

# Machine Learning

How can a computer learn ?

# What is Artificial Intelligence ?

- **A science !**
- Try to mimic capabilities of humans for problem-solving and decision-making :
  - **Bounded rationality** : systems that can act rationally
  - **Cybernetics** : systems that can adapt
  - **Expert systems** : systems that can think logically
  - **Machine Learning** : system that can learn from experience

# What is Artificial Intelligence ?

## Computing Machinery and Intelligence

Alan M. Turing

Mind (Journal)

### I.—COMPUTING MACHINERY AND INTELLIGENCE

By A. M. TURING

#### 1. *The Imitation Game.*

I PROPOSE to consider the question, ‘Can machines think?’ This should begin with definitions of the meaning of the terms ‘machine’ and ‘think’. The definitions might be framed so as to reflect so far as possible the normal use of the words, but this attitude is dangerous. If the meaning of the words ‘machine’ and ‘think’ are to be found by examining how they are commonly used it is difficult to escape the conclusion that the meaning and the answer to the question, ‘Can machines think?’ is to be sought in a statistical survey such as a Gallup poll. But this is absurd. Instead of attempting such a definition I shall replace the question by another, which is closely related to it and is expressed

**“ What we want is a machine that can  
learn from experience “**

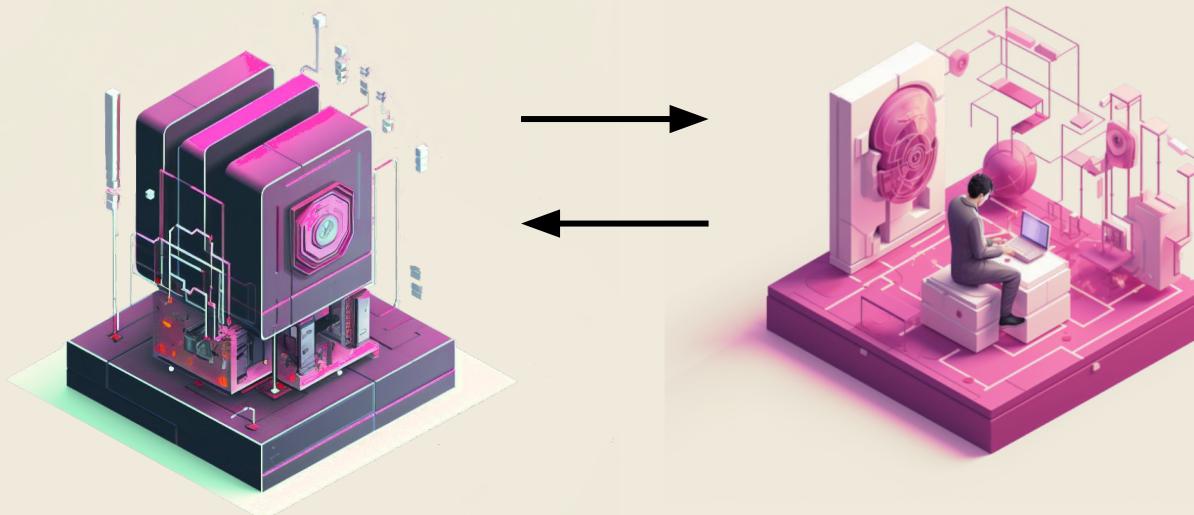
Alan M. Turing

# What is Artificial Intelligence ?

- We have no precise definition of intelligence !
- How can we measure the intelligence of a system ?
  - We need a set of methods and tools to measure that.
- **First attempt** : the Turing Test !

# What is Artificial Intelligence ?

Human or Machine ?



Human subject + console

# Issues with the Turing Test

- Is the human judgement efficient ?
- The **anthropomorphic fallacy** : our tendency to attribute human emotions and characteristics to inanimate objects and aspects of nature, such as plants, animals, or the weather.
  - We have a tendency to see intelligence everywhere !
  - Also referred as the **ELIZA effect**: to tendency to see intelligence in computer even when there is nothing.
- The Turing test is not efficient to measure intelligence !

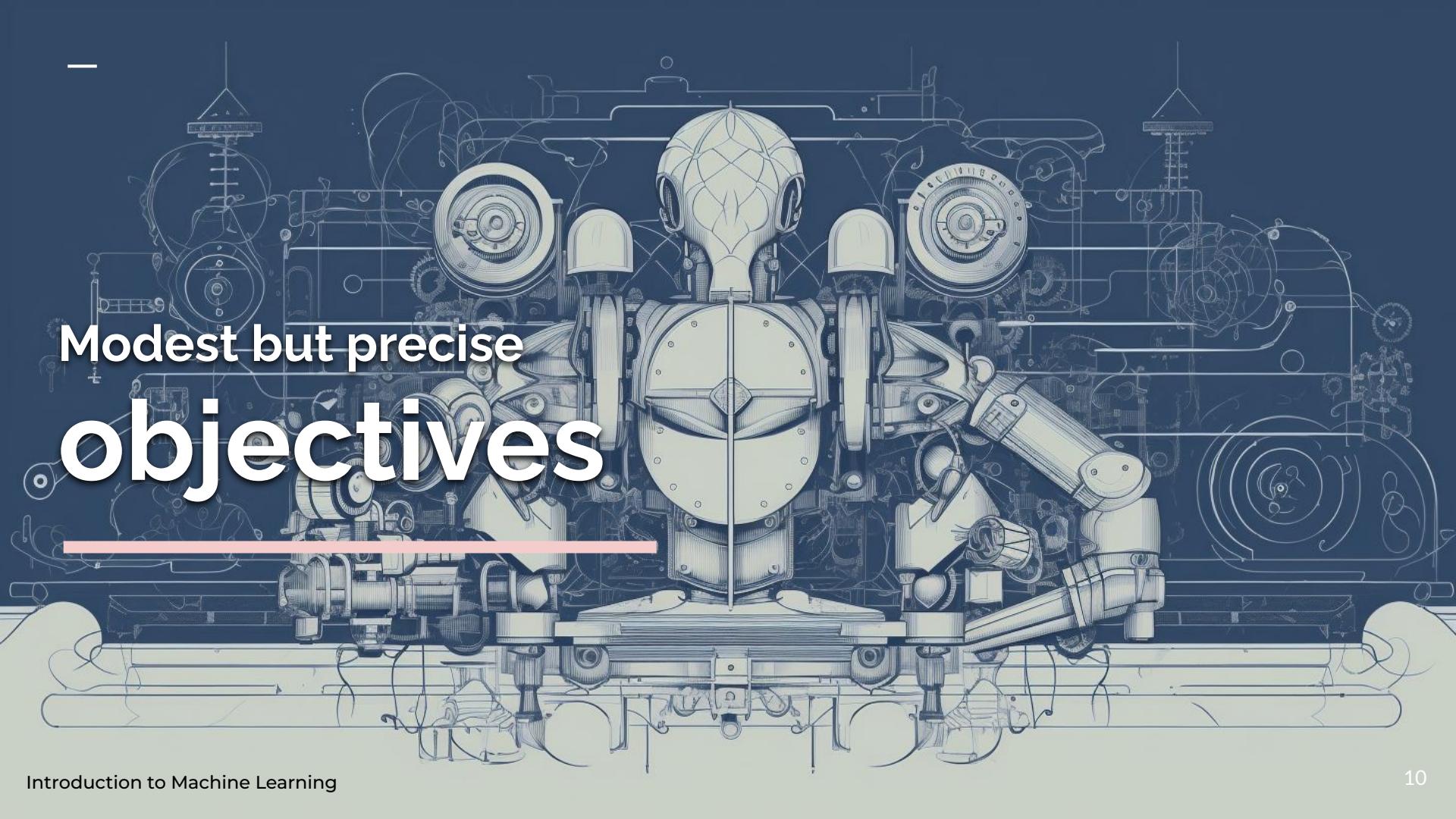
# Issues with the Turing Test

- **It is slow**! We need simple tests than we can automatise.
- It tests the capacity of a machine to behave as a human. Human behaviors are not always intelligent.
- Doesn't test intelligent behaviors such as problem solving and creativity.
- Penalize too much intelligence: if too intelligent, the machine will be detected.

