Computer Vision

AI MACHINE LEARNING SUMMER SCHOOL

ABHIJEET PARIDA

EDUCATION

B. Tech. Mechanical Engineering
Amrita School of Engineering
Bengaluru, India

Major - Hypersonic Flows and Gas Dynamics

M. Sc. Computational Science and Engineering
Technical University of Munich
Munich, Germany

Major - Deep Learning for Medical Imaging

Research Interests-
Deep Learning for Medical Imaging, Few Shot Learning, UAD, Machine Learning, Semantic Segmentation, Deep Learning for Fluid Flows.

WORK EXPERIENCE

Data Scientist
deepc GmbH
(05/2019- 05/2022)

Development of the orchestration of AI models and design of workflows for processing of radiological image data.

R&D DevOps Eng
Children's National
(06/2022-)

Development of Children specific Imaging DL Models for Surgical Innovation and Precision Medicine with GWU and CHLA.

OPEN MODEL

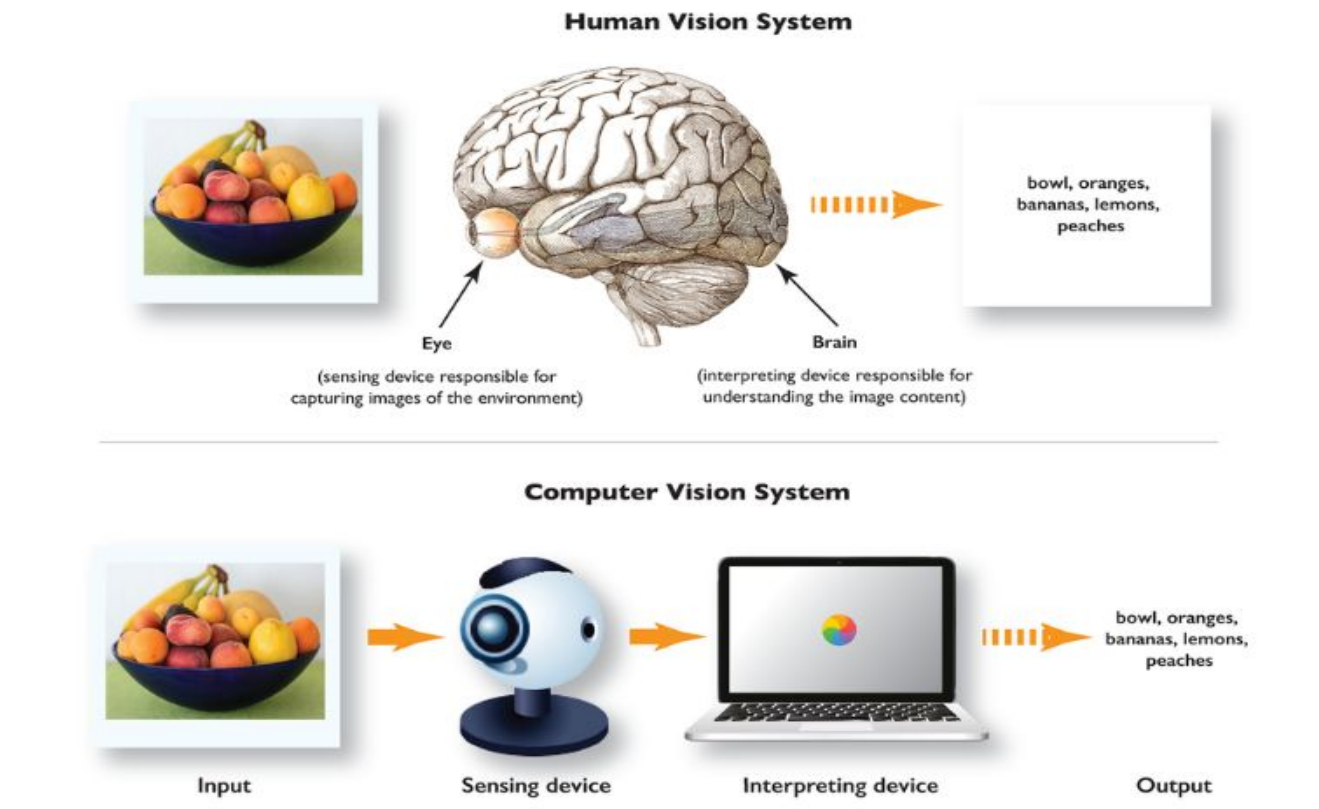
- Neural Network-Based Segmentation of MS Lesions in FLAIR Images (DockerHub)

