Image processing & Computer Vision Applications

LAKSHIKA NANAYAKKARA

Digital Image Processing

Applications of image processing

- **Visual information** is the most important type of information perceived, processed and interpreted by the human brain.
- **One third of the cortical area** of the human brain is dedicated to visual information processing.
- Digital image processing- interpretation of such visual information

Applications of DIP

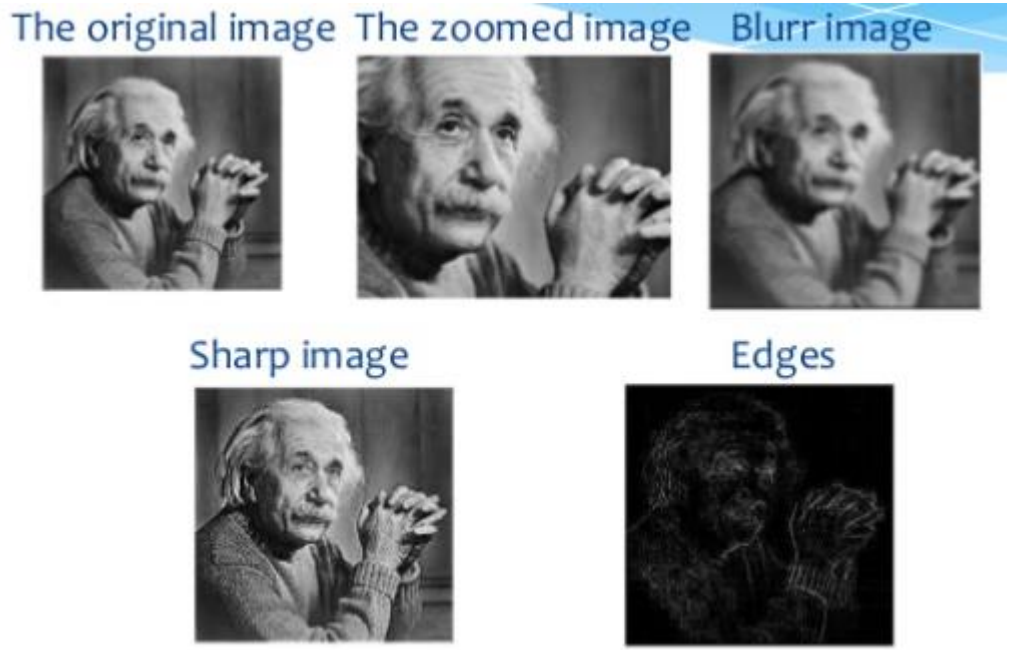
- image sharpening and restoring
- medical domain analysis
- remote sensing
- machine/robot vision
- colour processing
- pattern recognition
- video processing
- microscopic imaging

Image sharpening and restoration

To make better image or manipulate them to retrieve desired output.

Similar to the Photoshop results

It includes, zooming, blurring, sharpening, gray scale result, edge detection, image recognition and retrieval etc.



Medical domain

Common applications are,

- Gamma Ray imaging
- PET scan
- X-ray imaging
- Medical CT
- UV imaging

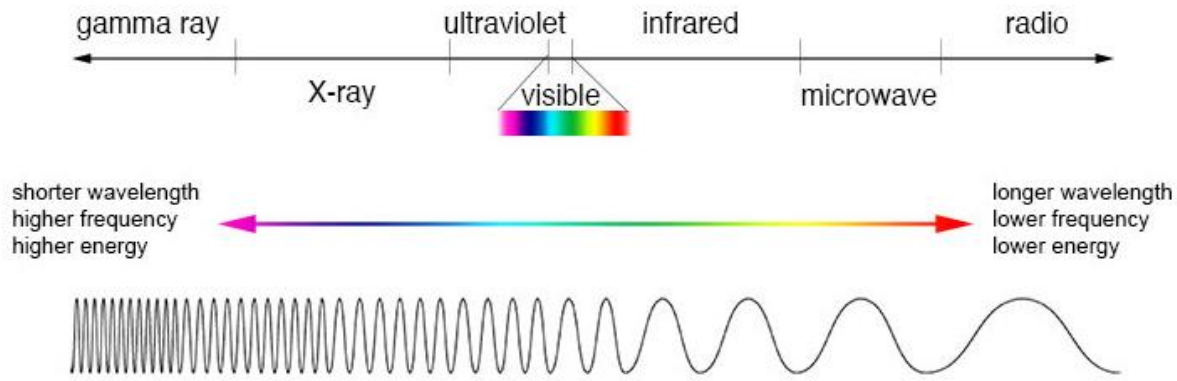
Gamma Ray imaging

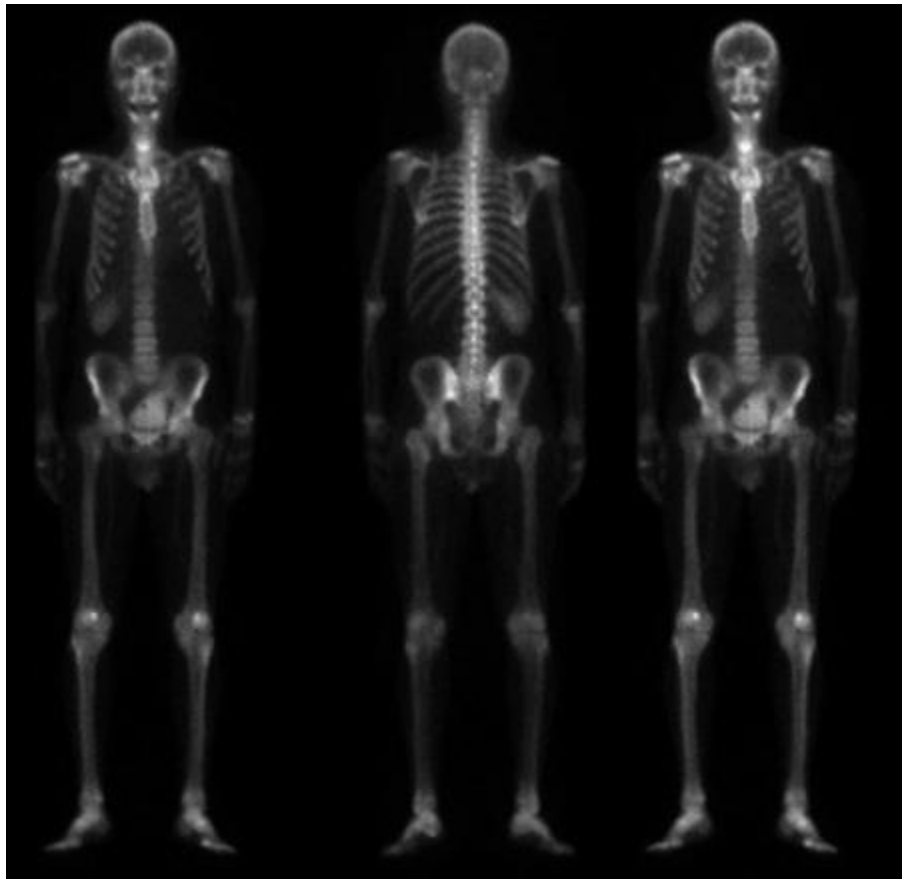
Used in nuclear medicine and astronomical observations