# Issues with the Turing Test

- **Not applicable**
  - There are easier ways to test AI programs. For example, by giving problems to the machine to solve.
- **Useless**
  - Do we need such a complex test to achieve the fundamental goals of AI research?

Modest but precise  
objectives



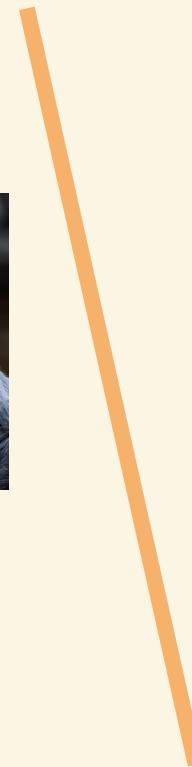
# How to measure intelligence ?

- There are easier ways to test AI programs. For example, by giving problems to the machine to solve.
- **Problem:** we don't really know the difficulty of the task to be solved: is there a shortcut that allows us to solve the task simply?

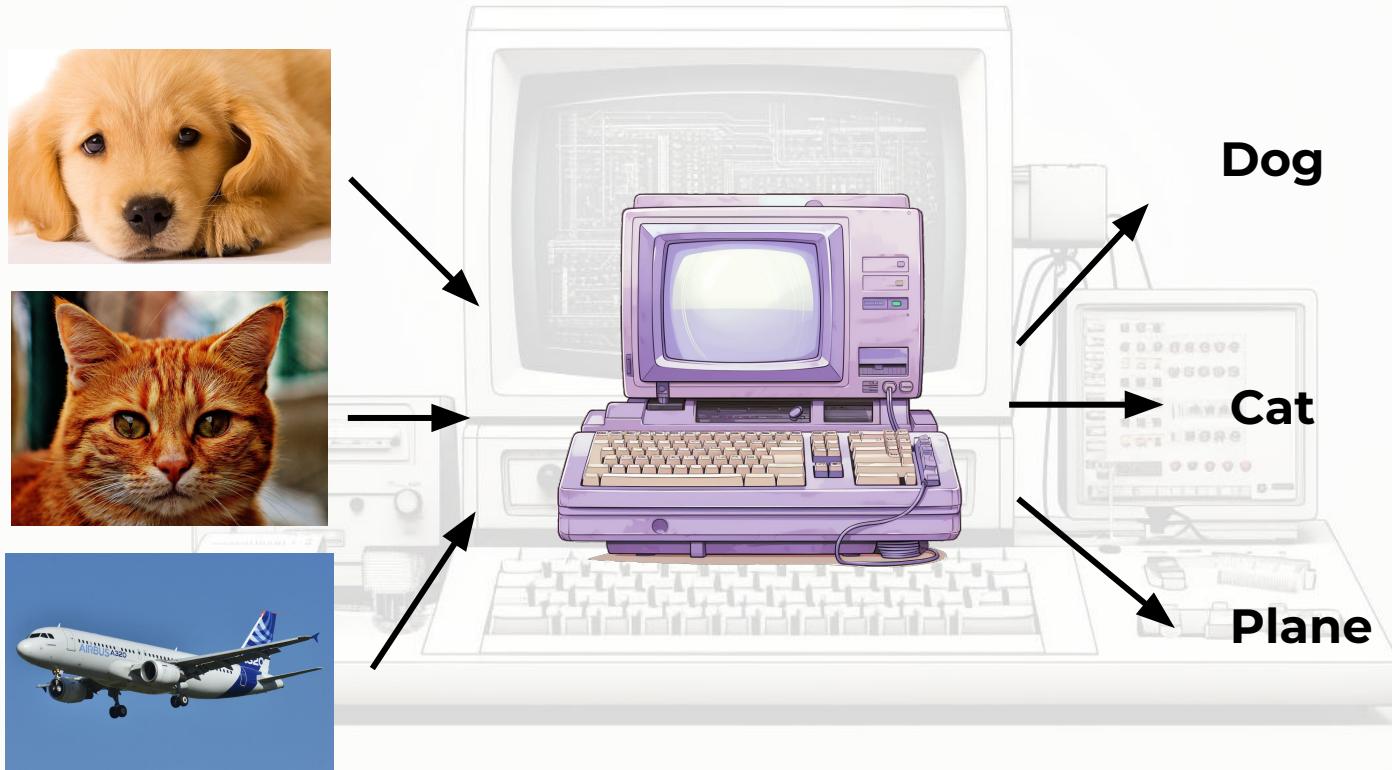
# How to measure intelligence ?



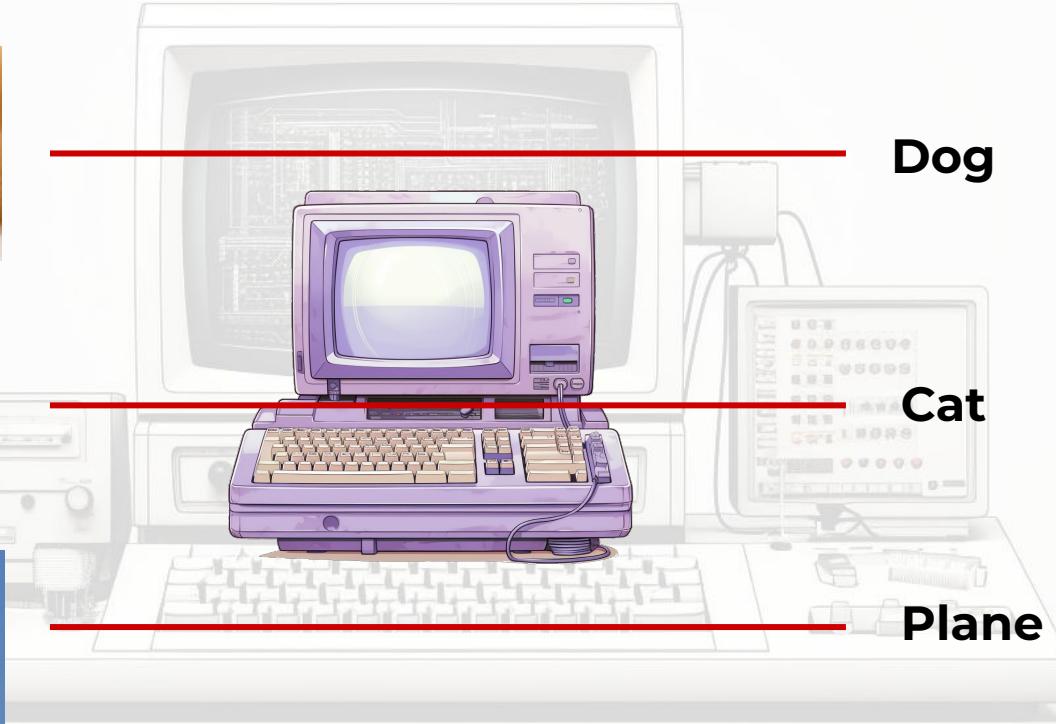
# How to measure intelligence ?