- Anatomy Based GM, WM and CSF Segmentation (DockerHub)

CONTENT

- What is Computer Vision?
- Why Computer Vision is Hard?
- What is an Image?
- What is a Video?
- What are major Image Processing Techniques?
- Demo of a task
- Outlook
- Outro

What is Computer Vision?

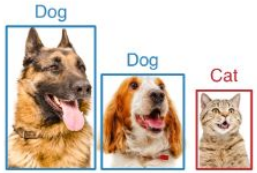


Src - https://www.cybiant.com/wp-content/uploads/2020/01/CKC-Human-vision-vs-computer-vision-e1600159792269.png

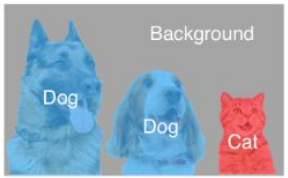
What is Computer Vision?: CV Tasks

Image Classification:
recognize an object in an image.

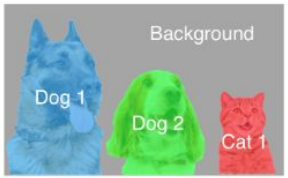
Object Detection:
detect multiple objects with their bounding boxes in an image.



Semantic Segmentation:
associate each pixel of an image with a categorical label.



Instance Segmentation:
associate each pixel of an image with an instance label.



Src -A One-Stop Guide to Computer Vision — part 1 | by Benedict Soh | Towards Data Science

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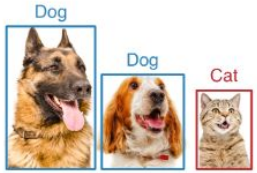

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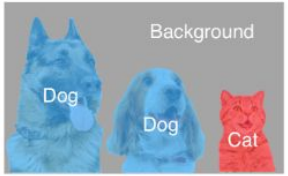

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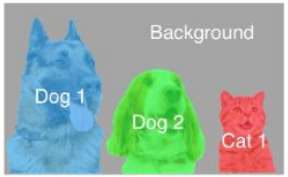


Src -A One-Stop Guide to Computer Vision — part 1 | by Benedict Soh | Towards Data Science

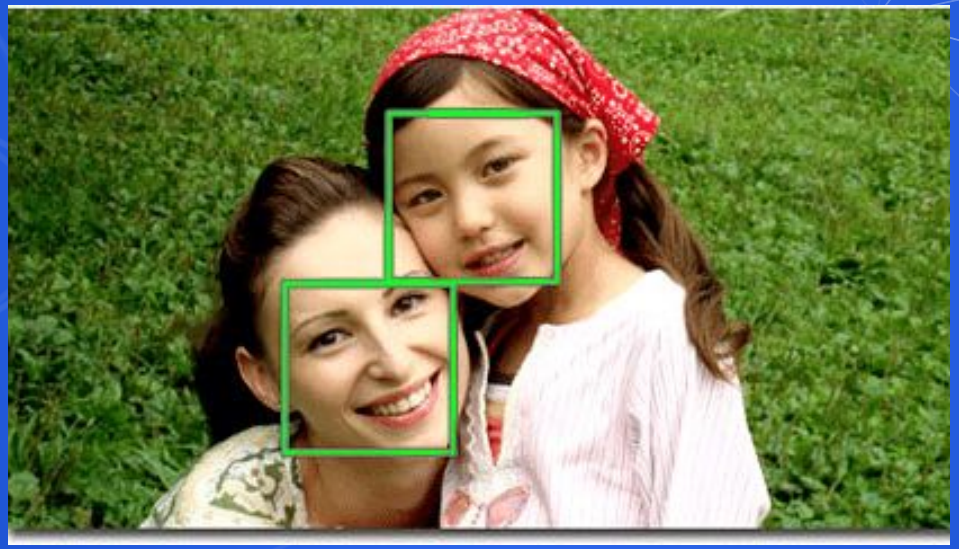
What is Computer Vision?: Applications

Optical Character Recognition

Src - Applications of Image Processing Techniques on Palm Leaf Manuscripts-A Survey | Semantic Scholar