Nuclear medicine approach will inject a radioactive isotope that emits gamma rays as it decays.

Images are produced by the emissions collected by gamma rays detectors.

Used to locate the sites of bone pathology, infections and tumors.





Bone scan
in Gamma
ray imaging

PET scan

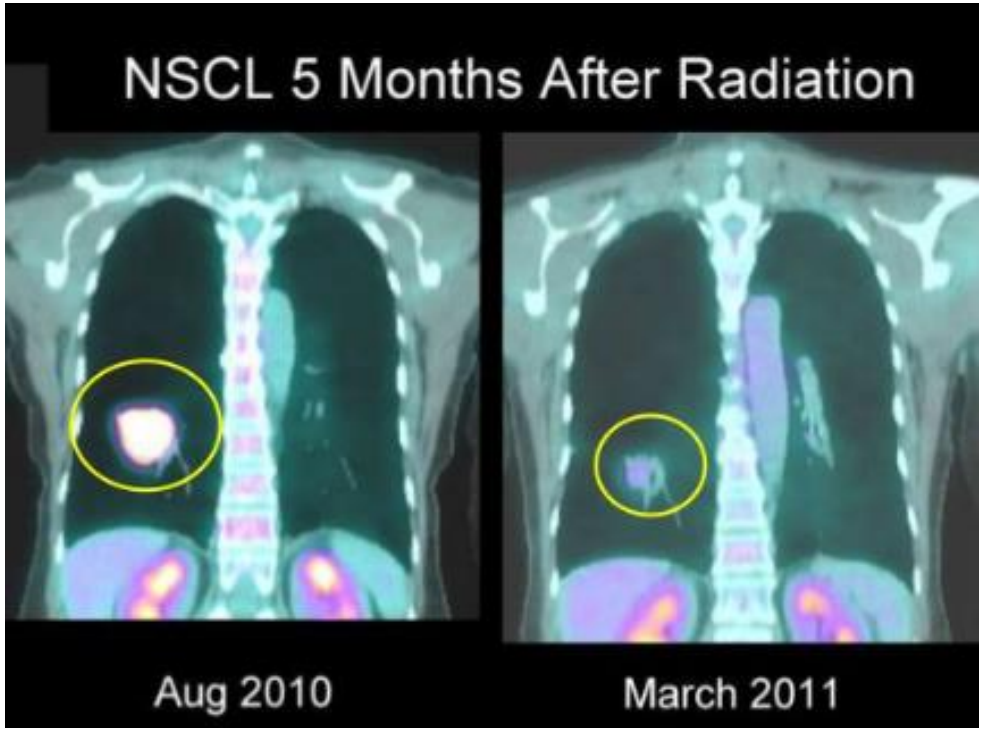
Known as “ Positron Emission Tomography”

Similar to the X-ray tomography.

In here instead of giving an external source of X-ray energy, the patient is giving a radioactive isotope which emits positrons as it decays.

When it meets electrons, both are annihilated and 2 gamma rays are given off.

These will ultimately created tomographic image.