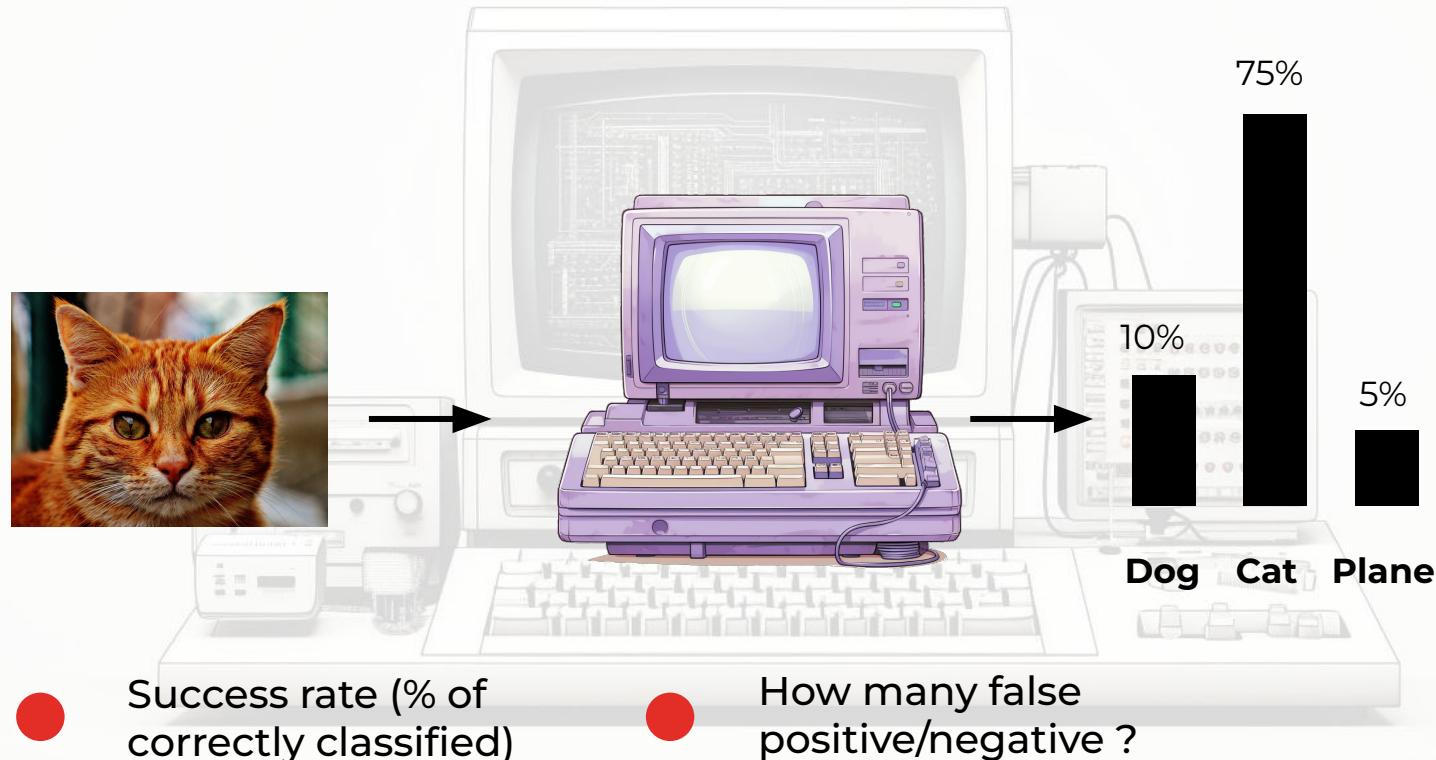
# Image classification



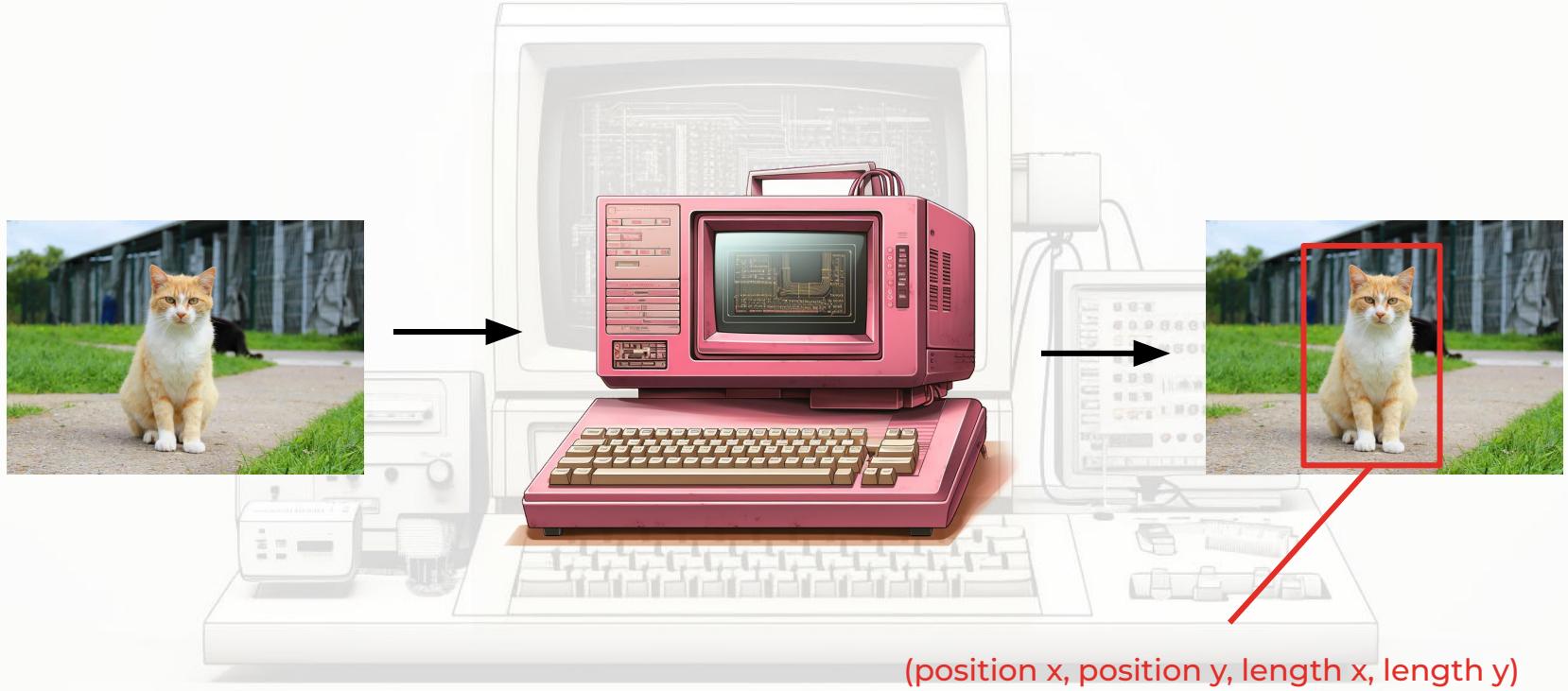
# Image classification



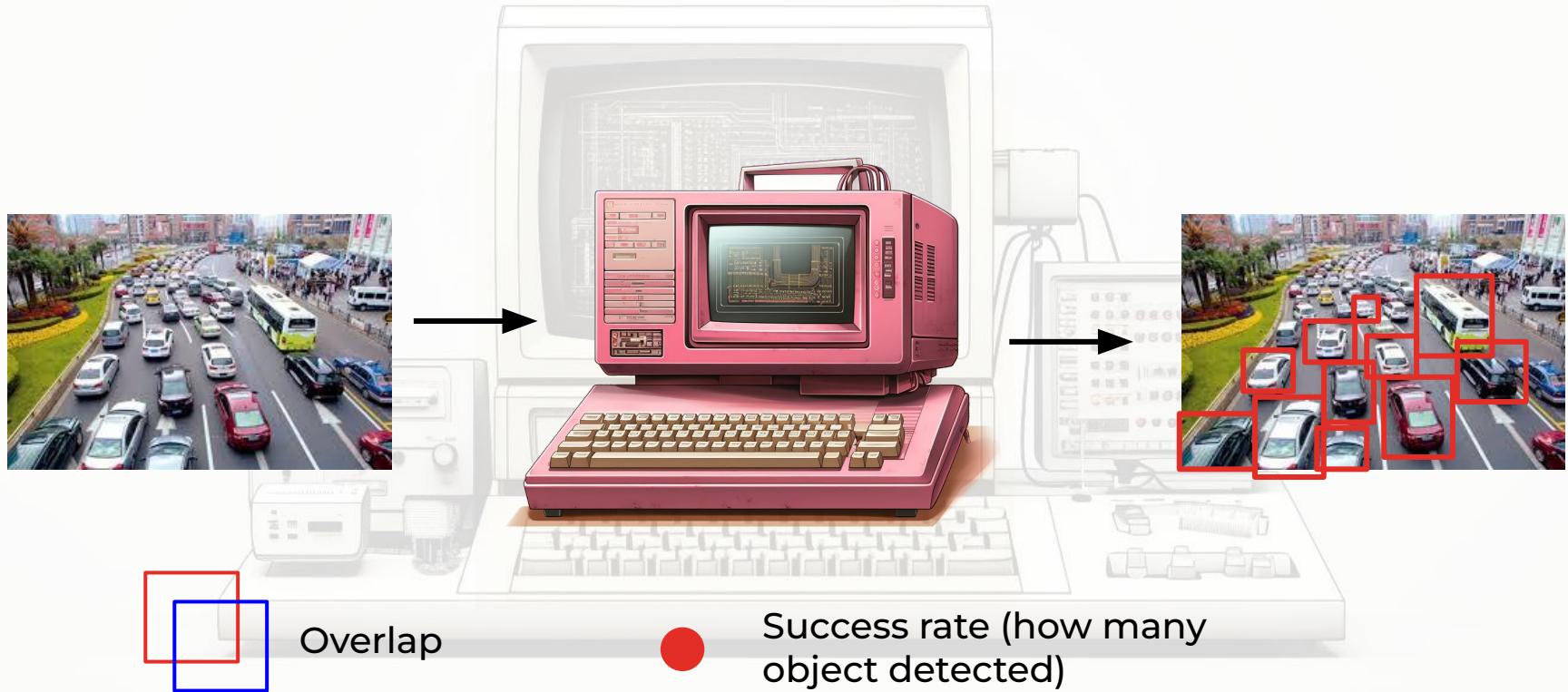
# Image classification



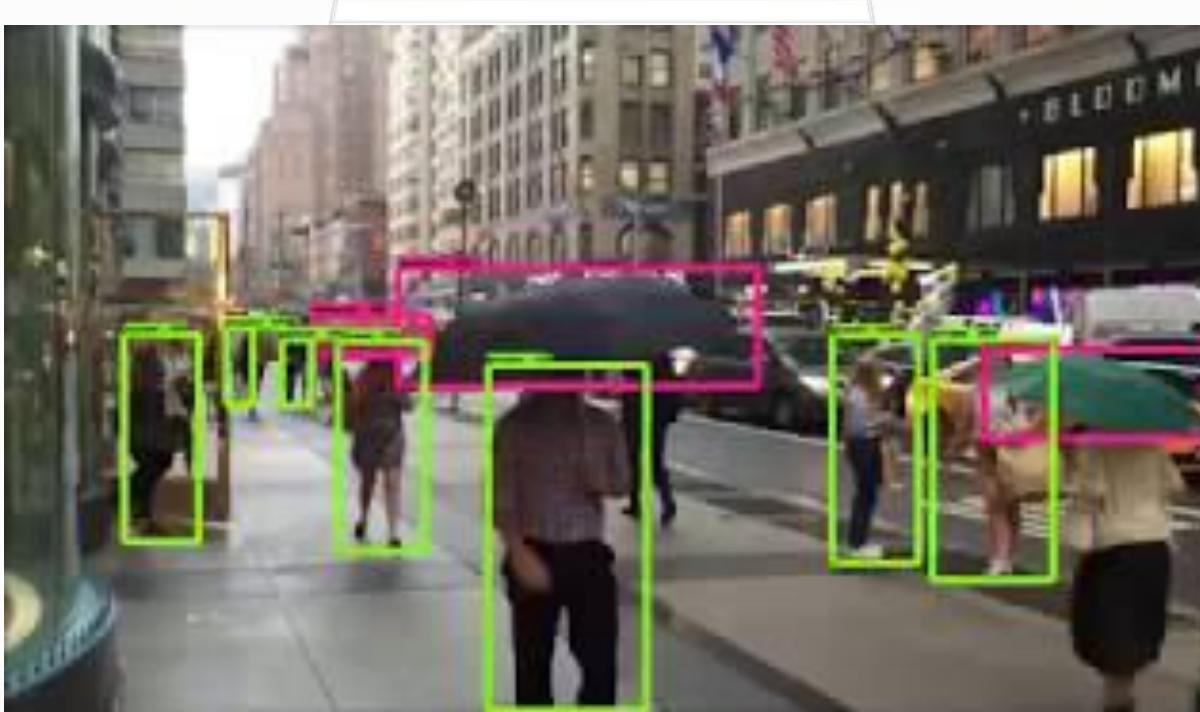