What is Computer Vision?: Applications

Face Detection/ Sony Smile Shutter



Src - Face detection in photos and automatic shutter mode when everyone | ResearchGate

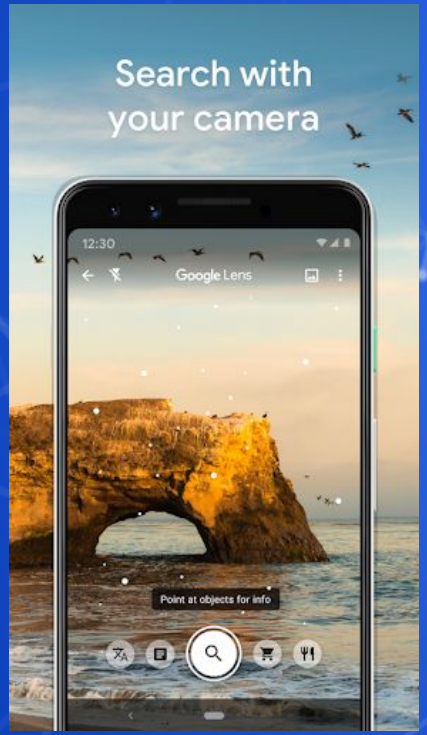
What is Computer Vision?: Applications

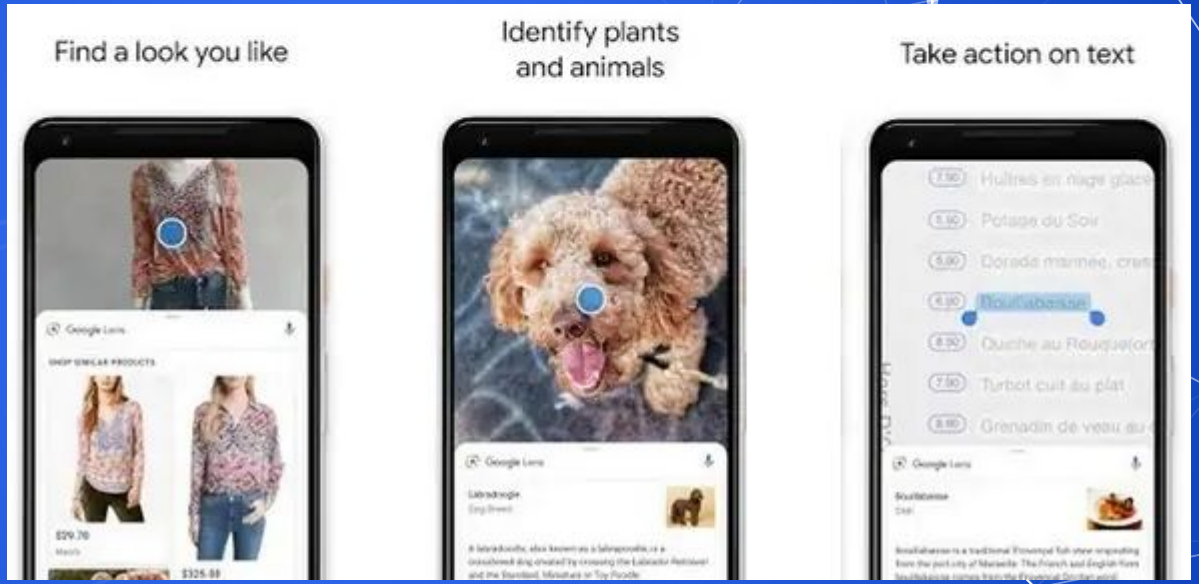
Facial Recognition/ ID Card Scanning

Src -https://topclassactions.com/wp-content/uploads/2020/11/facial-recognition.jpg.optimal.jpg

