

Introduction To Computer Vision

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- 3 AI Vs ML Vs DIP Vs CV
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- ▶ CV is a four credit course(3-1-0-4)
- ▶ Three hrs of theory in a week, and Demo of experiment in one hour
- ▶ Mid Sem: 20%;
- ▶ Programming Assignments: %20;
- ▶ Project: %20;
- ▶ End Sem 40%
- ▶ TAs: JOY MERITA, HRISHITA, JASMIN JOY

Goal of Computer Vision: Mimic HVS using computer



Human Vision System



Eye

Sensing device responsible for capturing images of the environment



Brain

Interpreting device responsible for understanding the image content

bowl, oranges,
bananas, lemons
peaches

Computer Vision System



Input



Sensing device



Interpreting device

bowl, oranges,
bananas, lemons
peaches

Output



- ▶ Goal of AI : Mimic nature in solving problems
- ▶ Goal of ML: Mimic human brain in solving problems
- ▶ Goal of DIP: Process the input image for various applications
 - Low Level Image Processing: i/p: image; o/p: image
 - Middle Level Image Processing: i/p: image; o/p: features of image
 - High Level Image Processing: i/p: features of image; o/p: information from image
- ▶ ML is AI
- ▶ DIP is basis for CV

Definition of Computer Vision



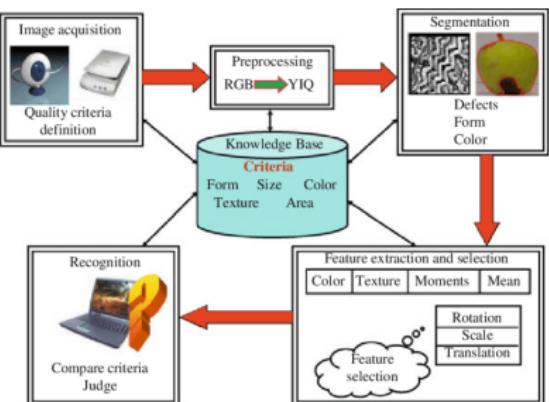
- ▶ Defn of Computer Vision:
Given the image(s) of a scene,
find the information about the
scene

- ▶ Giving more weightage for
high level image processing
refers to Computer vision

- DIP: Low level: 60% ;
Middle Level 30%; High
Level: 10%
- CV: Low level: 10% ;
Middle Level 30%; High

Level: 60%

- $CV = DIP + PR/ML$



Brief History of Computer Vision



- ▶ In 1950s, Using ANN, edges of objects were computed and some simple objects such as circles and squares were recognized
- ▶ In 1966, Marvin Minsky(Turing Award Winner(1969), MIT) gave the following summer project to an undergraduate student
 - Connect a camera to a computer and make computer to print(text) what the camera sees
- ▶ In 1970s
 - UK police developed number plate recognition system
 - MIT introduced the first ever Computer Vision course



Brief History of Computer Vision (cont.)



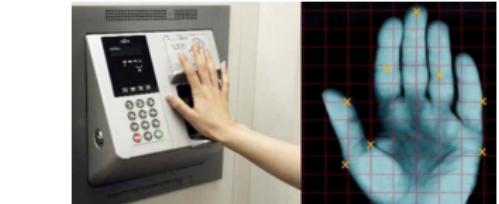
- ▶ In 1990s, Face recognition started maturing, making use of a large data available in the internet
- ▶ Recent Trend in Computer Vision
 - CV in edge devices
 - CV in cloud
 - Deep Vision
- ▶ Factors accelerating growth of CV
 - Availability of a large data
 - Affordable computing power
- Availability of Dedicated hardware and software for computer vision tasks
- Need of solutions for many real world problems for which only CV can give efficient solutions



Some Applications of CV



- ▶ Bio-metric Identification
 - Finger Print Recognition
 - Palm Vein Recognition
 - IRIS Recognition
 - Retina Recognition
 - Hand Geometry Recognition