# Object detection



# Object detection

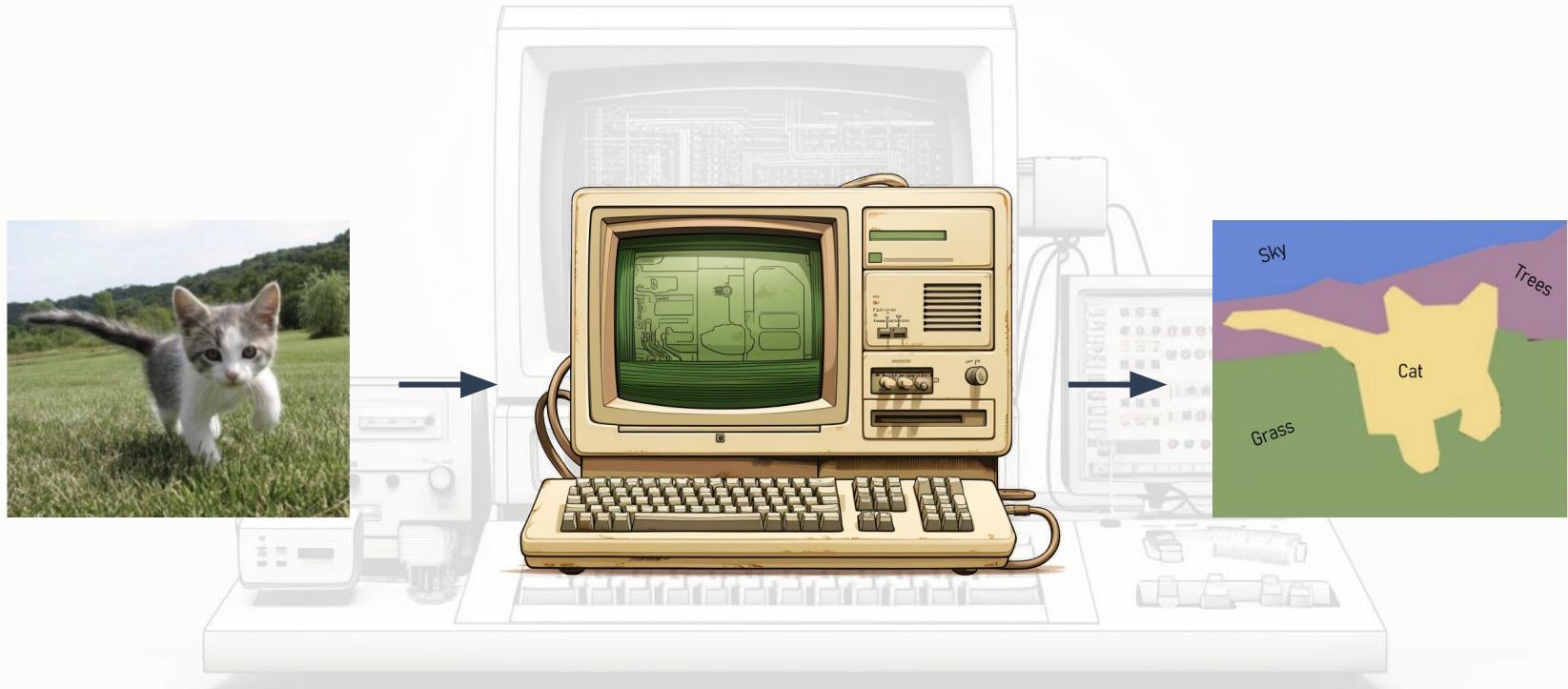


# Object detection



[https://youtu.be/\\_zZe27JYi8Y?si=gmZhJGjta5Q3vVdq](https://youtu.be/_zZe27JYi8Y?si=gmZhJGjta5Q3vVdq)

# Semantic Segmentation



# Semantic Segmentation



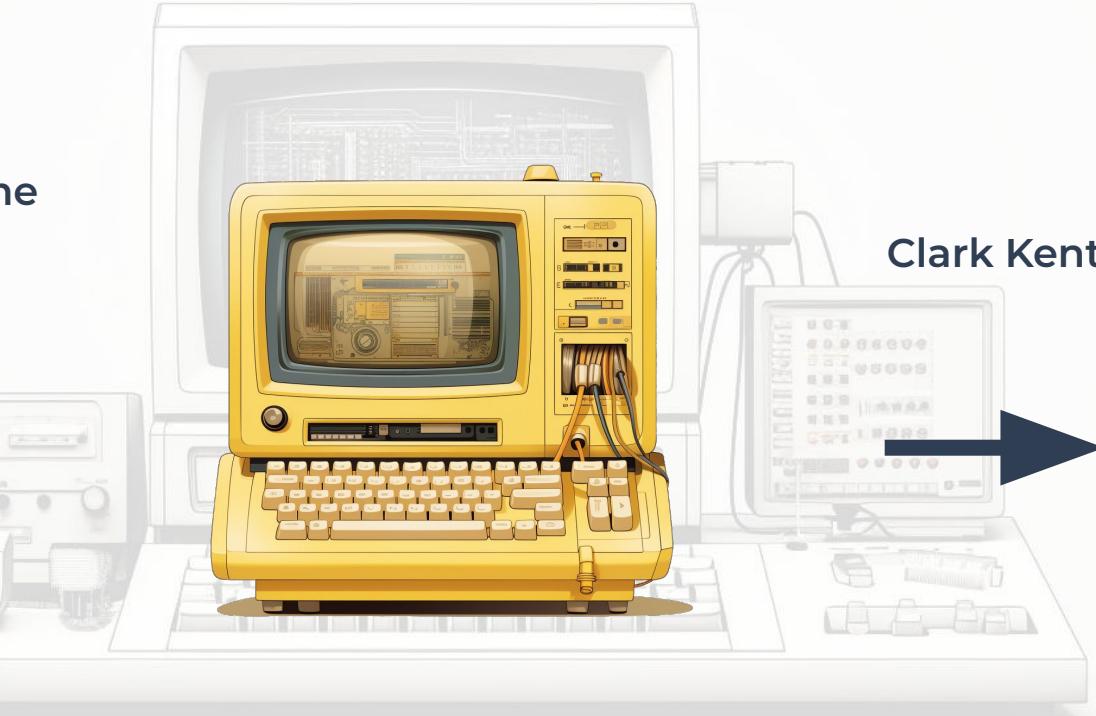
