

# COMPUTER VISION

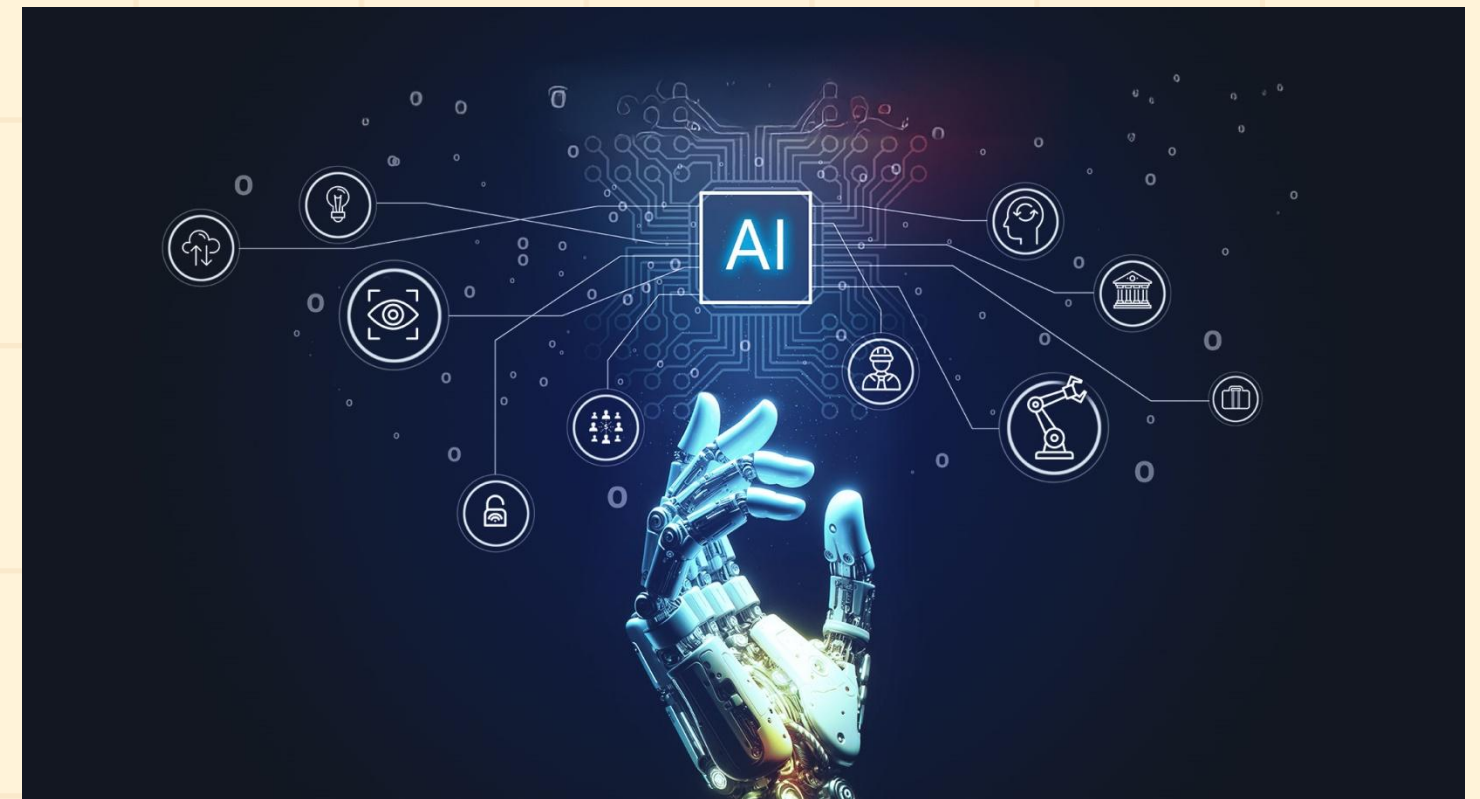
PART 2

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# WHAT IS ARTIFICIAL INTELLIGENCE ?

**Artificial Intelligence (AI)** is a technology that allows machines or computers to think, learn, and make decisions like humans.