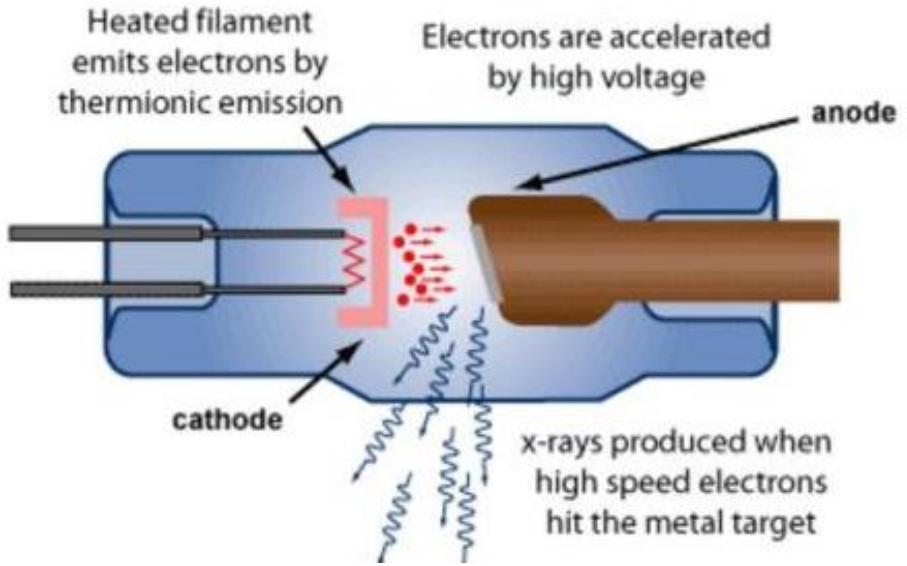

NSCL 5 Months After Radiation
Aug 2010
March 2011

X-ray imaging

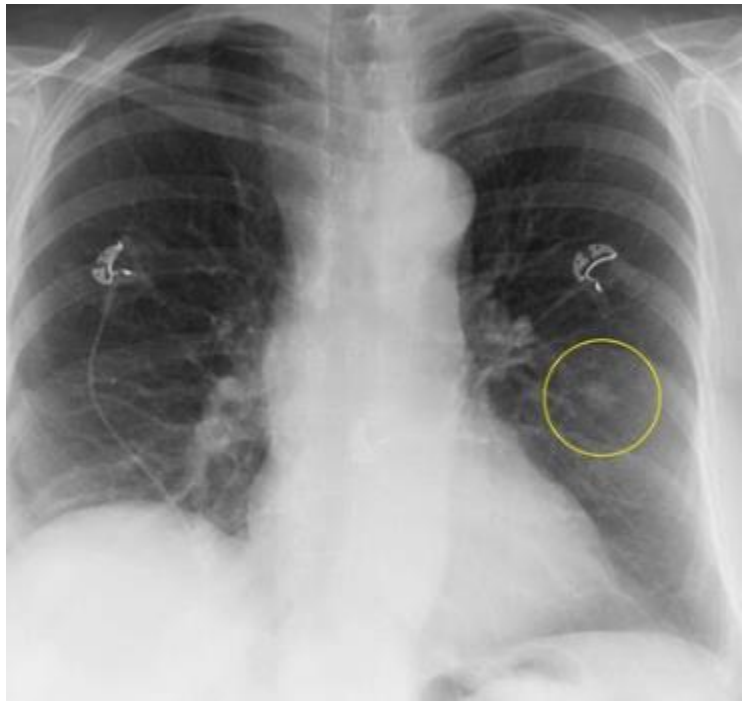
Oldest source of EM radiation which used for imaging

Used in medical diagnosis and astronomy.

Imaging are generated using an X-ray tube.



Chest X-ray image



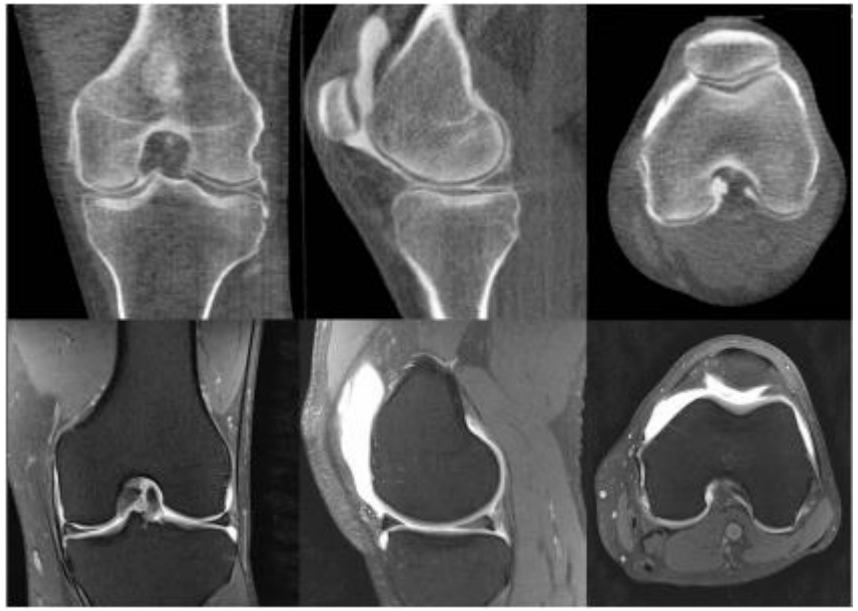
CT imaging

Known as “Computerized Axial Tomography (CAT).

Each CAT image is a slice taken perpendicularly through the patient.

Various slices are generated when he is moved in a longitudinal direction

“A CT scan, is a medical imaging procedure that uses computer-processed combinations of many X-ray measurements taken from different angles to produce cross-sectional images of specific areas of a scanned object, allowing the user to see inside the object without cutting.”



Knee joint

Different Types of Tasks

Image acquisition: digitization/quantization, compression, encoding/decoding

Image Enhancement : for improvement of pictorial information for human interpretation, both input and output are in the image form (e.g., the first few application examples above).

Image Understanding and Image Recognition: Input is in image form, but output is some none image representation of the image content, such as description, interpretation, classification, etc.

Pre-processing stage of computer vision of an artificial intelligent system (robots, autonomous vehicles, etc.)

Pre-Processing

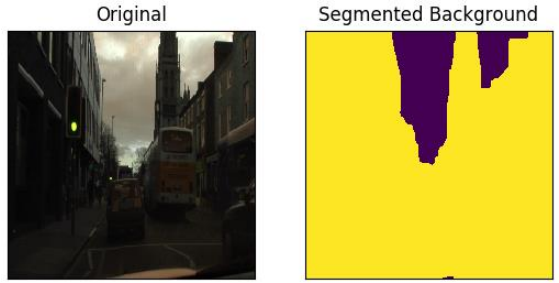
Read image - load folders containing images into arrays.

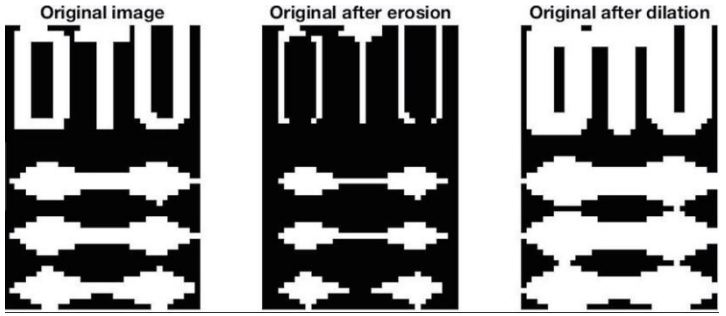
Resize image

Remove noise(Denoise) – used Gaussian blur

Segmentation

Morphology(smoothing edges)