<https://segment-anything.com/>

# Semantic Segmentation



# Information extraction

What's the name  
of the main  
character ?



# Information extraction

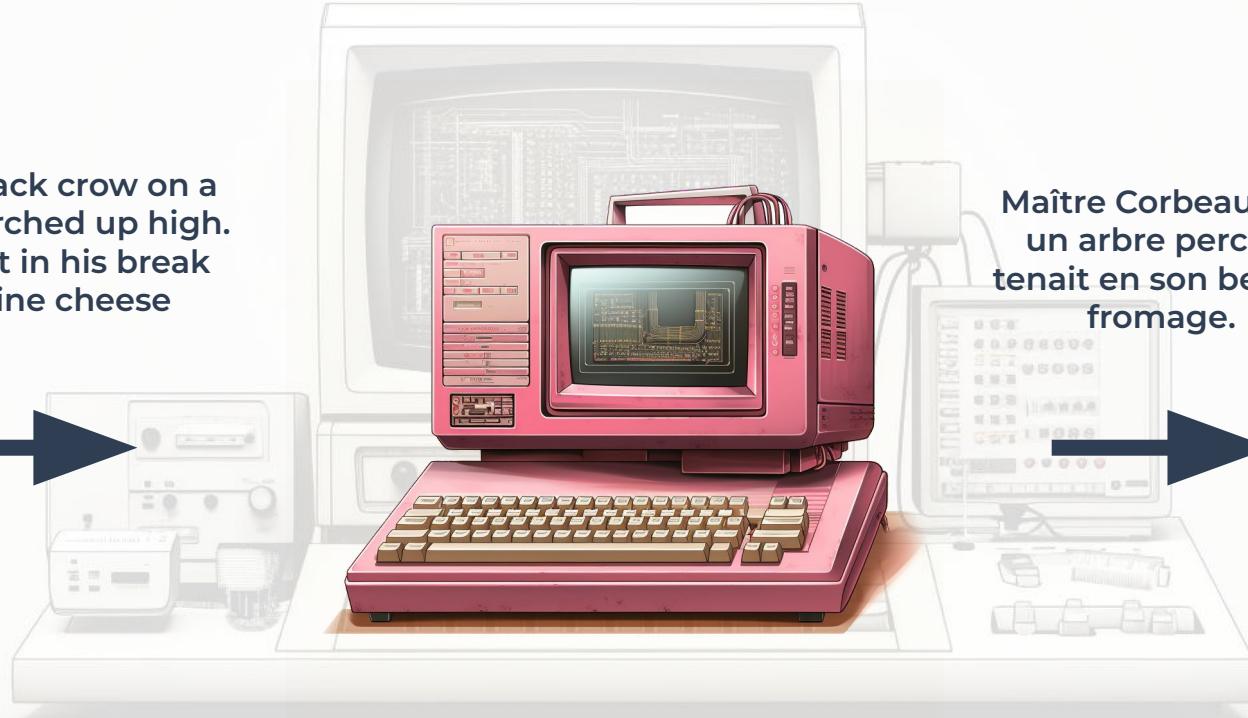
What's the name  
of the main  
character ?