## AI is like teaching a child.

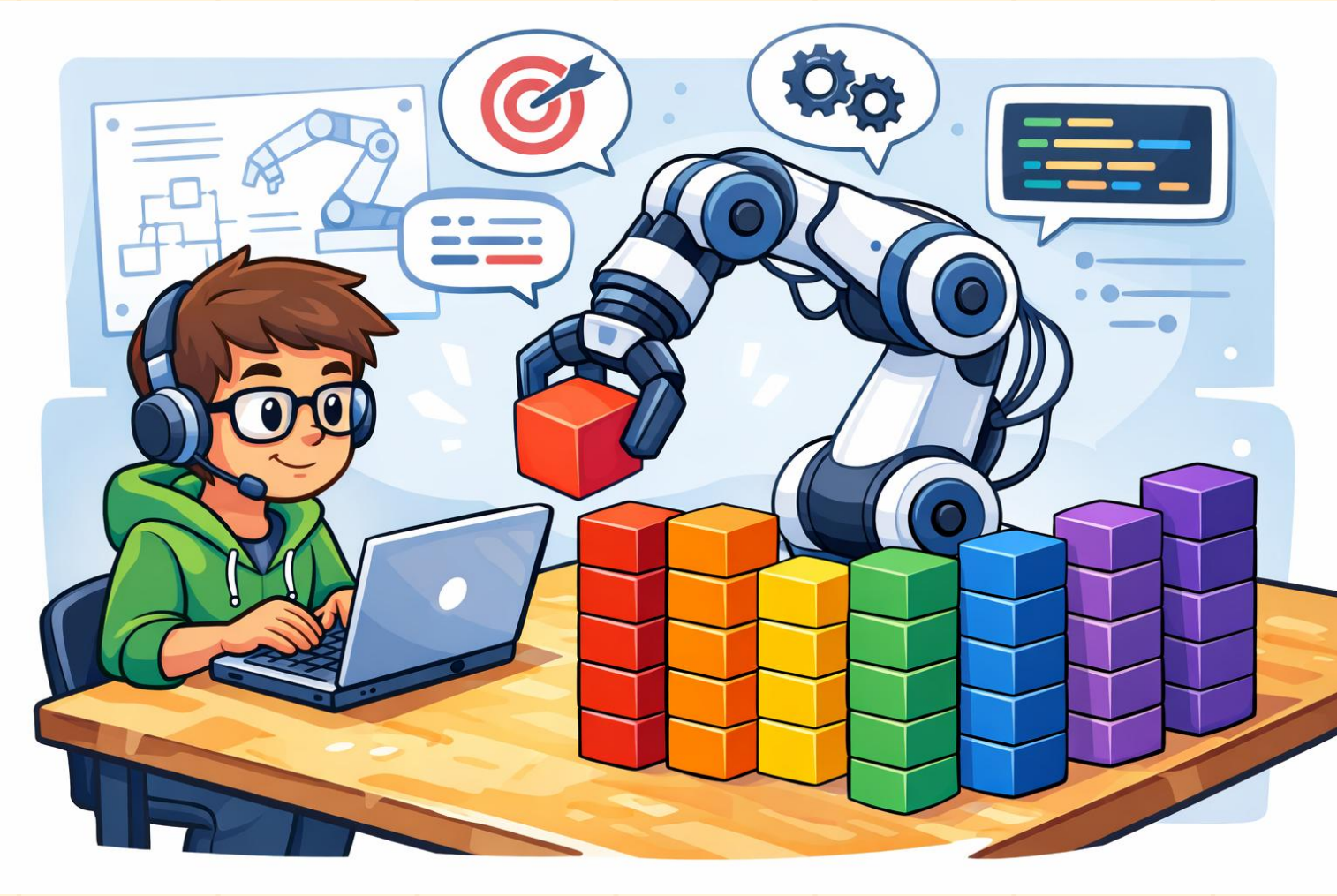
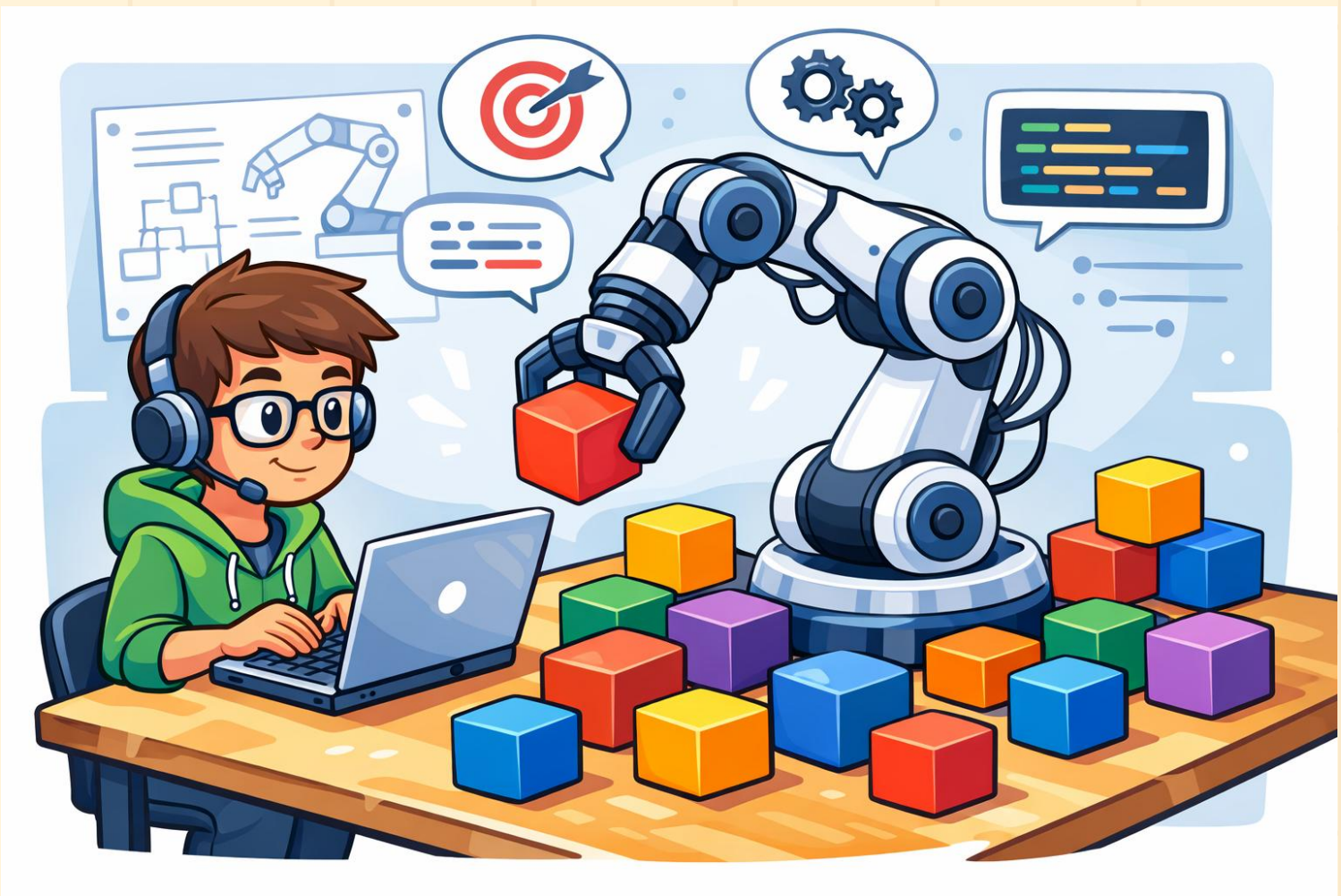
We show examples, the child learns patterns, and then makes decisions on new situations.