What is Computer Vision?: Applications

Google Lens

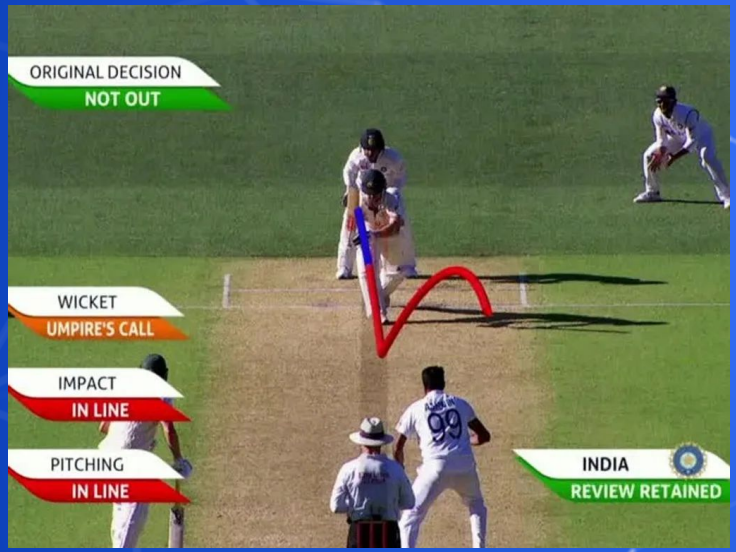




Src - https://lens.google/

What is Computer Vision?: Applications

Sports Ball Tracking

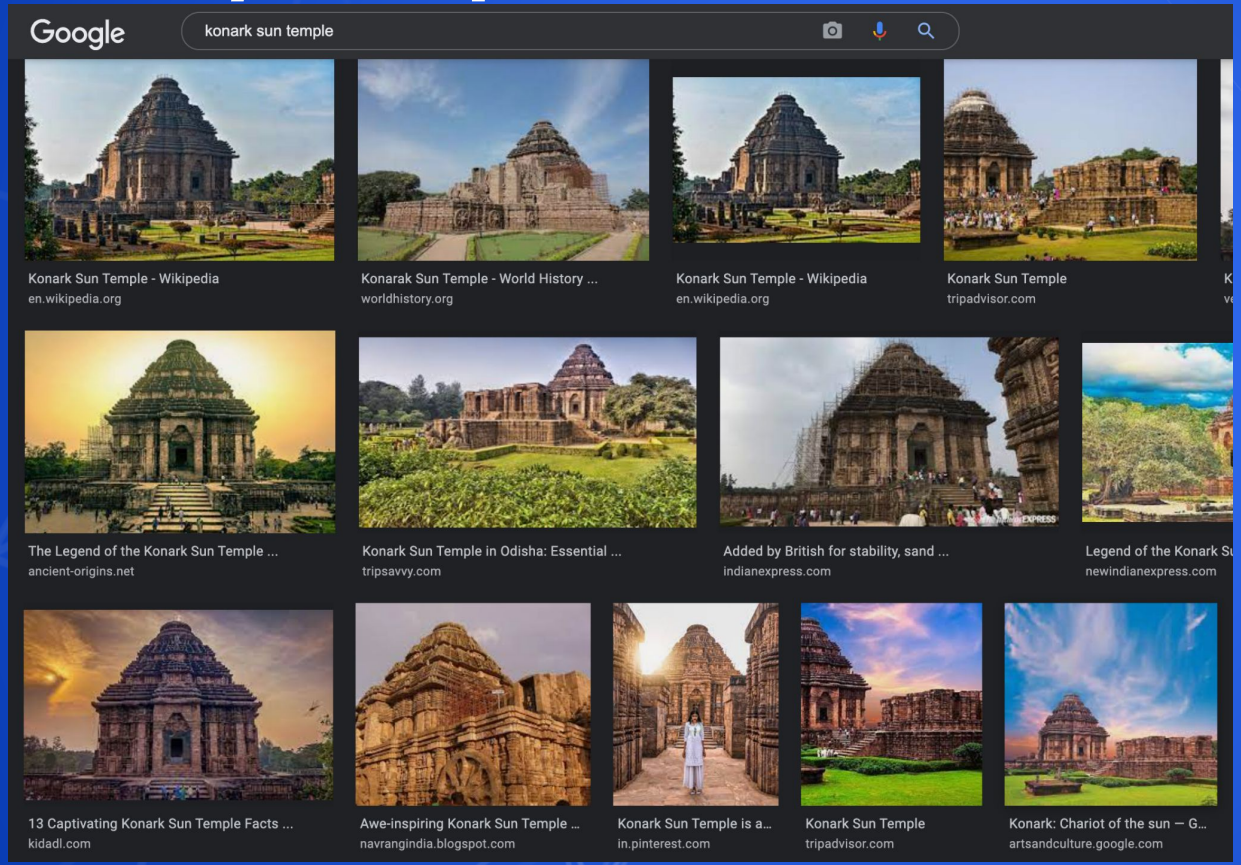