Corrections

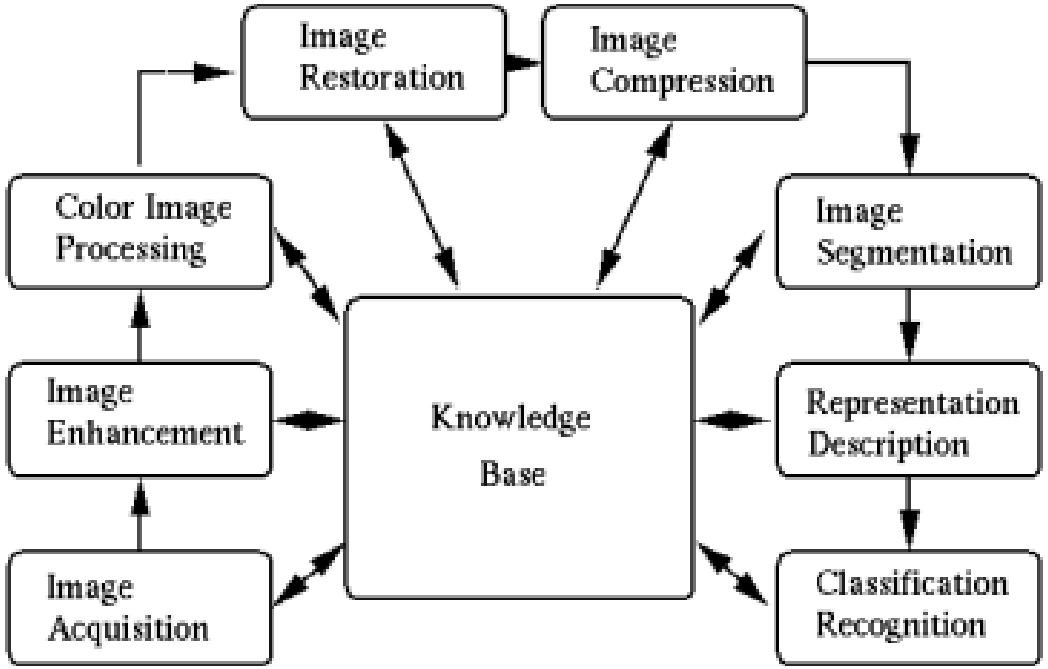
Lighting corrections - histogram equalization

Noise

Geometric corrections - If the entire scene is rotated or taken from the wrong perspective, it may be valuable to correct the geometry prior to feature description.

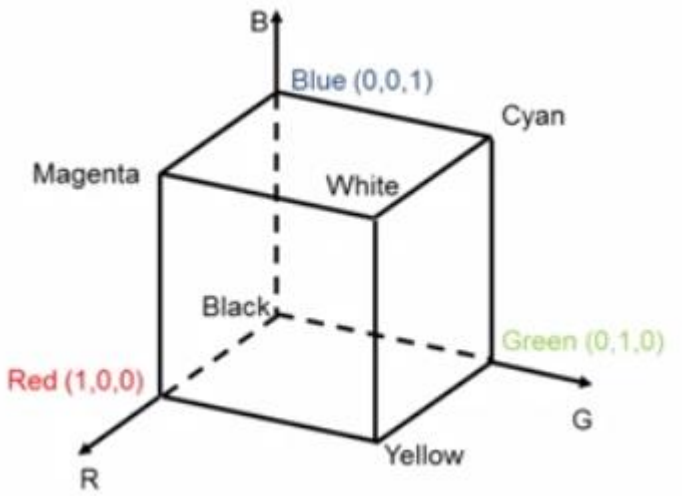
Color corrections - It can be helpful to redistribute color saturation or correct for illumination artifacts in the intensity channel.

Overall idea



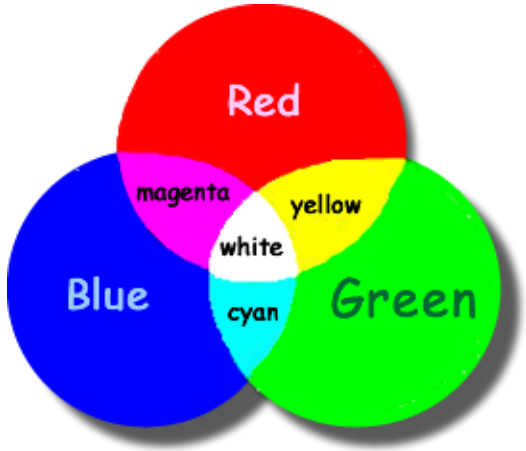
Color Representation

- Very powerful characteristics – segmentation, racking, detection
- Primary colors and secondary colors
- Color model
  - RGB model
  - CMY and CMYK model