Give data → AI learns

Show new data → AI predicts or decides

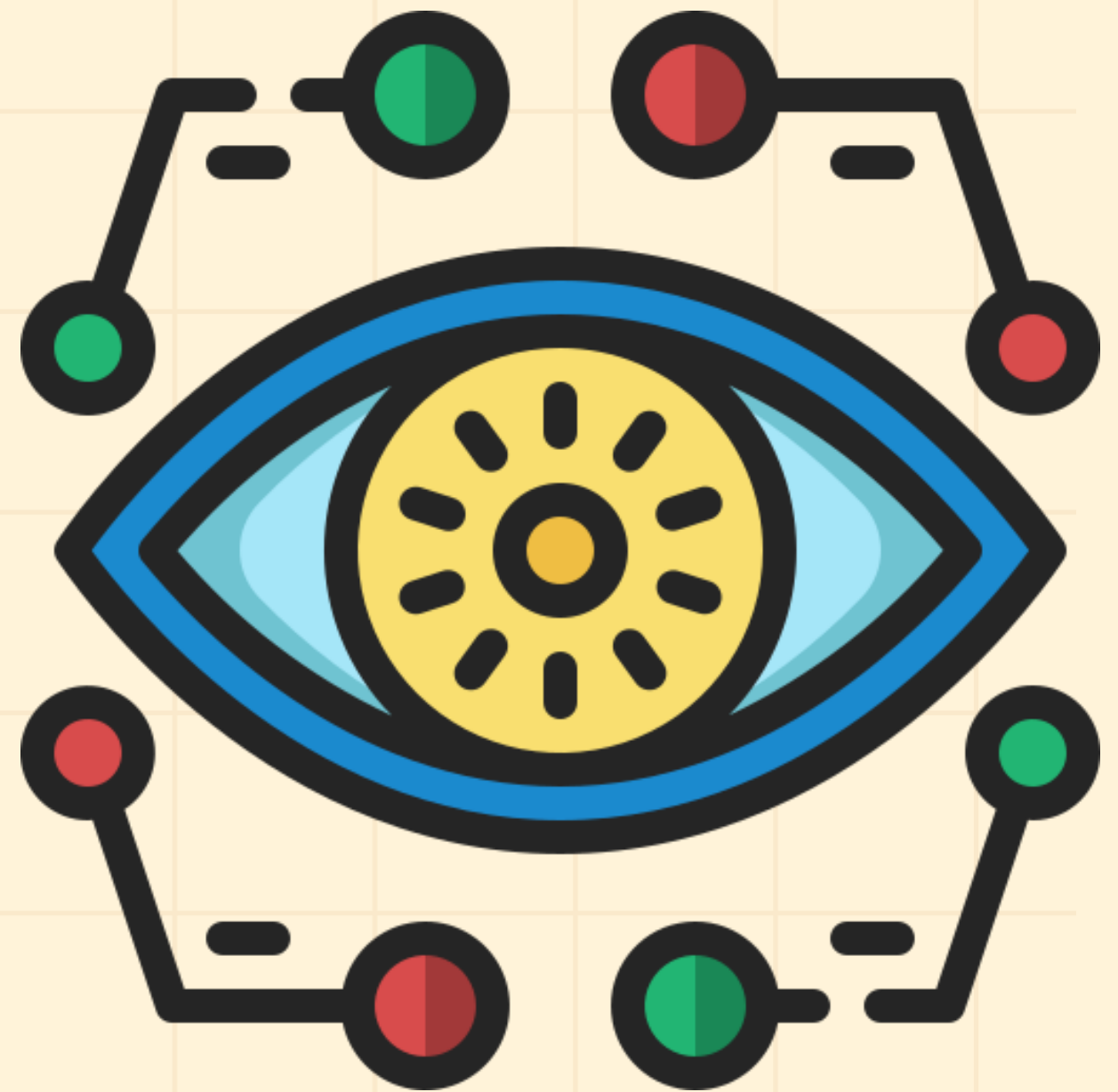






# COMPUTER VISION

Computer Vision is a branch of Artificial Intelligence that helps computers see, understand, and interpret images or videos, just like humans do



# Applications -

## 1. Face Unlock Technology



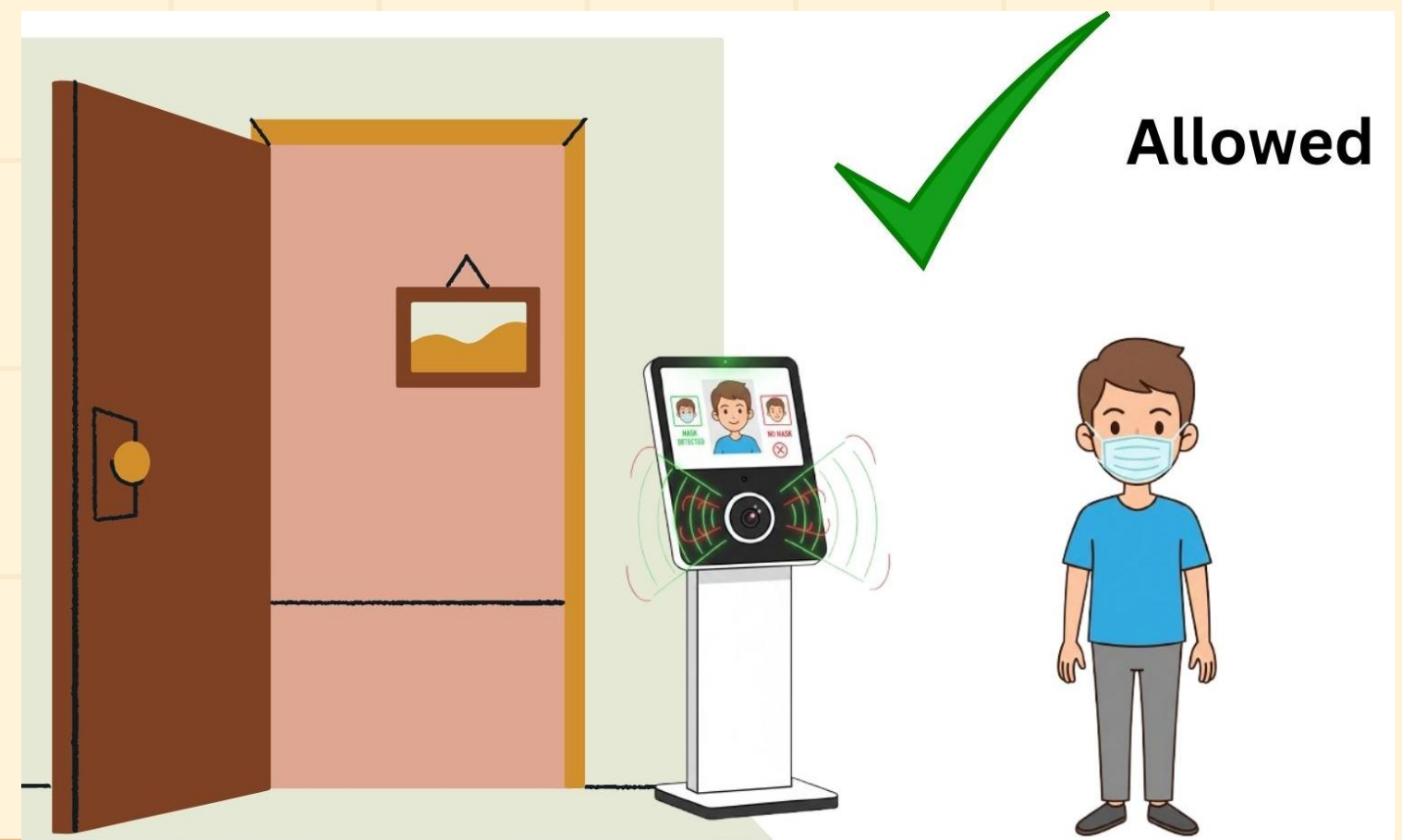
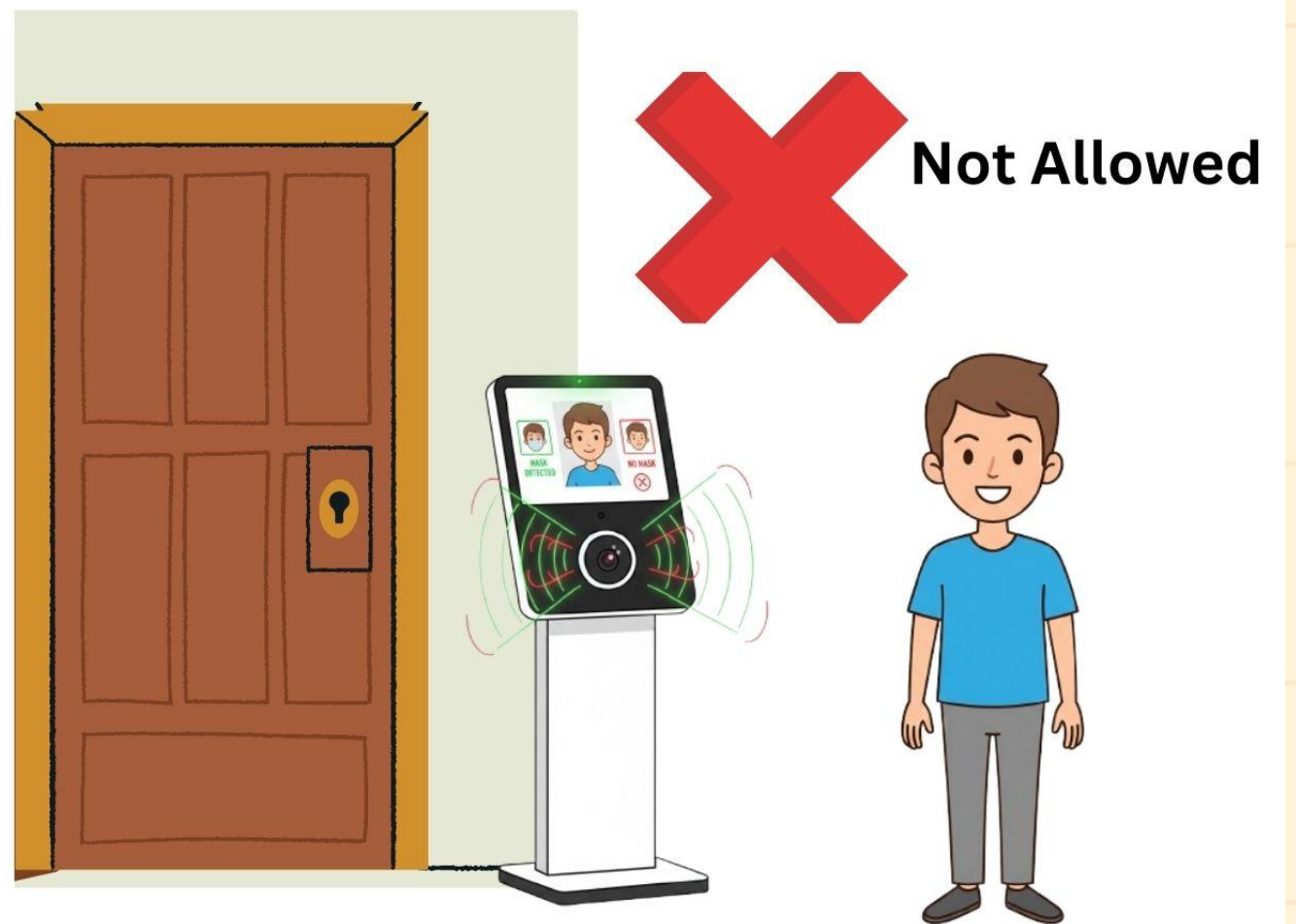
# 2. Self Driving Cars