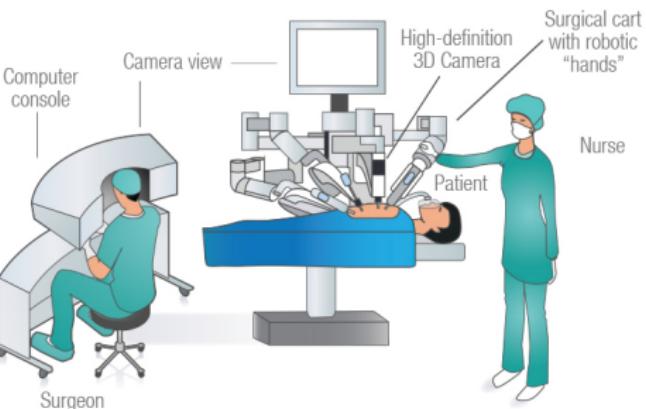
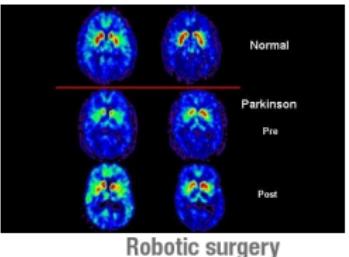


Some Applications of CV (cont.)



► CV in health care

- 2D-slice or 3D image reconstruction
- Disease diagnosis from image(s)
- Robotic Surgery



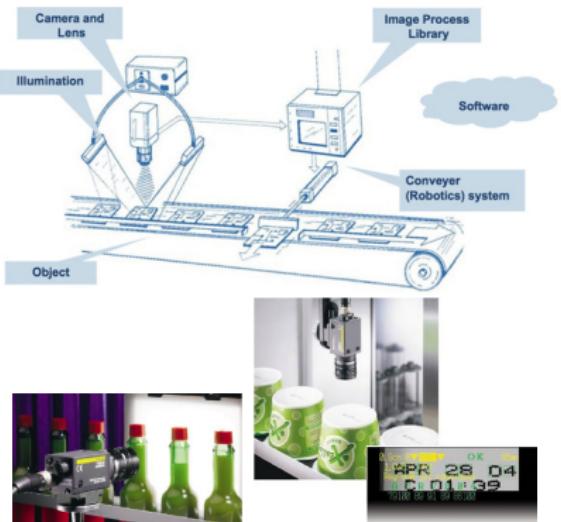
Some Applications of CV (cont.)



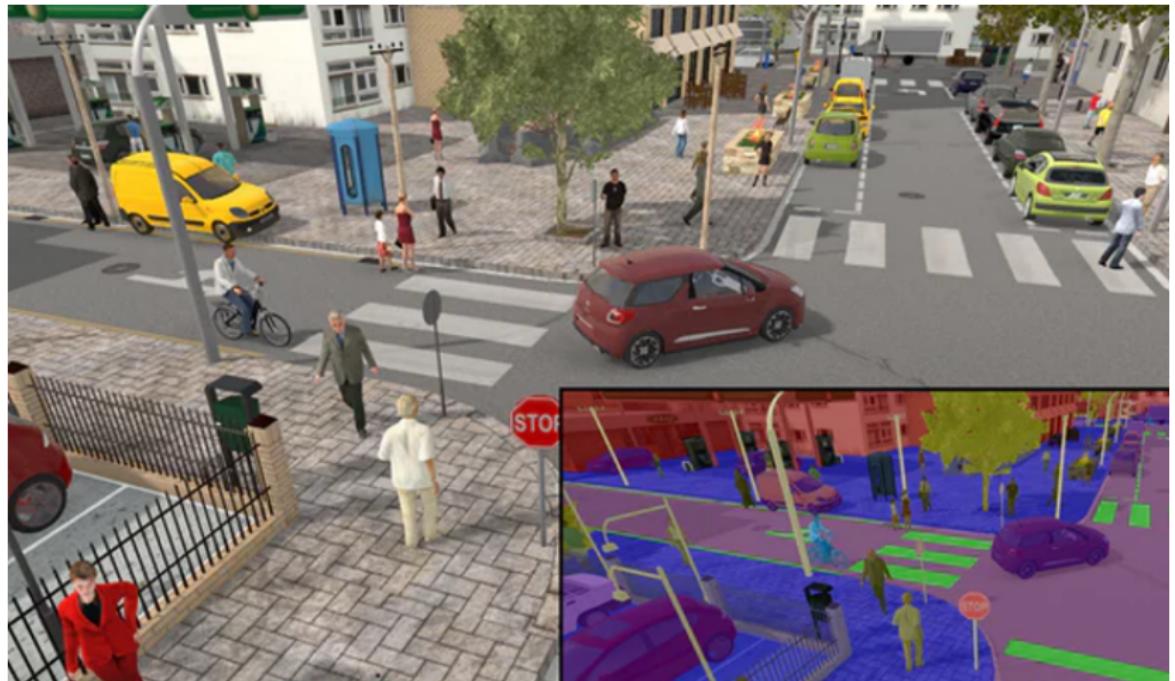
► CV

Manufacturing/automation (Machine Vision)

- Quantity Check
- Quality Check
- Check label (whether torn or MFD is correct etc.)
- Dimension Measurement
- Counting (No of tablets, number of persons etc.)
- Self Driving Car



Some Applications of CV (cont.)



