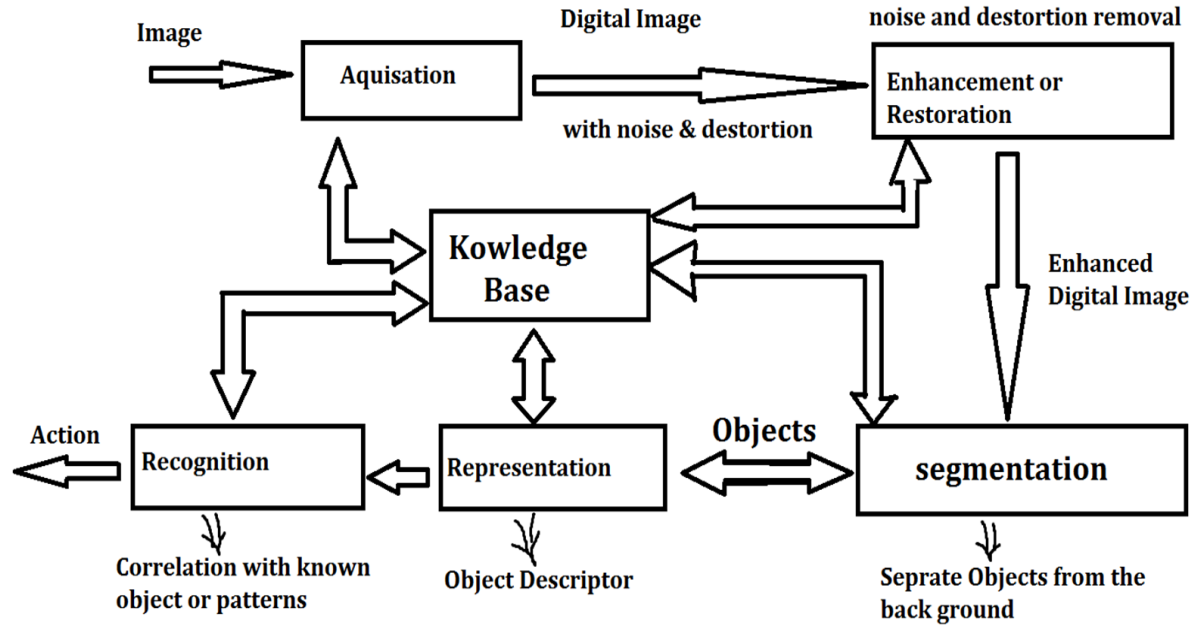# Computer Vision

Agenda

1. What is Computer vision
2. Computer vision-based system
3. Computer vision applications
4. Image types
5. image processing techniques
   - High level processing
   - Low level processing
6. Image file

What is Computer vision

- **Computer vision** deals with how computers can be made to identify objects, scenes and activities from images or videos to simulate human vision system .

- **The main topics of computer vision** research include image classification, target detection, image segmentation, target tracking, optical character recognition (OCR), and facial recognition.

- **In the future,** computer vision is expected to enter the advanced stage of autonomous understanding, analysis, and decision-making, enabling machines to "see" and bringing greater value to scenarios such as unmanned vehicles and smart homes.

Computer vision-based system

fig(1.1) Image Processing Based Systems

Computer vision-based system

- **Image acquisition:**
    Converts a scene to digital image.
- **Image enhancement/restoration:**
    Image enhancement -> Objective is noise removal to make better image perception for human and easier for machine processing.
    Image restoration -> Objective is to remove any known distortion of the image.
- **Image segmentation:**
    Segment enhanced image to find out the objects that may exist within the image and separate objects from the background.

Computer vision-based system

- **Image representation:**

  Describe objects and represent it in a well-defined way for further processing.

- **Recognition:**

  Uses the descriptions of the objects that of interests stored in the knowledge base, to take the proper action that depends on the application of the case and previous forecasted knowledge.

Computer vision applications
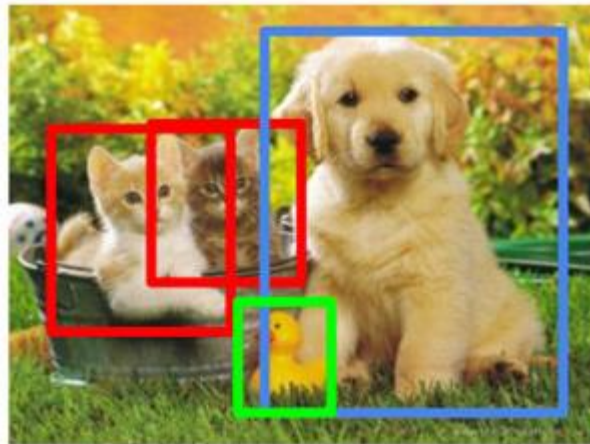
➢ **Image enhancement**

