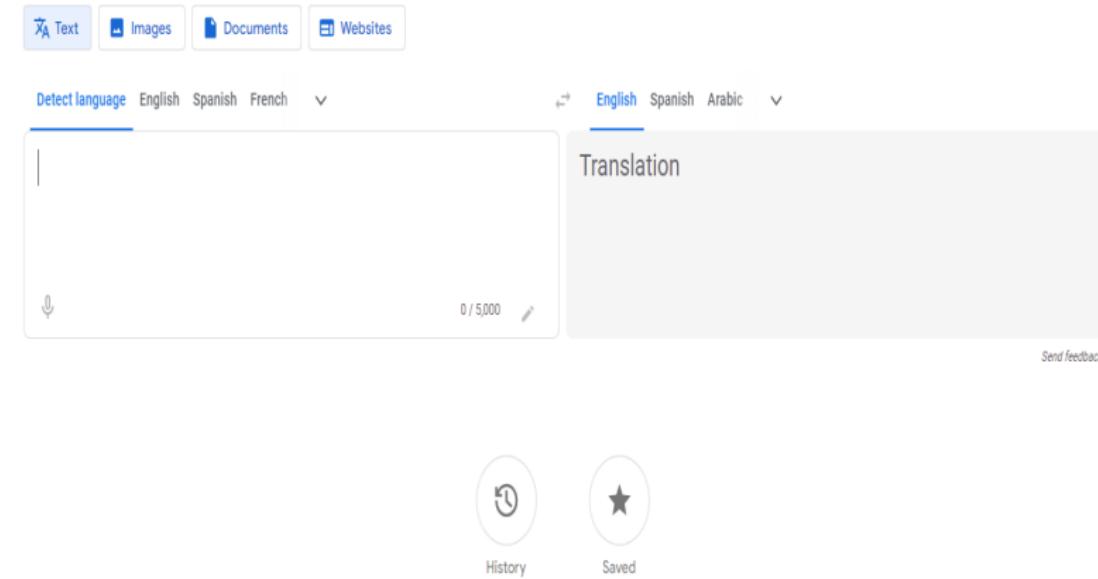
## Example: AI or Not AI : Personal Coupons



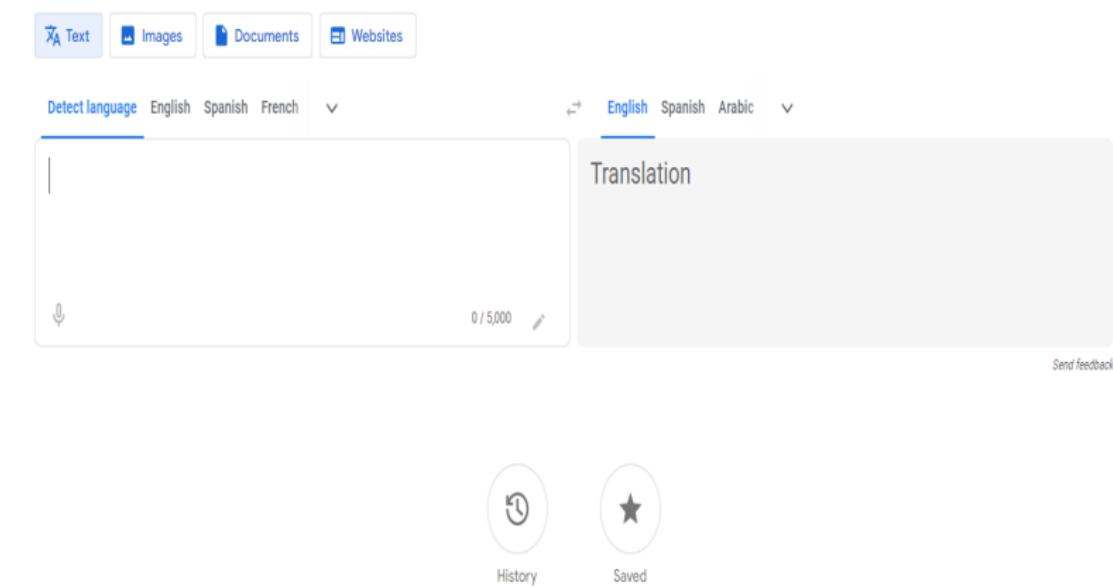
# Example: AI or Not AI : Credit Scores and Credit Card Application Acceptance



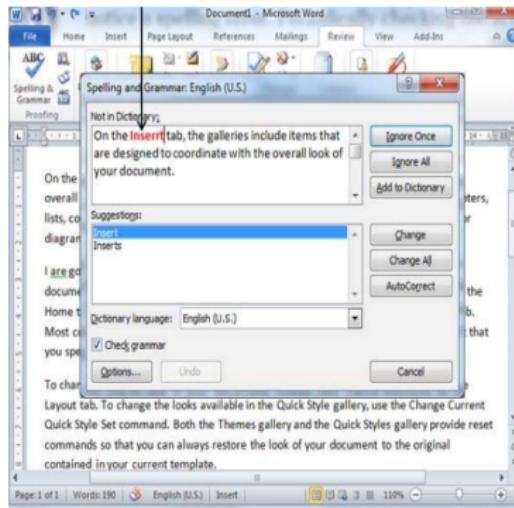
# Example: AI or Not AI : Language Translation Software



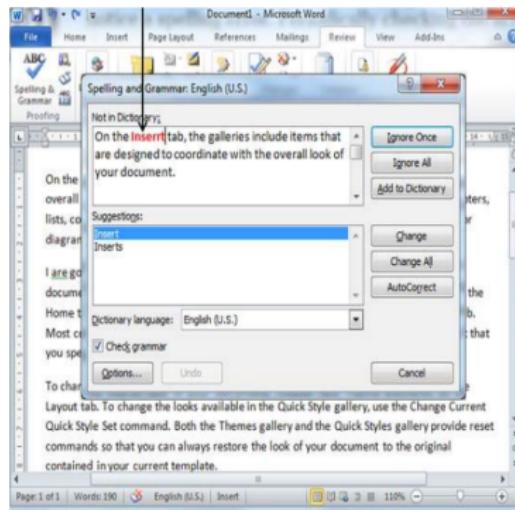
# Example: AI or Not AI : Language Translation Software (Before 2016)



## Example: AI or Not AI : Spell/Grammar Check



# Example: AI or Not AI : Spell/Grammar Check (Before 2016)



## Example: AI or Not AI : Voice Activated Personal Home Assistants



## Where do I find AI?

- ▶ Hugging Face (<https://huggingface.co>) is a large machine learning community with many data sets and publicly available AI models.
- ▶ kaggle (<https://www.kaggle.com>) is famous for it's competitions but also provides data and publicly available AI models.
- ▶ TensorFlow Hub (<https://www.tensorflow.org/hub>) and PyTorch Hub (<https://pytorch.org/hub/>) both provide many pre-trained AI models that take advantage of their well established Python Machine Learning APIs.
- ▶ You can buy it!

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