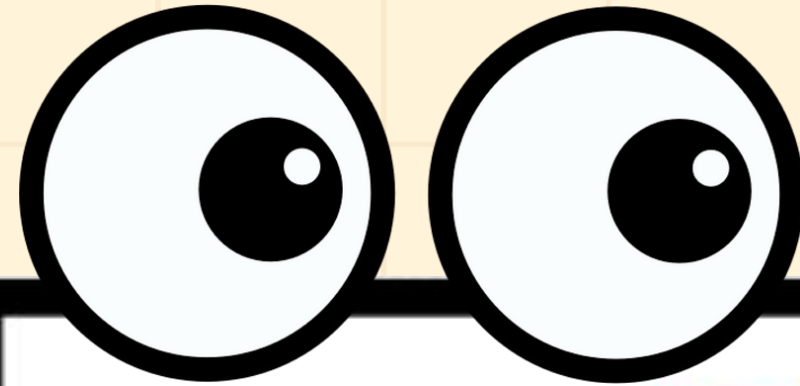
# 3. Face attendance system







# MACHINE VISION V/S HUMAN VISION



## Machine Vision



input



sensing device

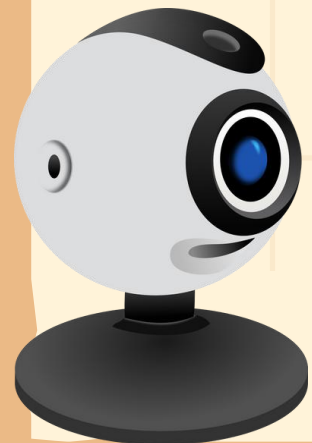
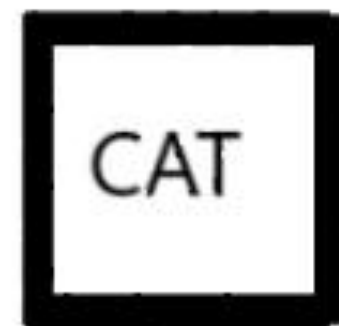