Some Applications of CV (cont.)



Some Applications of CV (cont.)



► CV in Abnormal object/activity detection

- Thief Detection based on action
- Detection of traffic violators
- Defect detection (Rails, road, fabric etc.)
- Forged image detection

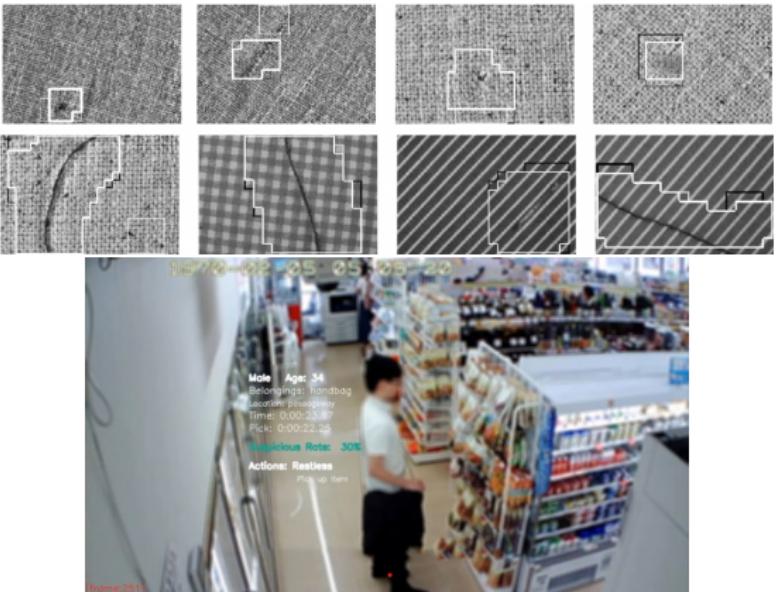
Images without anomalies



Images with anomalies



Some Applications of CV (cont.)



Some Applications of CV (cont.)

A screenshot of a smartphone screen displaying a video feed from a security camera. The video shows a man wearing a blue surgical mask, glasses, and a green plaid shirt standing in front of a doorway. The background is a red-paneled wall. A timestamp at the bottom right of the video frame reads "11:35 PM".

Alert! Motion detected in Room! man in
black shirt and glasses is standing in front
of doorway
person in image seems : Mask: 99.93%.

.

11:35 PM

Some Applications of CV (cont.)



CV in agriculture



Figure 1: Spaying Pesticides

Some Applications of CV (cont.)



CV in agriculture

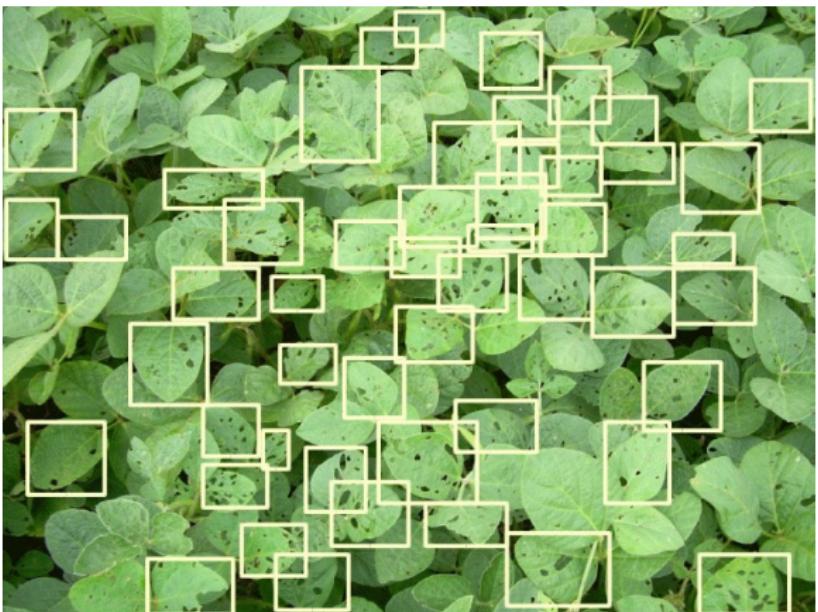


Figure 2: Disease Detection

Some Applications of CV (cont.)