Success rate (how many object detected)

# Automatic translation

Master black crow on a  
branch perched up high.  
Held tight in his break  
some fine cheese



Maître Corbeau, sur  
un arbre perché,  
tenait en son bec un  
fromage.

# Automatic translation

Master black crow on a  
branch perched up high.  
Held tight in his break  
some fine cheese



Maître Corbeau, sur  
un arbre perché,  
tenait en son bec un  
fromage.



Human evaluations



Comparison with  
human translations

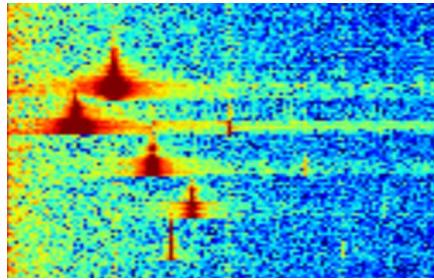
# Automatic translation



## Neural Machine Translation: A review

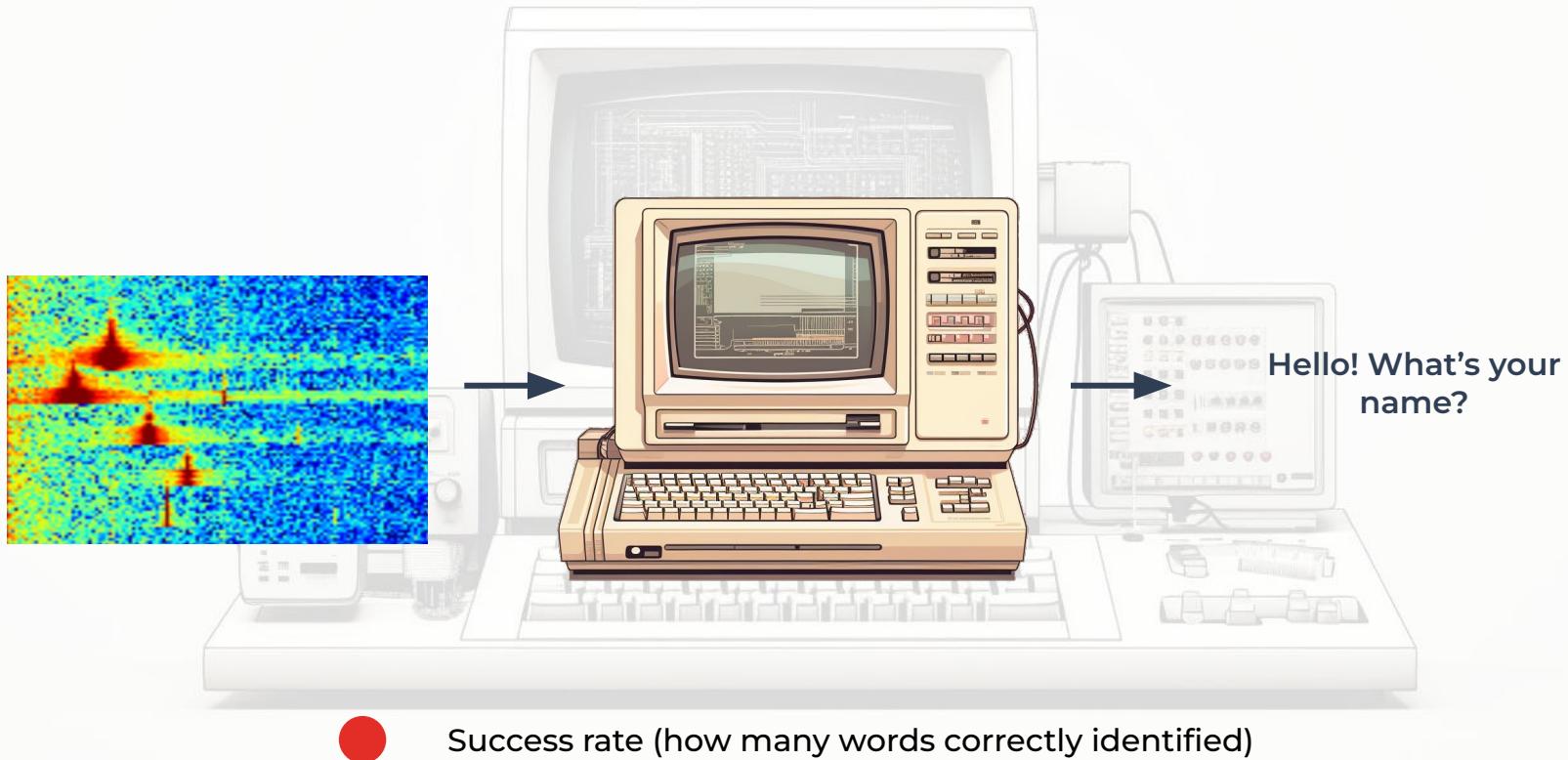
Journal of Artificial Intelligence, Research

# Speech-to-text (STT)



Hello! What's your  
name?

# Speech-to-text (STT)



# Generative AI (image)

259485384835



Diversity (different images,  
sounds, etc)



Quality (different from real  
images)