machine



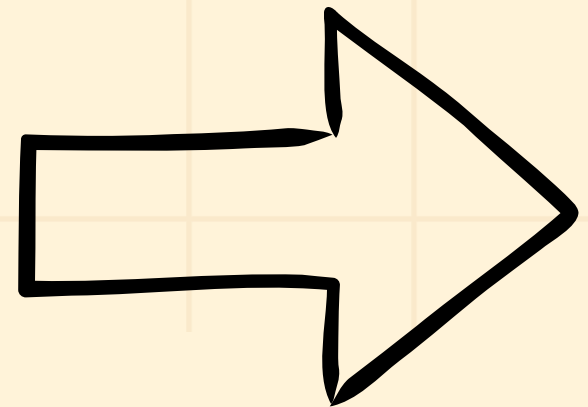
output

## Human Vision





# STEPS OF WORKING WITH COMPUTER VISION



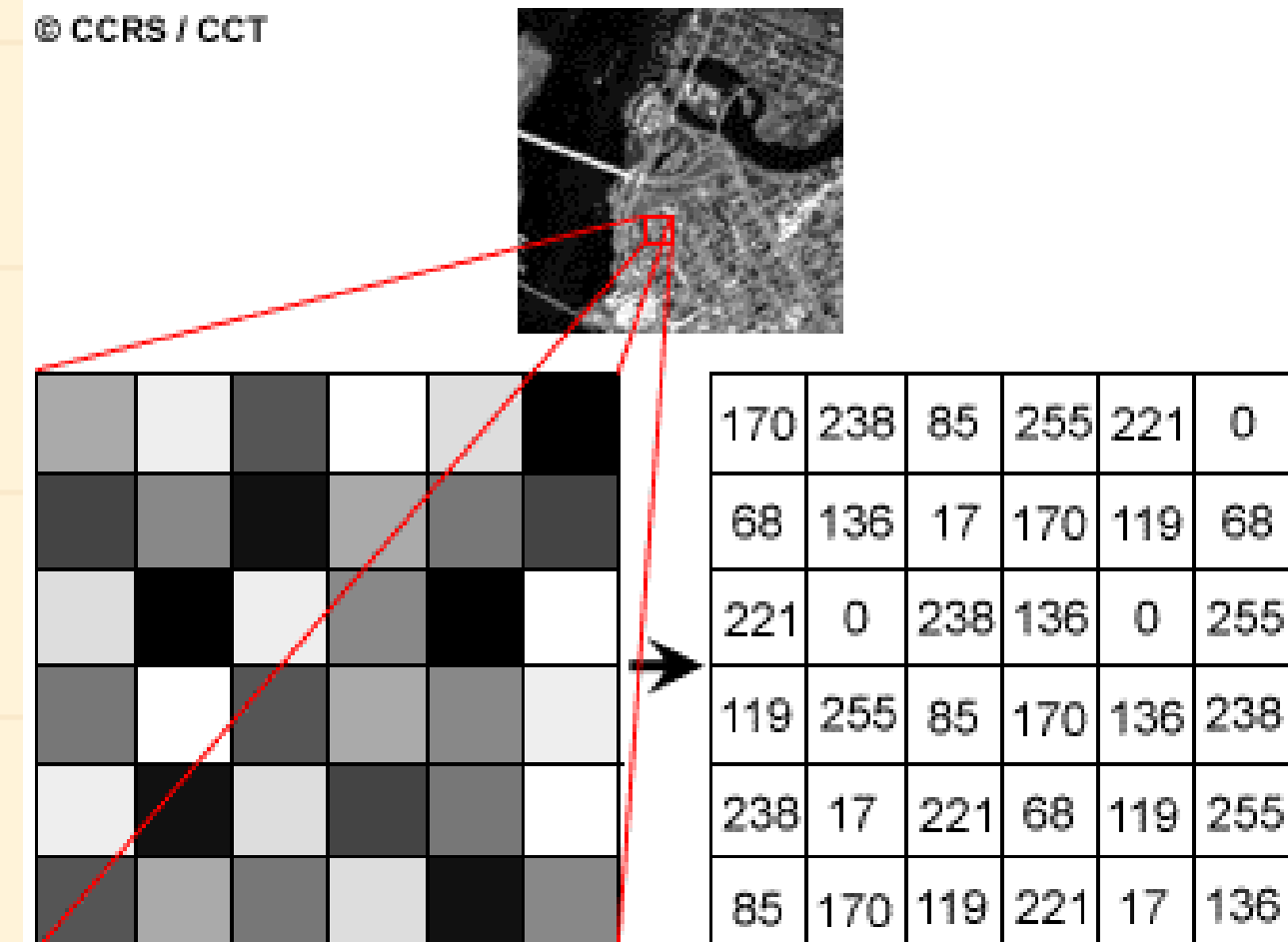
# STEP 1 - IMAGE CAPTURE

- The computer or camera takes an image or video.
- This image is made up of tiny dot called pixel.