CV in agriculture



Figure 3: Early Detection of Disease

Some Applications of CV (cont.)



CV in agriculture



Figure 4: Fruit Harvesting



- ▶ Counting number of passengers
- ▶ Attendance monitoring system
- ▶ Fragment analysis of blast site
- ▶ Wheel angle computation
- ▶ Detection of forgery in image/videos

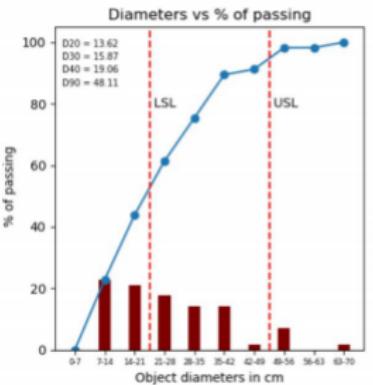
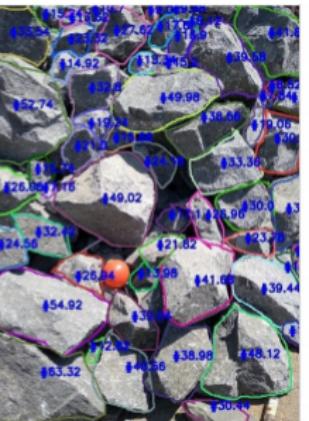
Counting number of passengers



Attendance monitoring system



Fragment analysis of blast site



Fragment analysis of blast site (cont.)



Comparison with wipfrag

IMAGE 1

Our's →

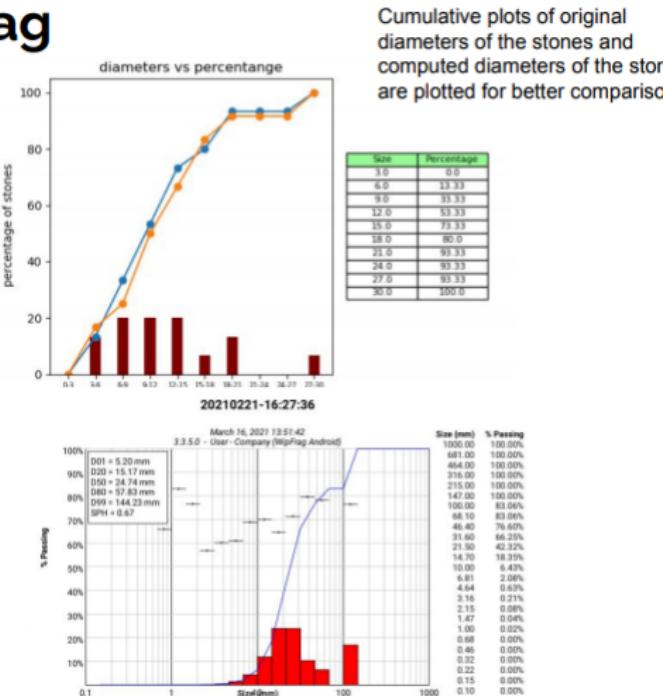


Our Algorithm output

Wipfrag →



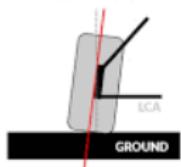
Wipfrag Output



Wheel angle computation



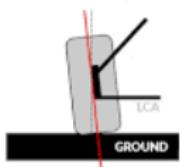
NEGATIVE
CAMBER



NEUTRAL
CAMBER



POSITIVE
CAMBER



Detection of forgery in image/videos



Bird's Eye View of the Course



- ▶ Basics of Images
 - Image Defn and types
 - Image Acquisition, Display and formats
- ▶ Low Level Image Processing
- ▶ Filtering
- ▶ Convolution and correlation
- ▶ Middle Level Image Processing
 - Edge Detection Algorithms
 - Segmentation Algorithms
 - Feature Extractions
- ▶ High Level Image Processing
 - Depth Estimation and Multi-camera View

Bird's Eye View of the Course (cont.)



- Object Detection
- Object Classification
- Motion Analysis

Summary



- ▶ What is CV
- ▶ How is CV different from DIP, ML, AI
- ▶ Brief History of CV
- ▶ Why is CV important
- ▶ What is ahead



Thank You! :)