Computer vision applications

➢ **Image Classification**

CAT

Computer vision applications

➢ **Object Detection**
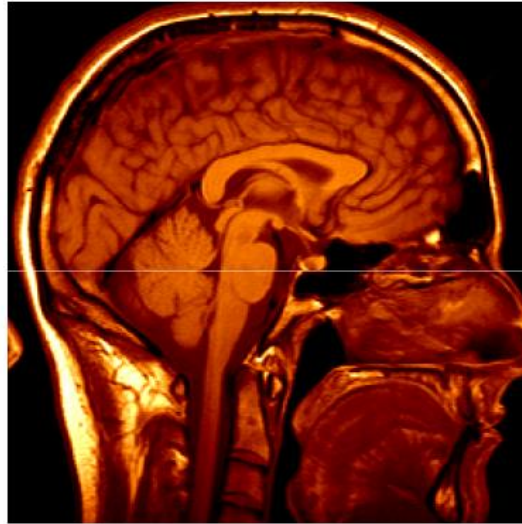

CAT, DOG, DUCK

Computer vision applications

➤ **Image segmentation**

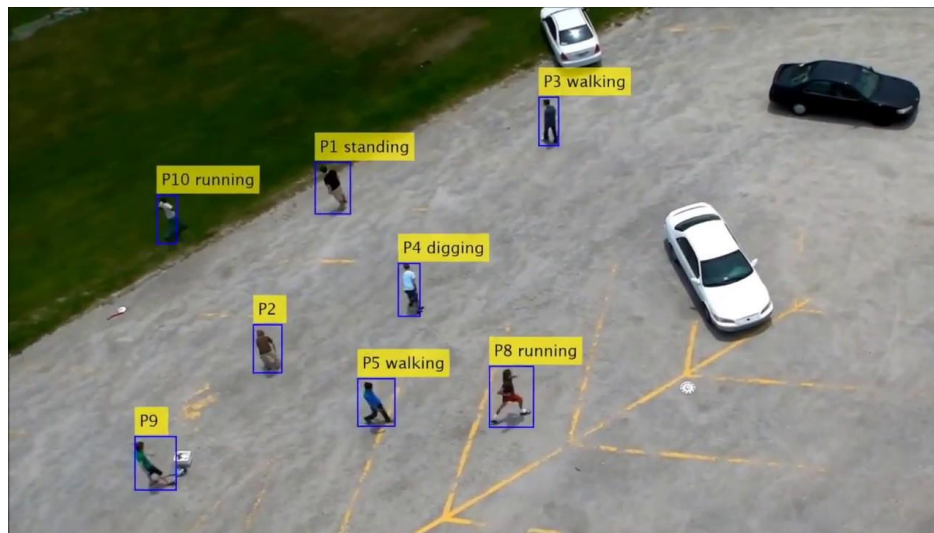# Computer vision applications

➢ **Medical imaging**
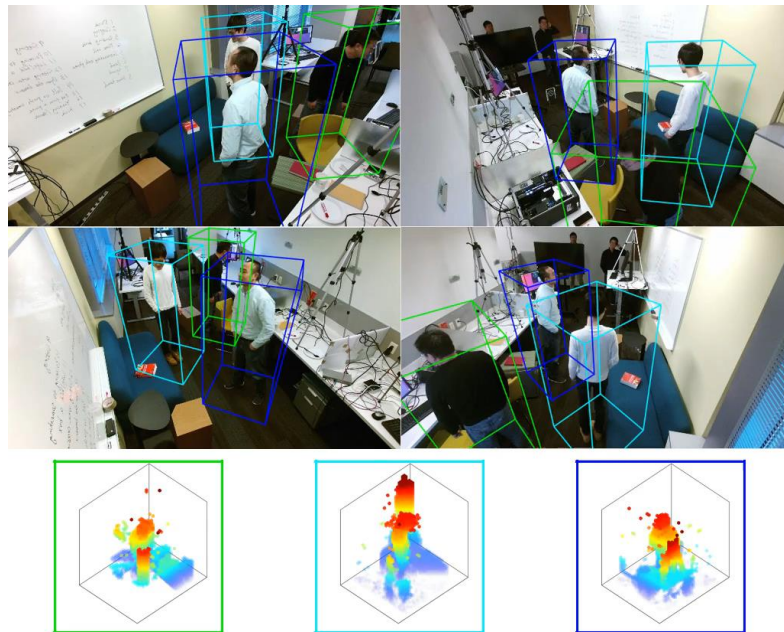

3D imaging

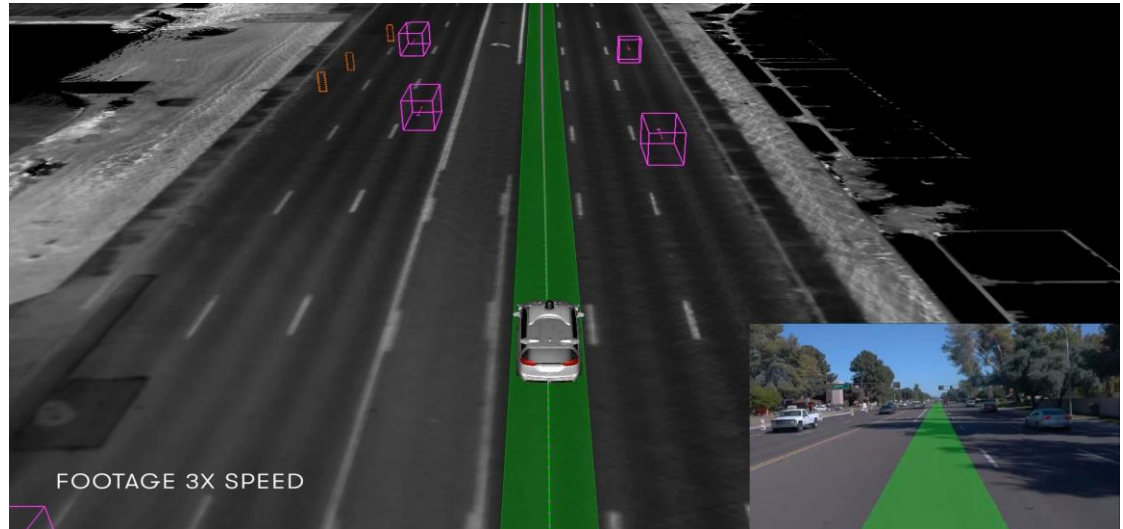Image guided surgery

Computer vision applications

➤ **Human Pose Estimation**

Computer vision applications

➢ **Object Tracking**

Computer vision applications

> **Self Driving Car**

FOOTAGE 3X SPEED

How computer sees image

What we see

What a computer sees

Image types

> ## RGB image

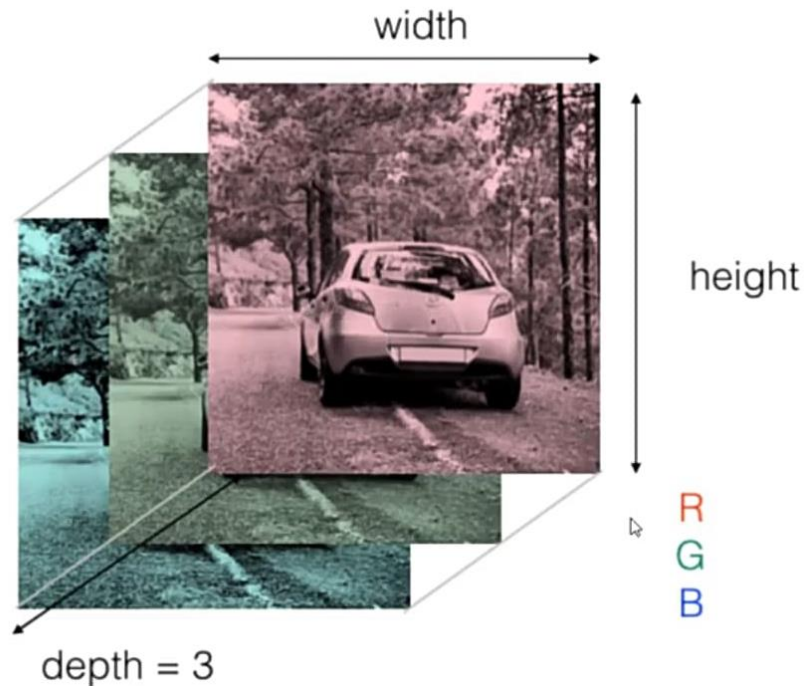Represent as : 3D matrix
(height x width x 3 channels)

Image types

➢ Gray image

Represent as : 2D matrix (height x width)
Each pixel represents intensity information in **range** 0 (for black) up to 255 (for white)

Image types

➤ **Binary Image**

Black for Background

White for Foreground

▪ Binary Image: has only 2 values for black and white (e.g., 0 and 255)

image processing techniques

High level	Low level

Use built-In functions or import libraries
Example:
 	
cv2.imshow('image',img)
	Implement functions from scratch to use
	Example:
	
	filelist = dir('Training data');
	for i=1 : length(filelist)
	for i=1 : length(filelist)
	filename = filelist(i);
	if ~strcmp(filename.name , '.') &&
	~strcmp(filename.name , '..')
	filename.name
	end
	end

Languages for image

- **Python:** A high-level programming supports functional, procedural and object-oriented styles of programming while having a simple syntax and being portable. Its compatibility with a range of libraries for computer vision, deep learning and machine learning applications.

- **MATLAB:** A high-level programming platform with an array of built-in tools and functions
Since image recognition and matrix calculation are interconnected, MATLAB turns out to be an excellent environment for computer vision, deep learning and machine learning applications.

- **c/c++ :** A low-level language is used widely for the creation of artificial intelligence programs and it's native libraries and specifications such as OpenCV have built-in intelligent features for processing pictures