Complementary Colors

Analogous Colors



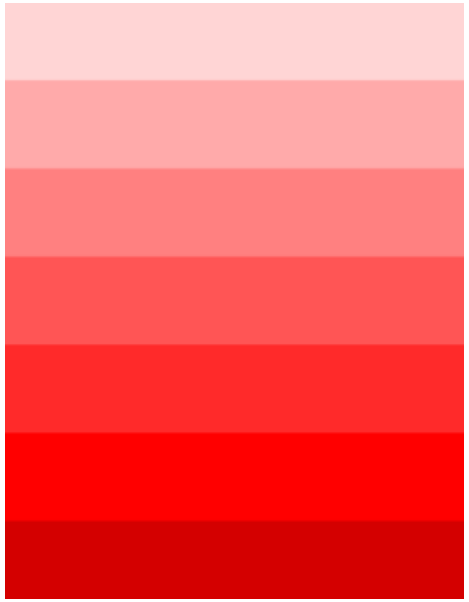
Analogous colors

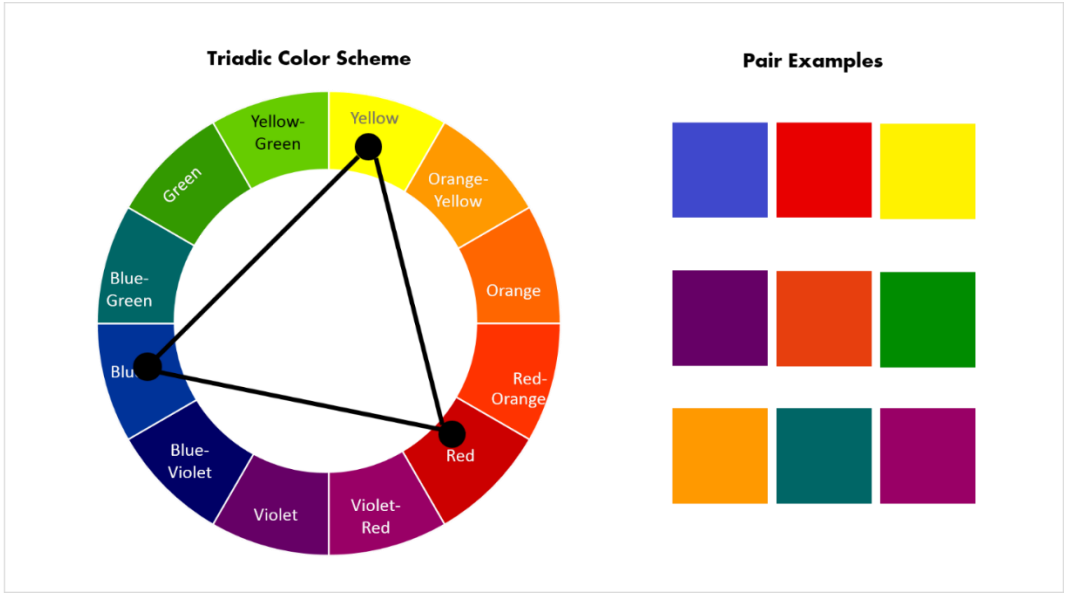
Complementary colors

Monochromatic colors

Triadic colors

Tetrad colors





Original RGB Image

Red Channel in Red

Green Channel in Green

Blue Channel in Blue

Recombined to Form Original RGB Image

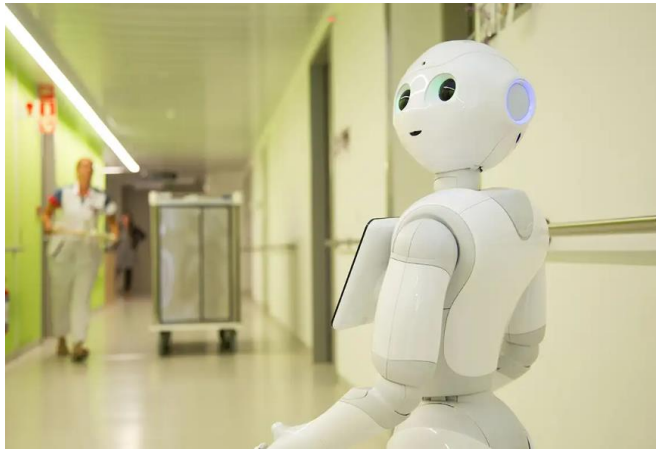
Image segmentation

Fixed threshold

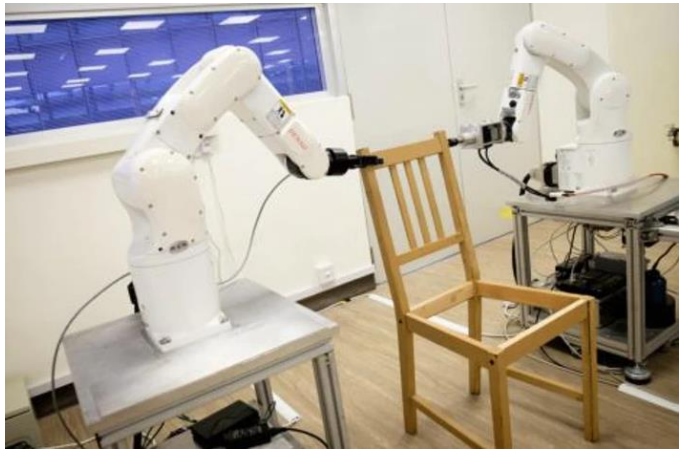
Machine/Robot vision

Machine vision system is a sensor used in the robots for viewing and recognizing an object with the help of a computer. It is mostly used in the industrial robots for inspection purposes. This system is also known as artificial vision or computer vision