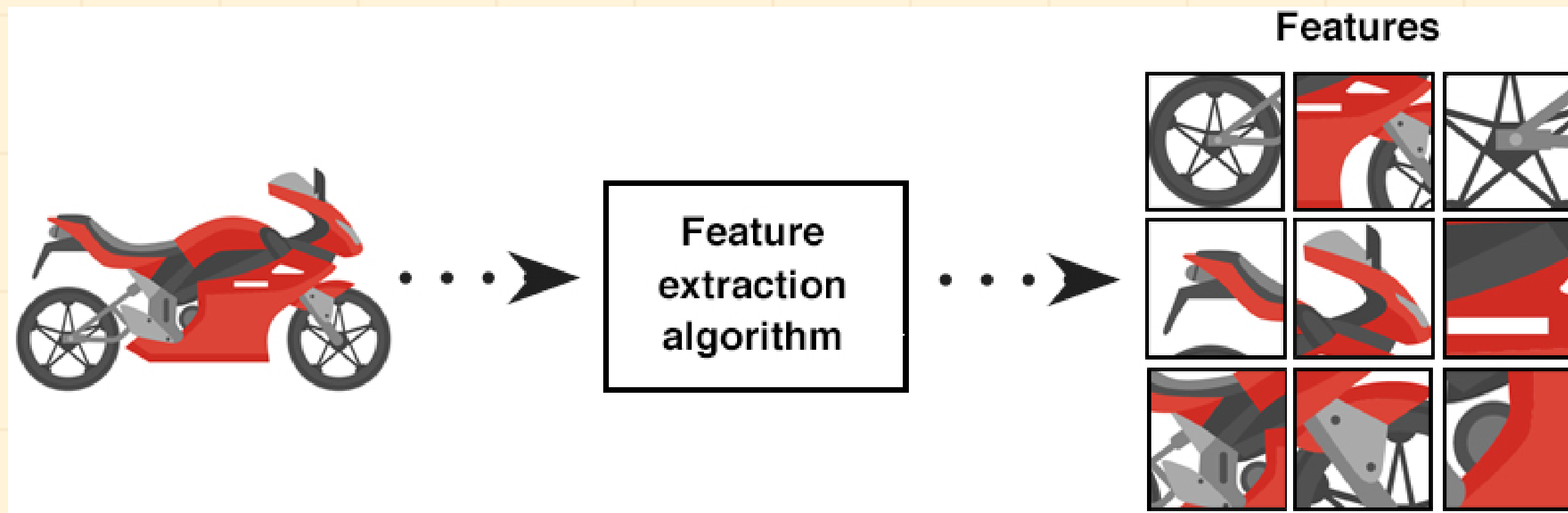
# STEP 2: IMAGE PROCESSING

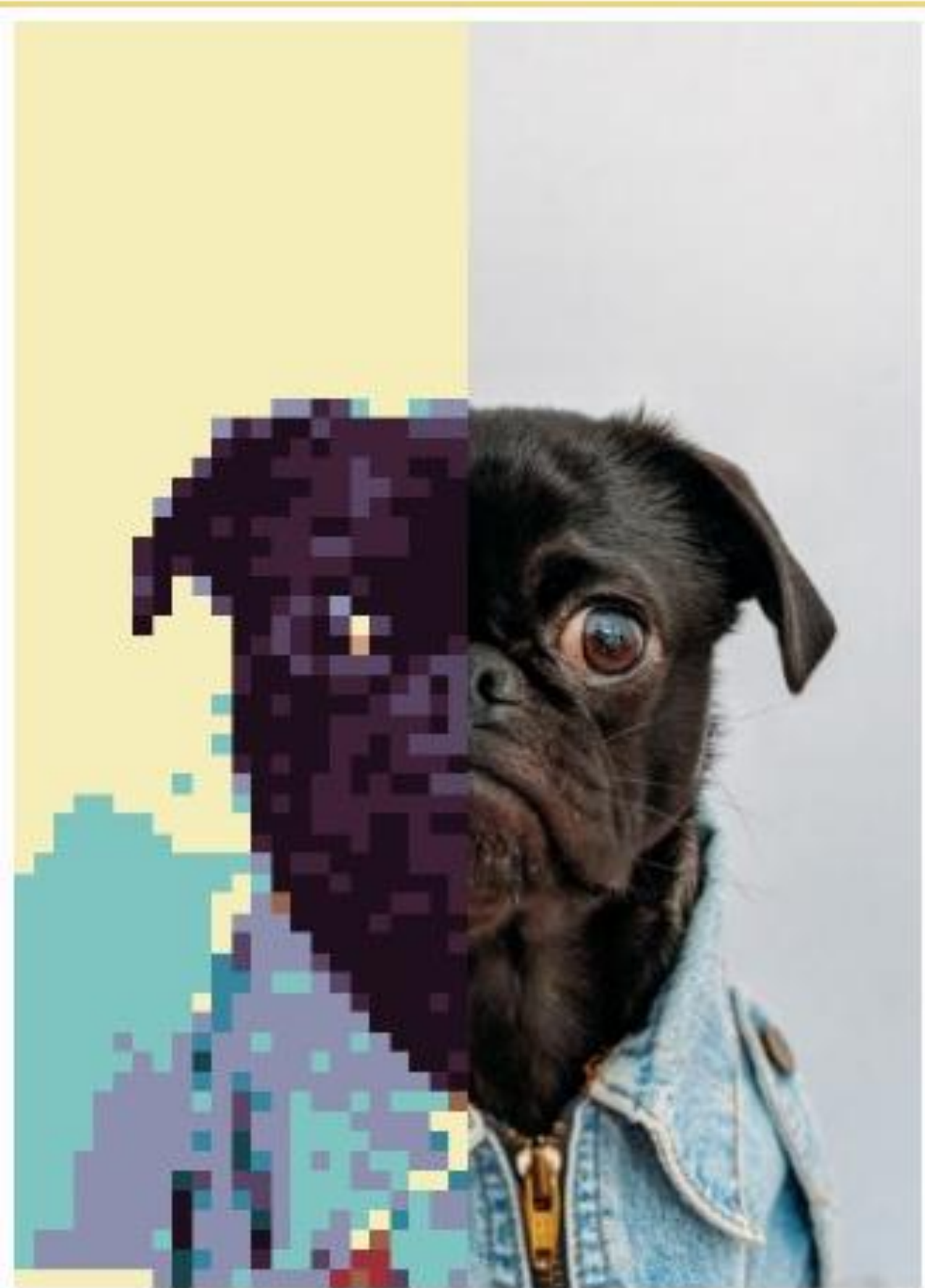
- The computer analyzes these pixels – Checking color, shapes and edges.
- It converts the image into numerical data , so that it can understand it.



# STEP 3: FEATURE EXTRACTION

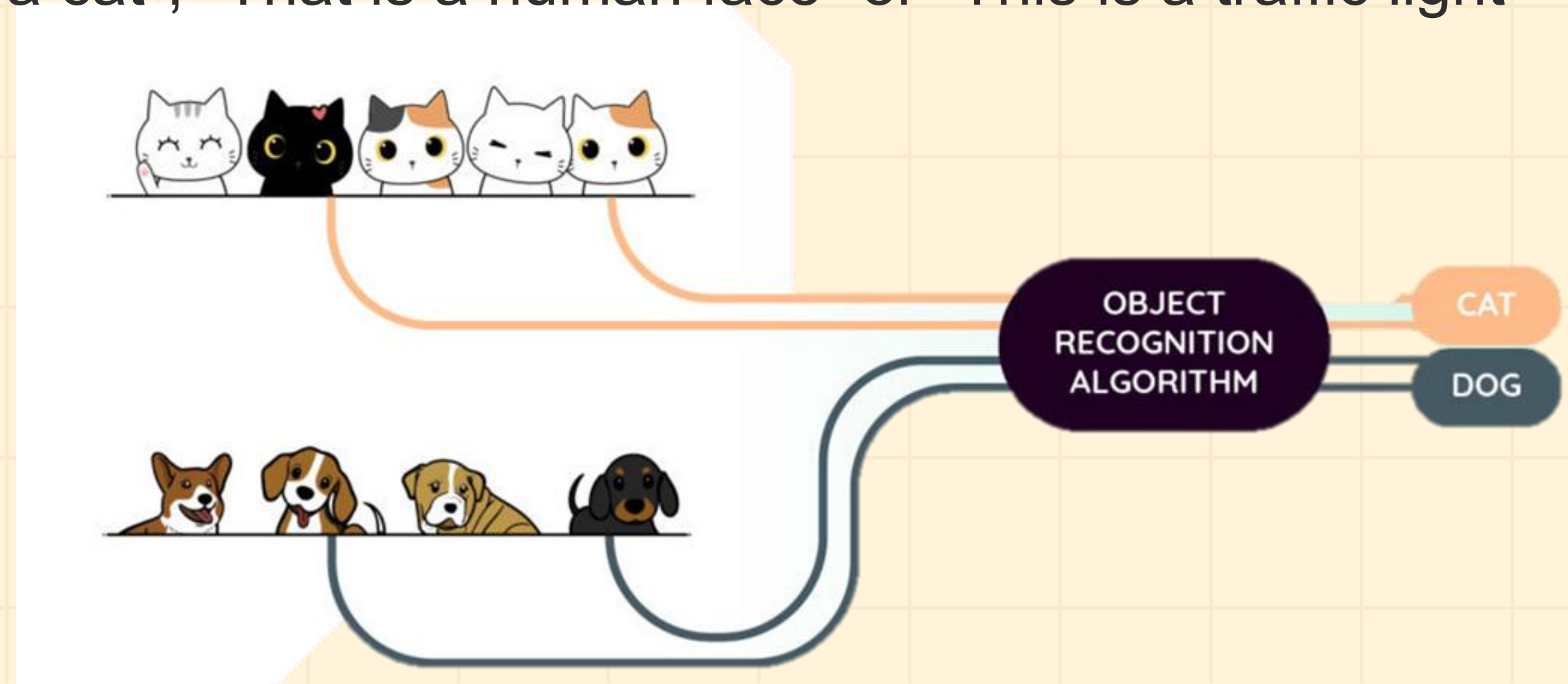
- The system looks for important details (called features) — like eyes, nose, or mouth for faces, or wheels for bikes.