Src - https://www.sportsadda.com/cricket/features/what-umpires-call-rule-cricket-conclusive-evidence-on-field-umpire-decision

What is Computer Vision?: Applications

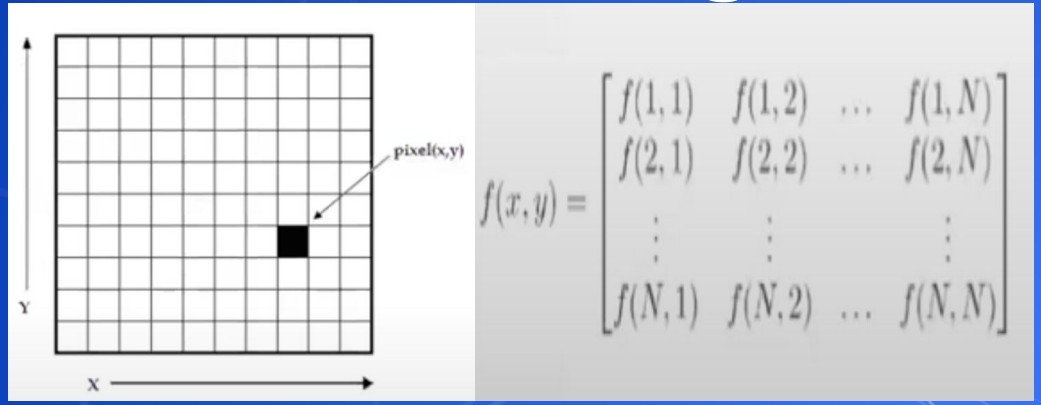
Medical Imaging

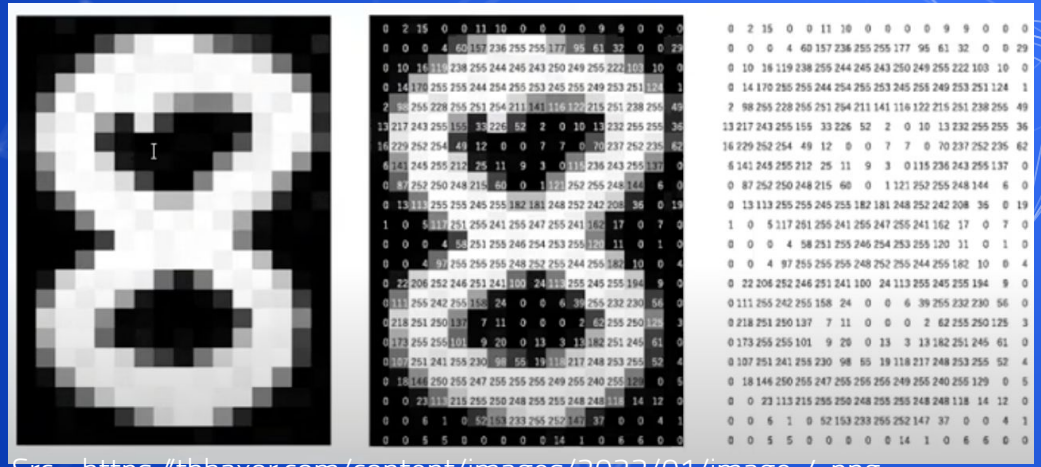
Why Computer Vision is Hard?