# Generative AI (image)

Midjourney

<https://www.midjourney.com>



Dall-E 3

<https://openai.com/dall-e-3>

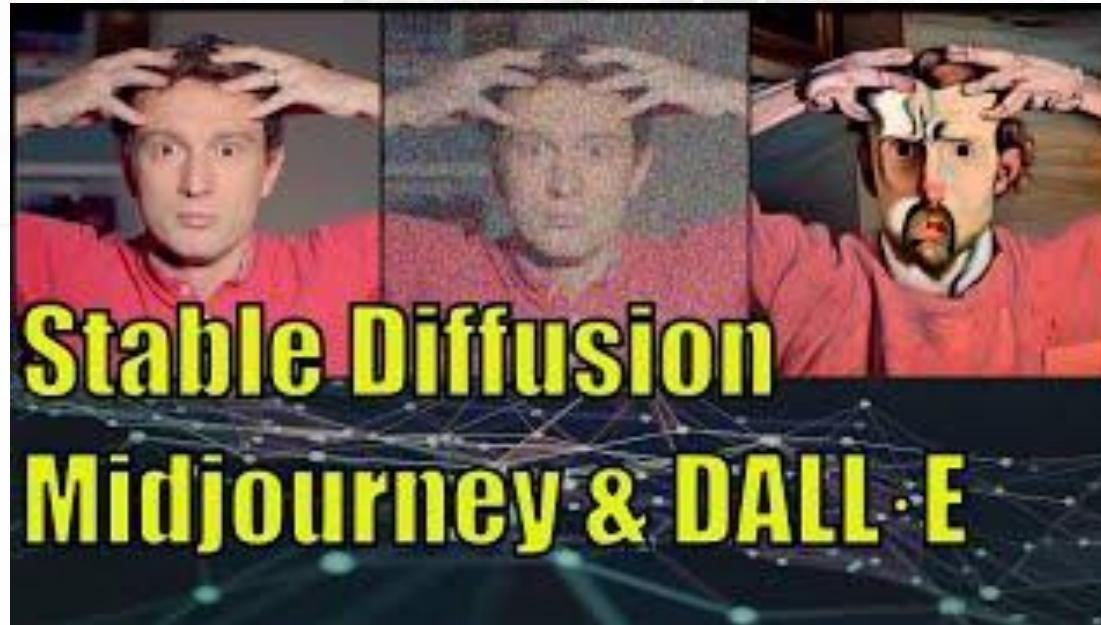


Stable Diffusion

<https://stability.ai/stable-diffusion>

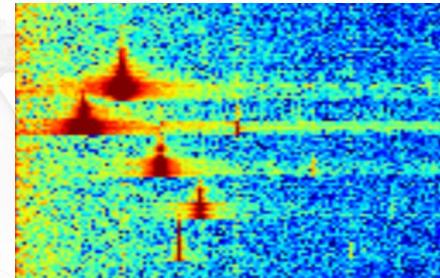


# Generative AI (image)



# Generative AI (TTS)

259485384835



Diversity (different images,  
sounds, etc)



Quality (different from real  
voice)

# Generative AI (TTS)

Suno.ai

<https://www.suno.ai/>

## Text

### [verse]

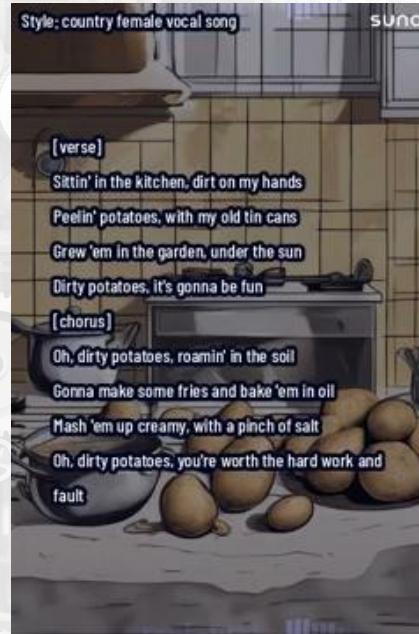
Sittin' in the kitchen, dirt on my hands  
Peelin' potatoes, with my old tin cans  
Grew 'em in the garden, under the sun  
Dirty potatoes, it's gonna be fun

### [chorus]

Oh, dirty potatoes, roamin' in the soil  
Gonna make some fries and bake 'em in oil  
Mash 'em up creamy, with a pinch of salt  
Oh, dirty potatoes, you're worth the hard work and fault

## Style of Music

country female vocal song



# Reinforcement Learning

Environment



Action



# Reinforcement Learning

Environment

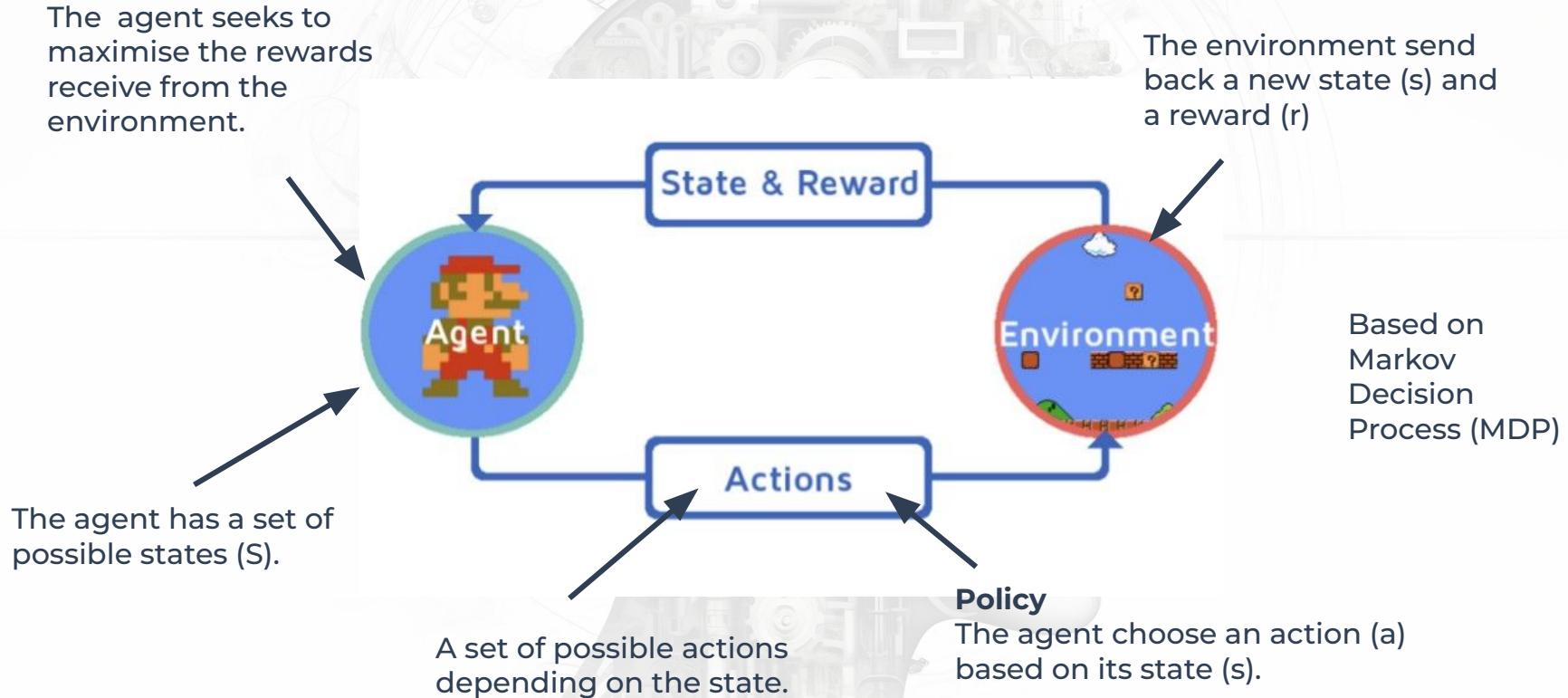


Action

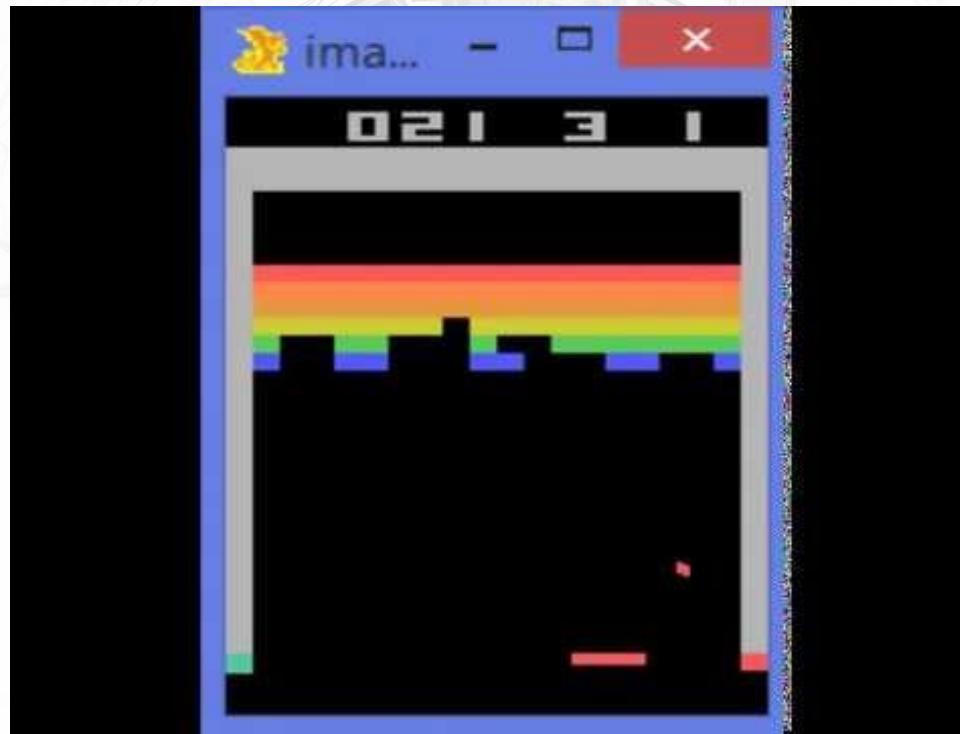


Win the game ? How many points ?