Hospital assistant



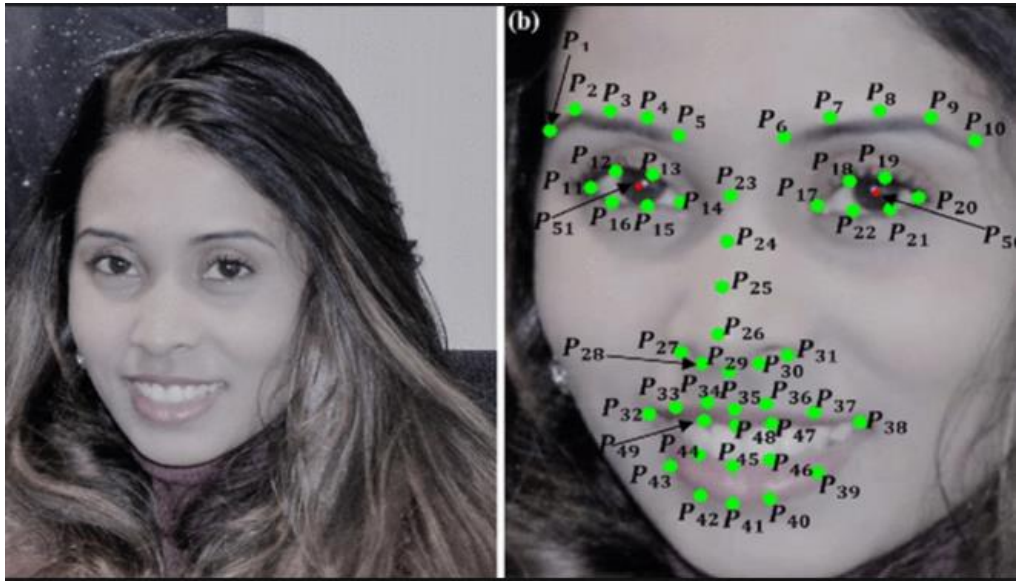
Assembling a chair

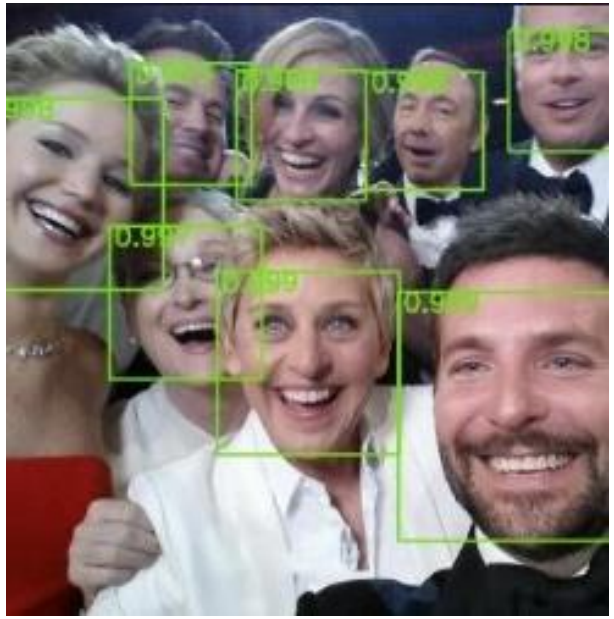


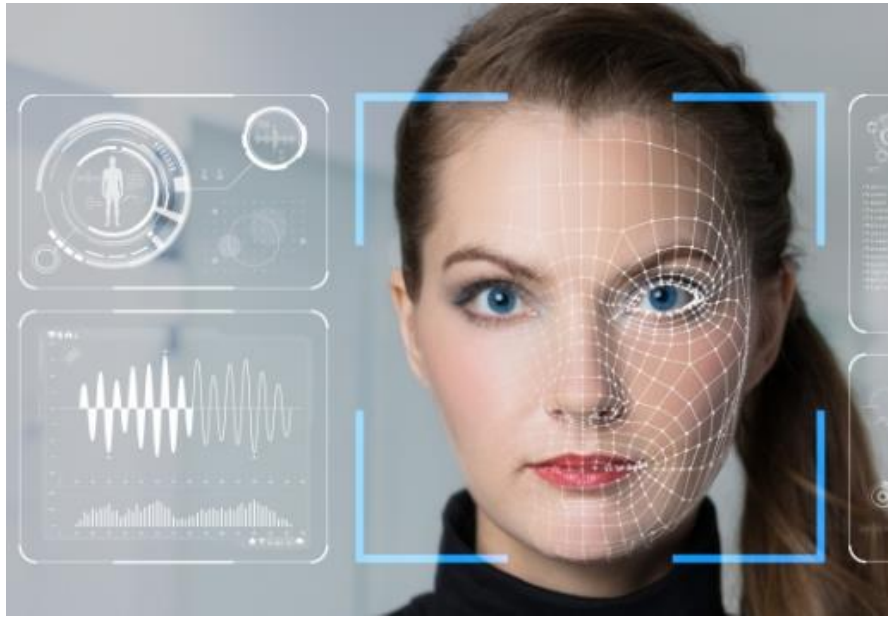
Food delivery

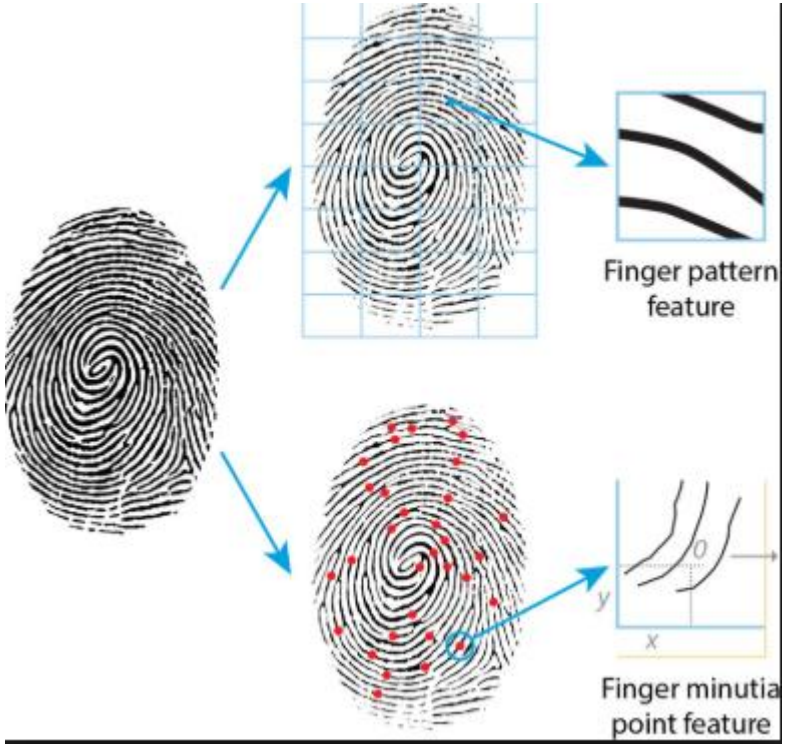
More ……

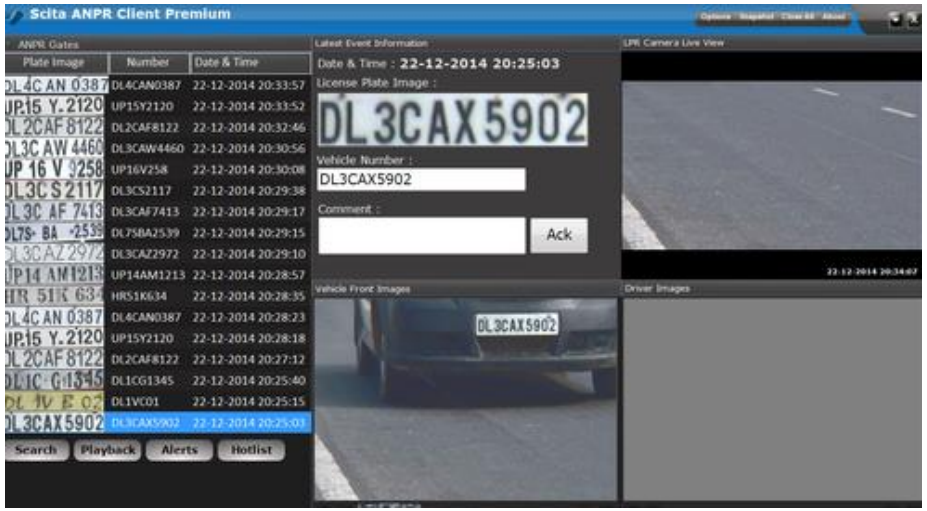

[MATCH]
MATCH MADE
ANDREA CANDIAN
LONDON UK
ENROLLED PHOTO
LAST MATCH
match 98%