- Viewpoint
- Lighting
- Scale
- Camera Limitation
- Occlusion
- Obfuscation

What is an Image?: Grayscale

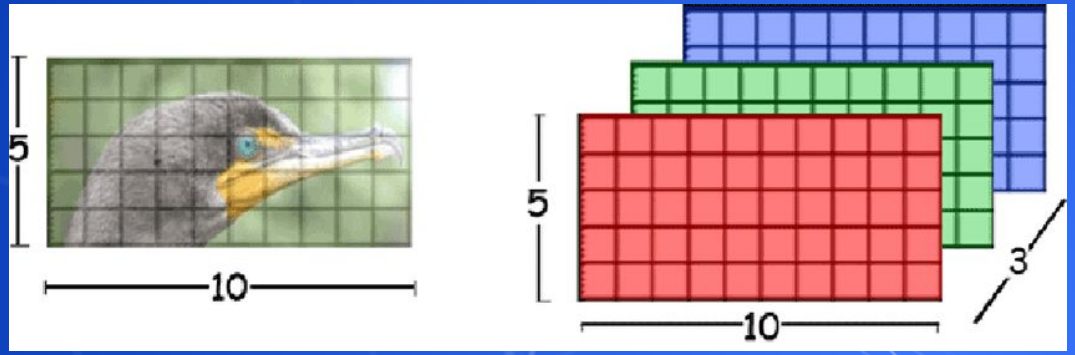




- Image is an combination of Pixels
- Pixels are spatial coordinate with a value
- The value is a number with range [0, 255]
- Computer representation is a matrix

Src - https://tbhaxor.com/content/images/2022/01/image-4.png

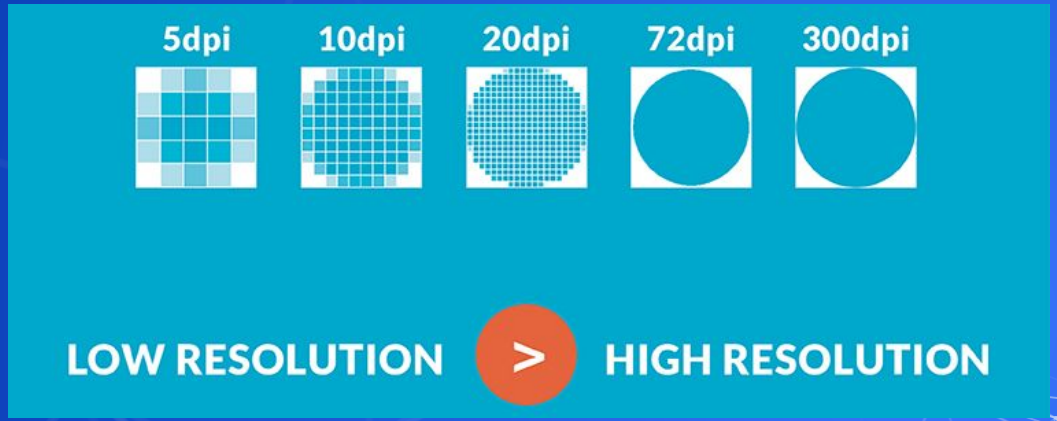
What is an Image?: RGBA Image



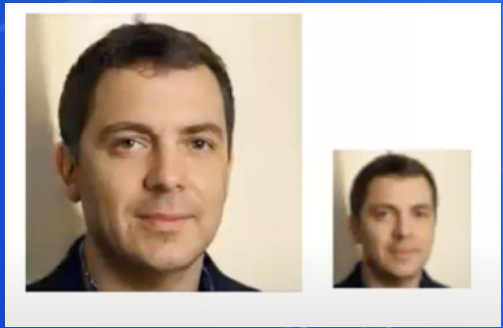
- Stacked multiple Channel to be interpreted as colors
- Pixel value signify intensity of the color
- Each Pixel of channel has range [0, 255]
- All possible colors 256C3 = 1,67,77,216
- PNGs can have A value to signify transparency