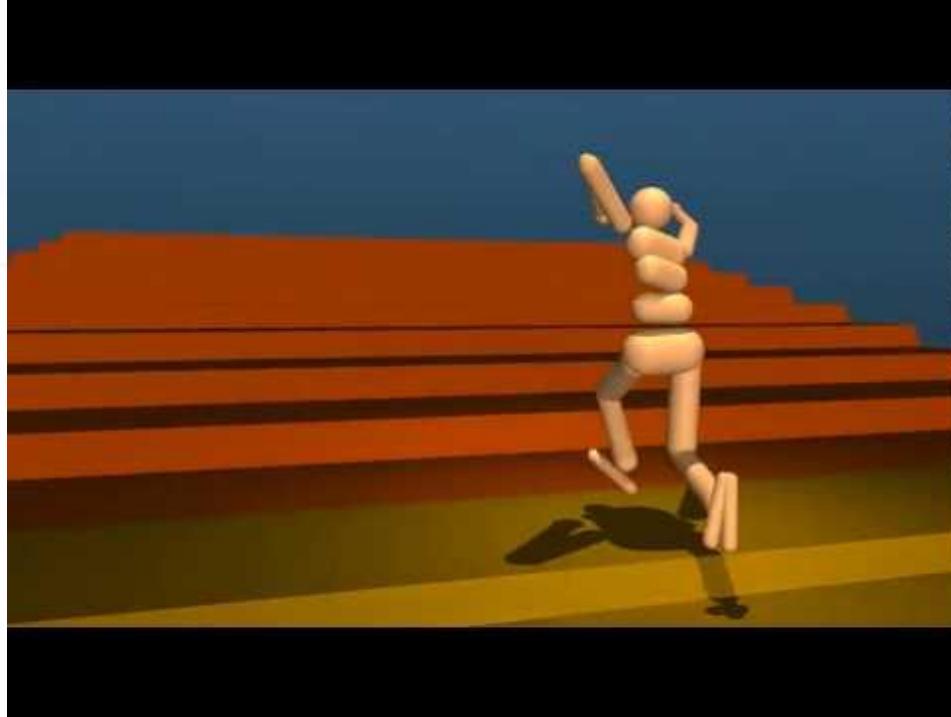
# Reinforcement Learning



# Deep Reinforcement Learning (DRL)



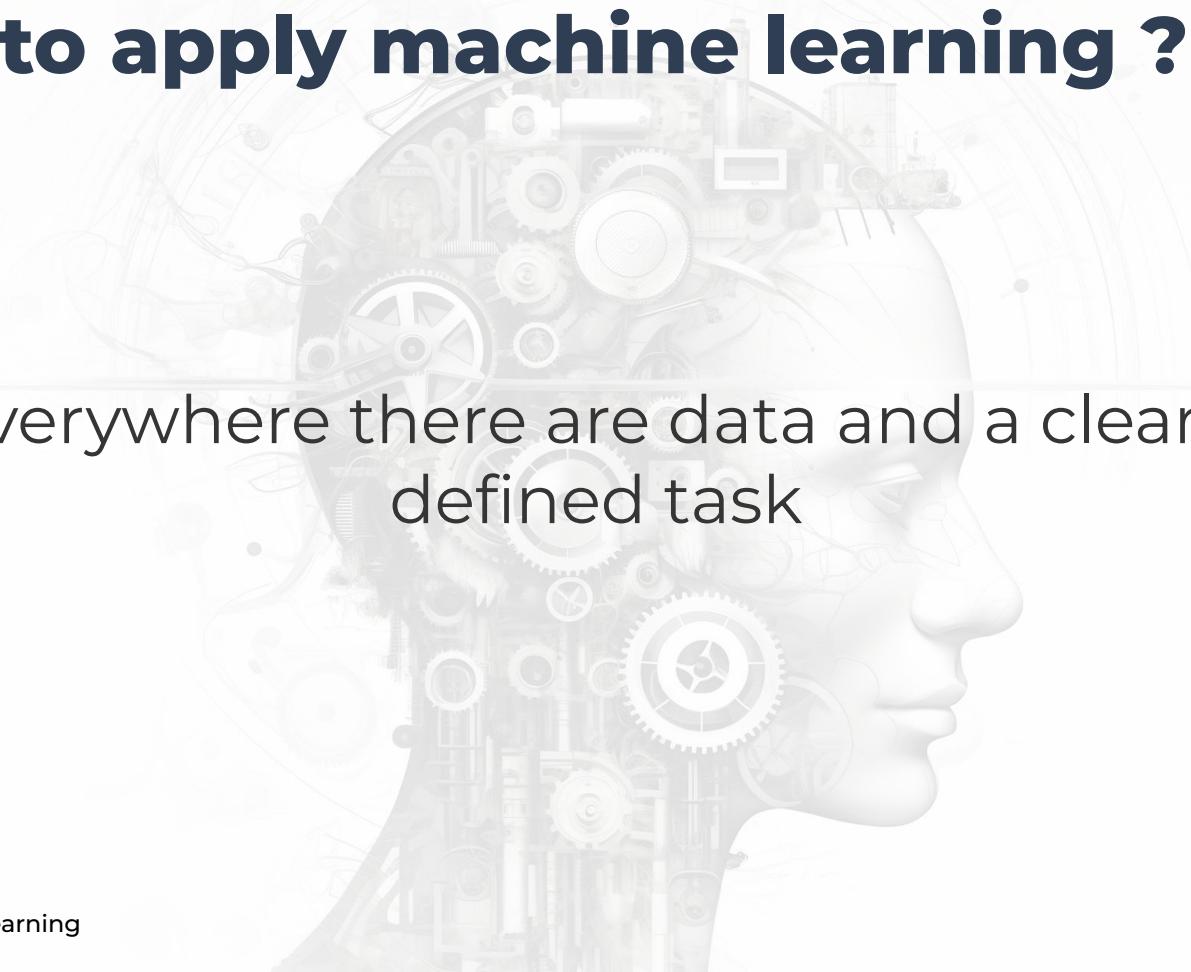
# Deep Reinforcement Learning (DRL)



# Reinforcement Learning



# **When to apply machine learning ?**



Everywhere there are data and a clearly defined task

# Other applications of machine learning



- Autonomous vehicles
- Robotics
- Pose estimation
- OCR
- Document classification
- Forecasting
- Risk evaluation
- Fraud detection.
- Recommendations systems