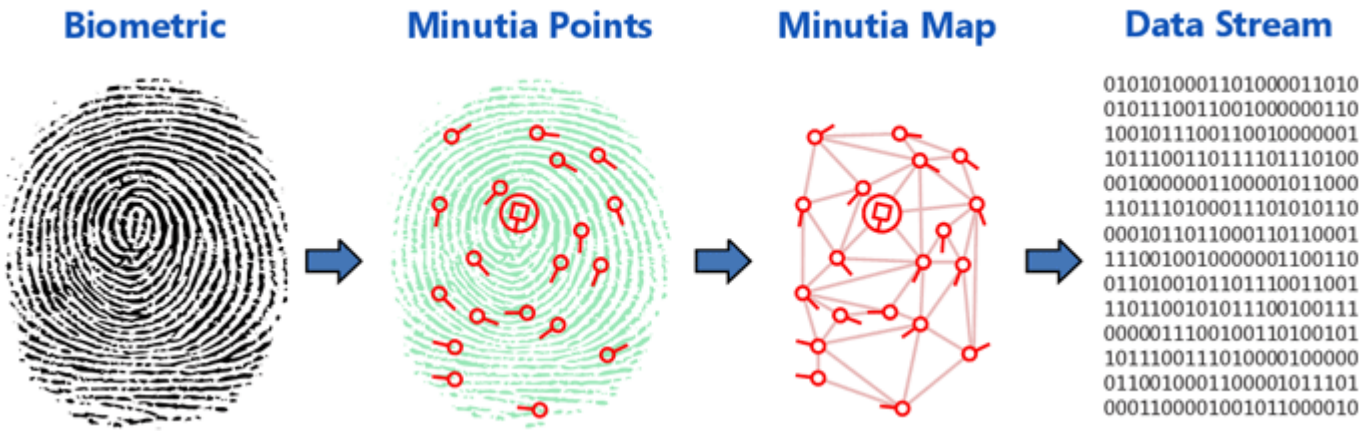

(b)






Finger pattern feature
Finger minutia point feature


Scita ANPR Client Premium
ANPR Gates
Plate Image
Number
Date & Time
Latest Event Information
Date & Time : 22-12-2014 20:25:03
License Plate Image :
DL3CAX5902
Vehicle Number :
DL3CAX5902
Comment :
Ack
LPR Camera Live View
Vehicle Front Images
Driver Images
Search
Playback
Alerts
Hotlist