# STEP 4: OBJECT RECOGNITION

- The AI model compares with what it sees with what it has learned before.
- It decides: “This is a cat”, “That is a human face” or “This is a traffic light”



# STEP 5: DECISION MAKING / OUTPUT

- Finally, it gives output



We know that Computer Vision helps computer see and understand images

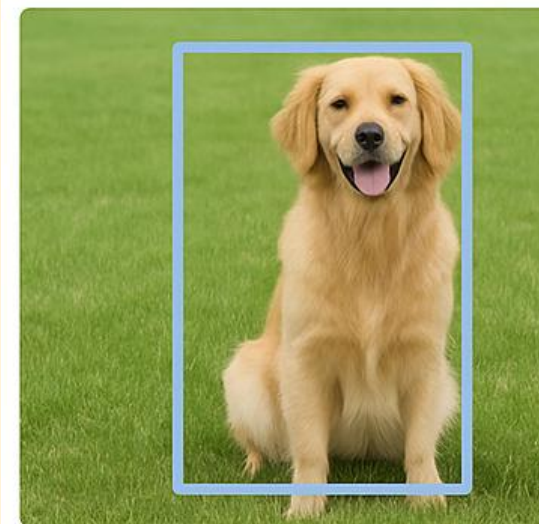
## Tasks are divided based on

- how many objects are present

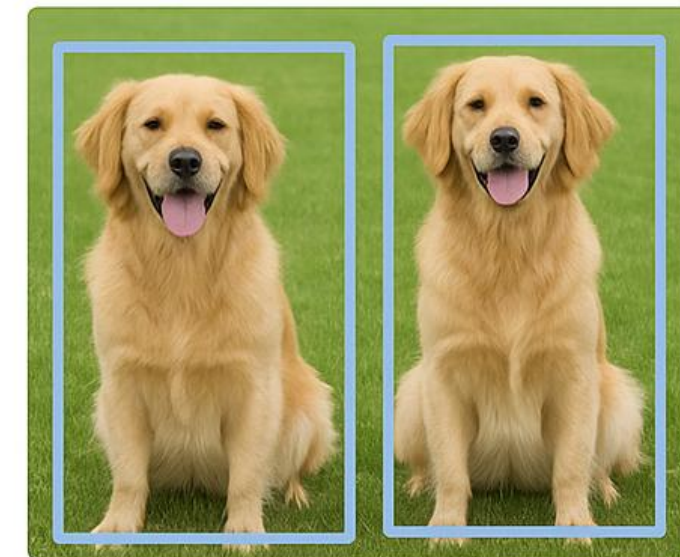
## Two major categories:

1. Single object Tasks
2. Multiple Object Tasks

Single Object



Multiple Objects



# Single Object Tasks

Image contains only one main object

Model focus on –

- What is the object?
- Where is the object

**It has two types-**

1. Image classification
2. Classification + localization



Single Object Tasks

# Classification

- Predicts **what the object is**
- Does **NOT** show location
- Output is a **label**



Single Object Tasks

# Classification + Localization

- Identifies **what the object is**
- Also identifies **where it is**
- Draws a **bounding box** around the object



# MULTIPLE OBJECT TASK

Image contains **many objects**

Model will:

- Detect **each object**
- Understand **object boundaries**
- Much more complex than single-object tasks

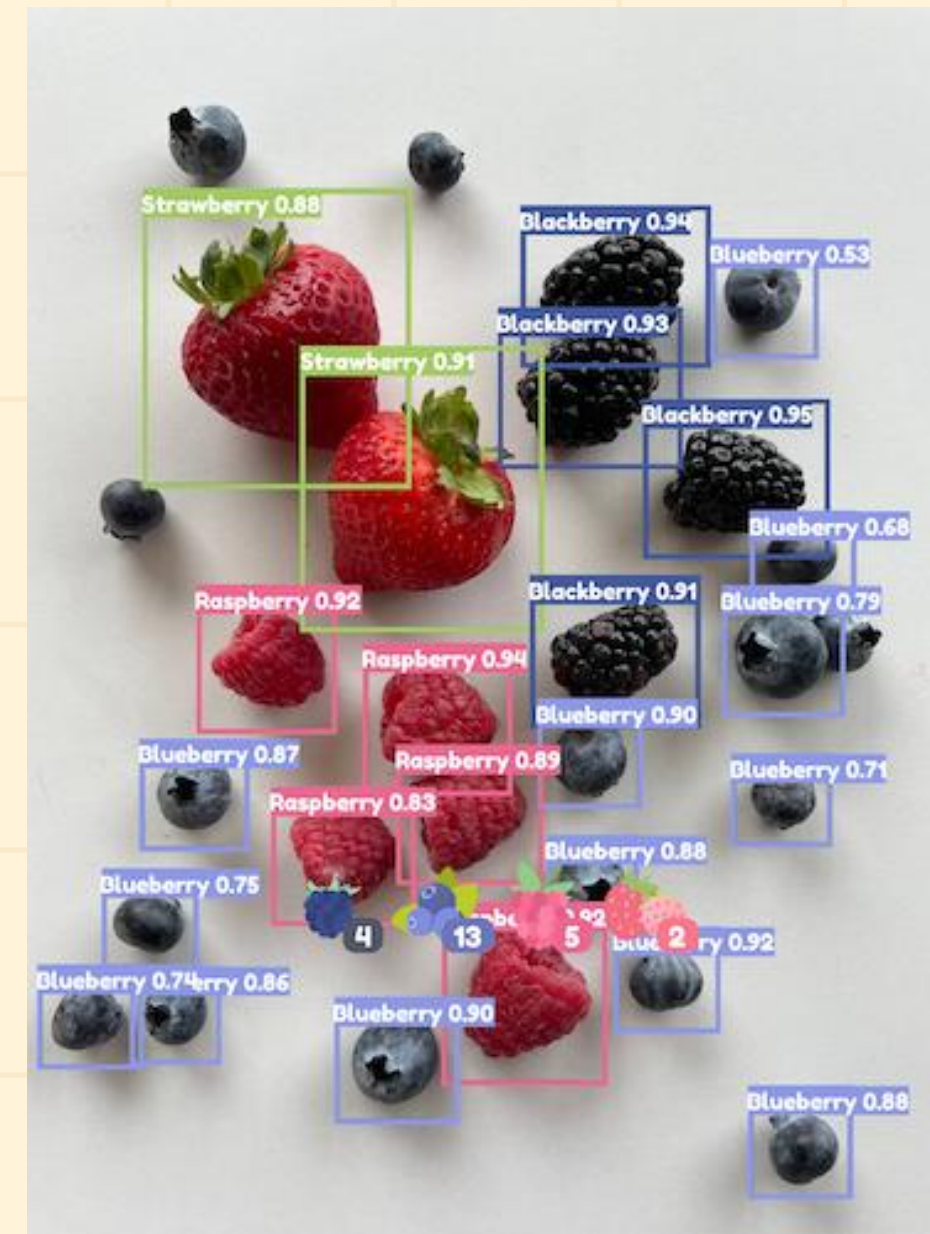
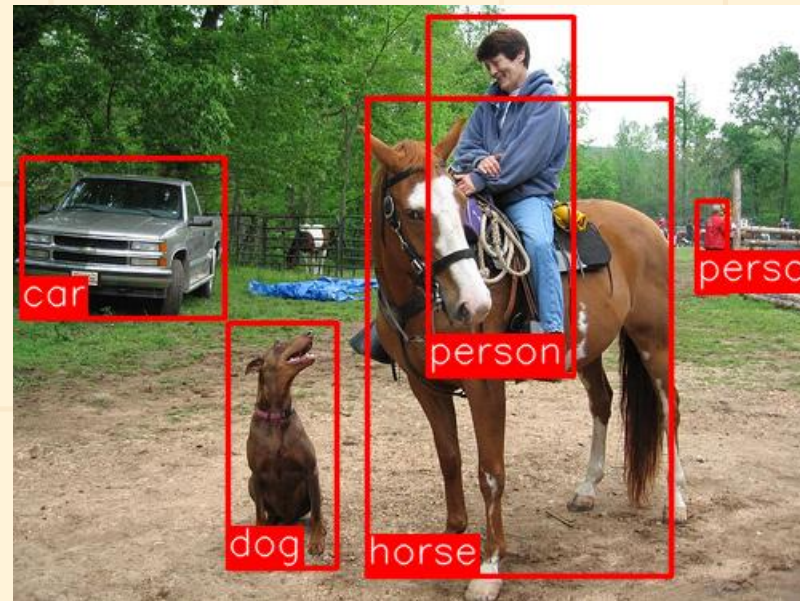
1. Object Detection