Src - https://tbhaxor.com/content/images/2022/01/image-4.png

What is an Image?: Image Resolution



- No of Pixels per inch of screen
- Called PPI/DPI
- Higher resolution; higher PPI; more details
- Change of Resolution leads to loss of details

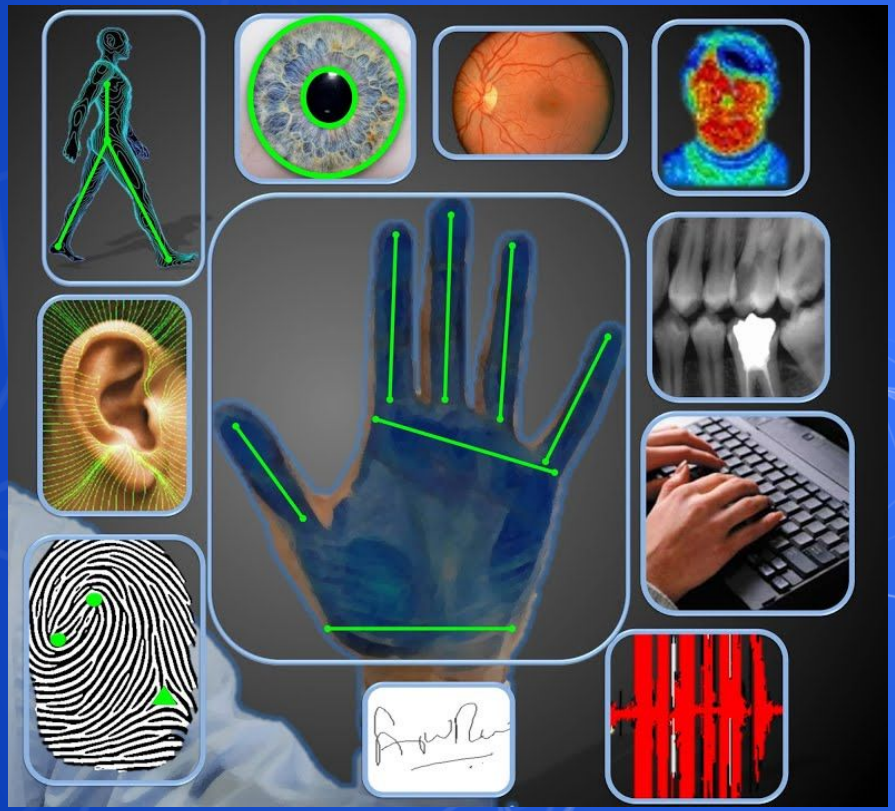


Src - https://www.insight180.com/wp-content/uploads/2018/02/resolution-feature.jpg

What is a Video?

Src - https://tbhaxor.com/content/images/2022/01/image-4.png

Image Processing



- The mathematical notations equivalence of images are matrices
- The process modifying the values of the image matrix using algorithms
- They enhance and/or analyse the content
- DIY photoshop

Image Processing: Cropping

Image Processing: Resizing

Image Processing: Flipping/Rotation

Image Processing: Brightness/Contrast

Image Processing: Edge Detection

Image Processing: Dilation/Erosion

Image Processing: Connected Components

Image Processing: HDR

Demo: Traffic Management System

Outlook:CNNs

Src - https://tbhaxor.com/content/images/2022/01/image-4.png

Outlook: 3D Computer Vision

Src - https://tbhaxor.com/content/images/2022/01/image-4.png

Outro:Learning Goals

- What is Computer Vision?
- Why Computer Vision is Hard?
- What is an Image?
- What is a Video?
- What are major Image Processing Techniques?
- How multiple tasks can come together for an important application