2. Image Segmentation

## Multiple Object Tasks

# 1. Object Detection

- Detects **multiple objects**
- Draws **bounding boxes** for each
- Assigns a **label** to every object



Multiple Object Tasks

## 2. Image Segmentation

- Divides image into **meaningful regions**
- Works at **pixel level**
- More detailed than object detection

**Two types of Image segmentation**

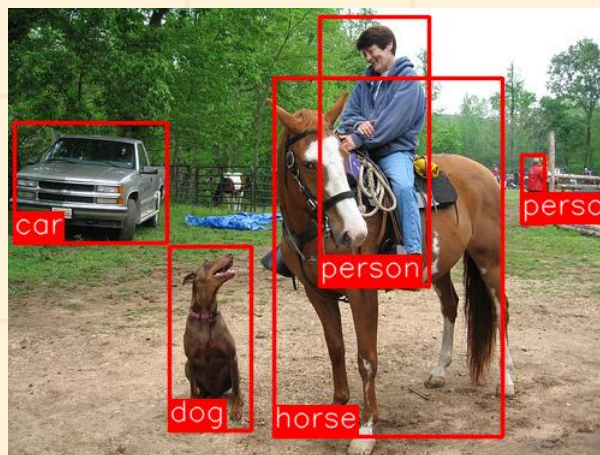
**1. Semantic Segmentation**

**2. Instance Segmentation**

# Difference between Object detection and Image Segmentation

## 1. Object Detection

predicts *boxes + labels*



## 2. Image Segmentation

predicts *a label for every pixel*

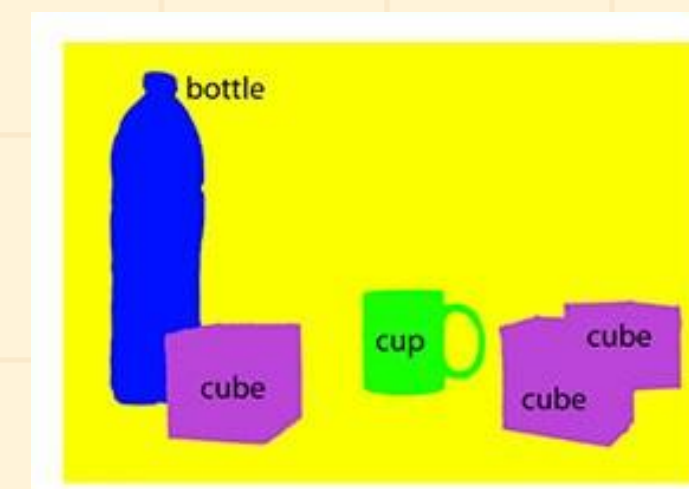


Image Segmentation

# 1. Semantic Segmentation

- Labels **each pixel**
- Same class objects share **same color**
- Does **NOT** differentiate between individual objects

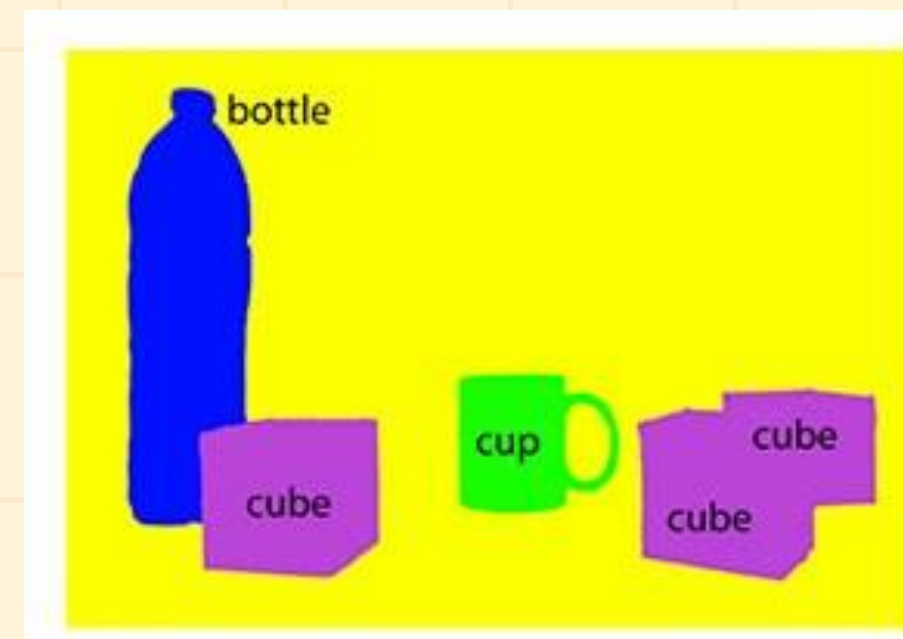


Image Segmentation

# 1. Instance Segmentation

- Labels **each object separately**
- Every instance has a **unique color**