Biometric
Minutia Points
Minutia Map
Data Stream
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1001011100110010000001
1011100110111101110100
0010000001100001011000
1101110100011101010110
0001011011000110110001
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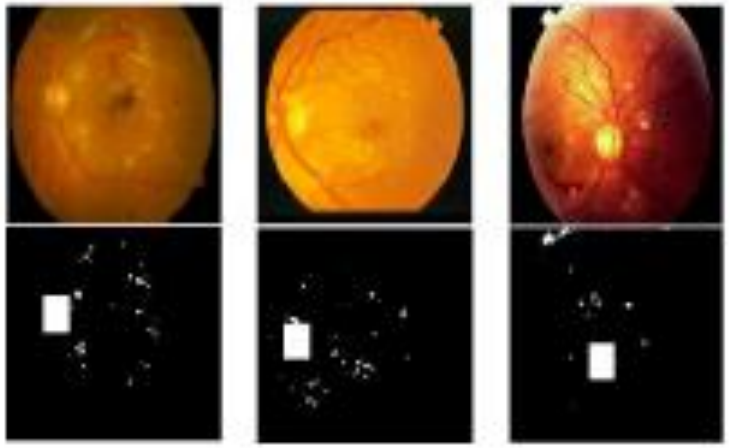
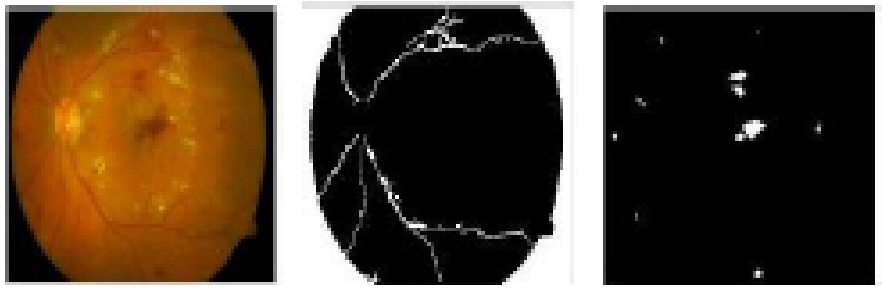
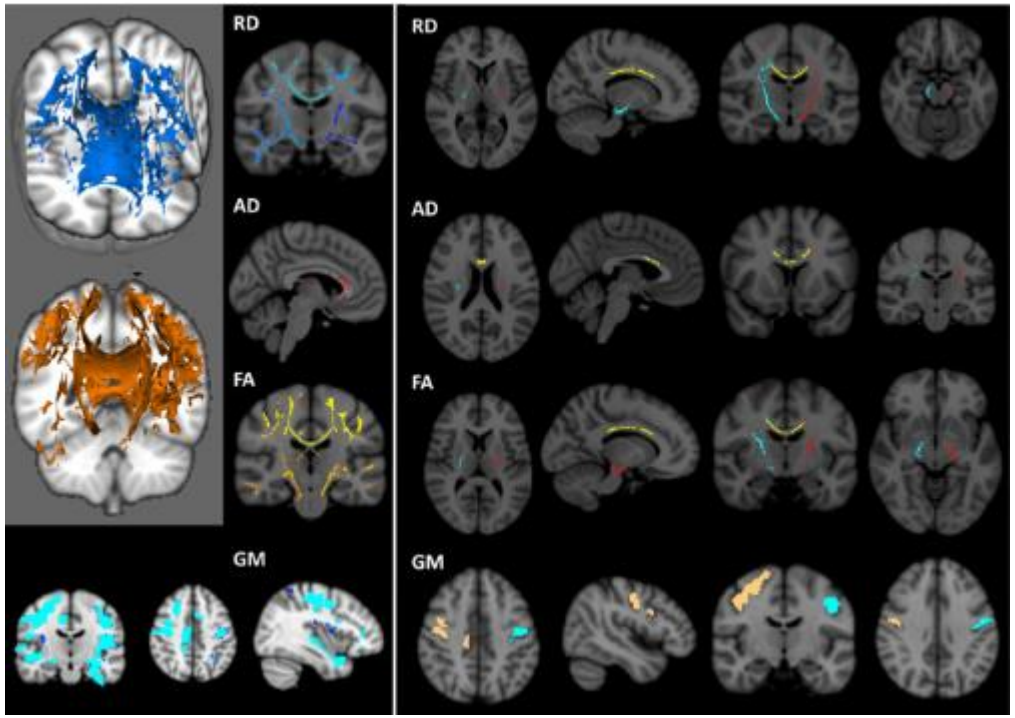
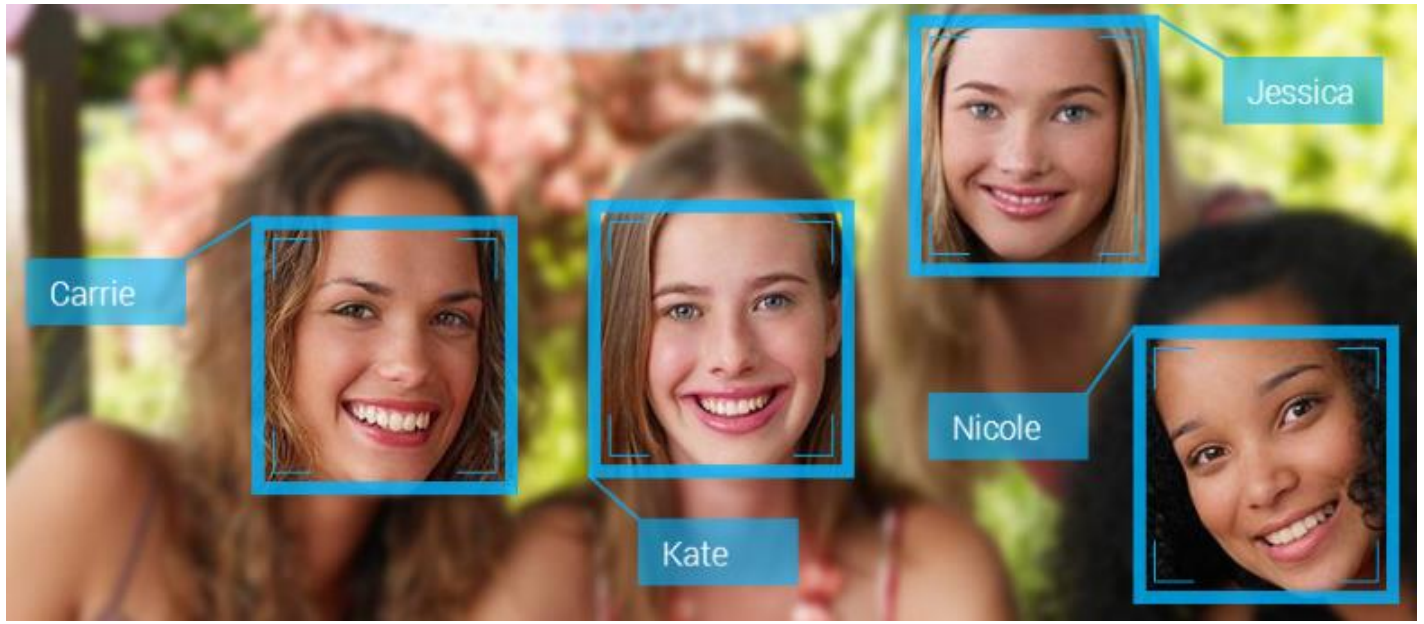
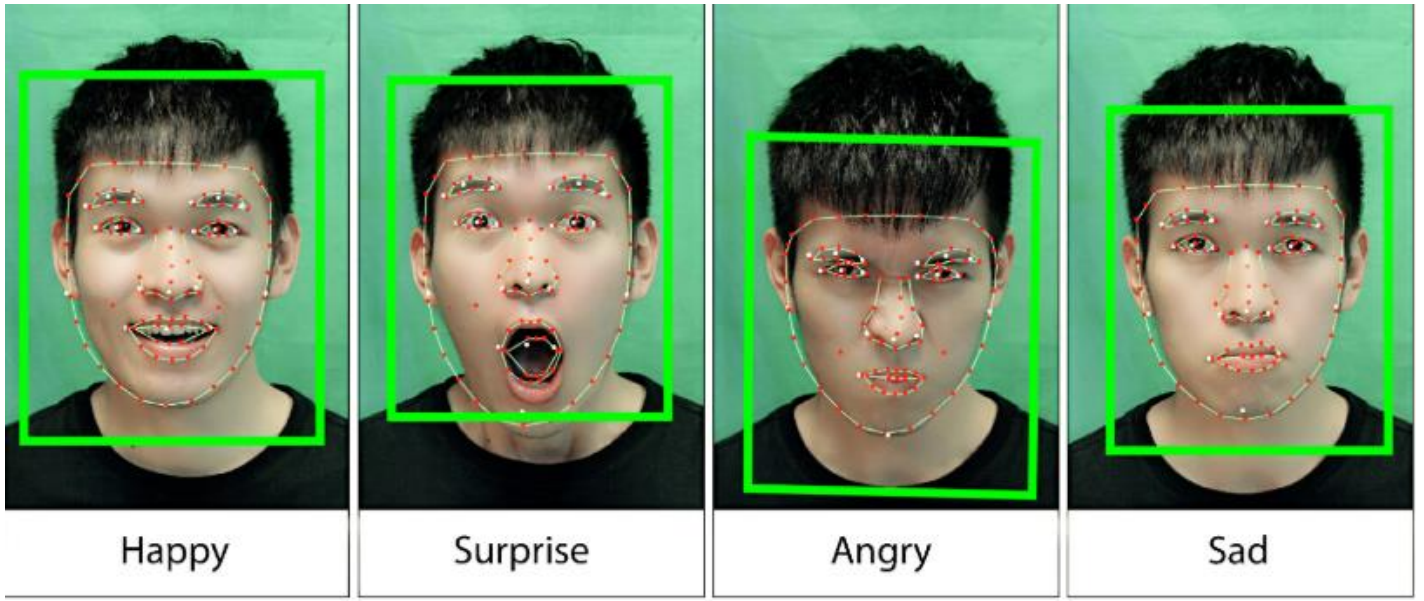


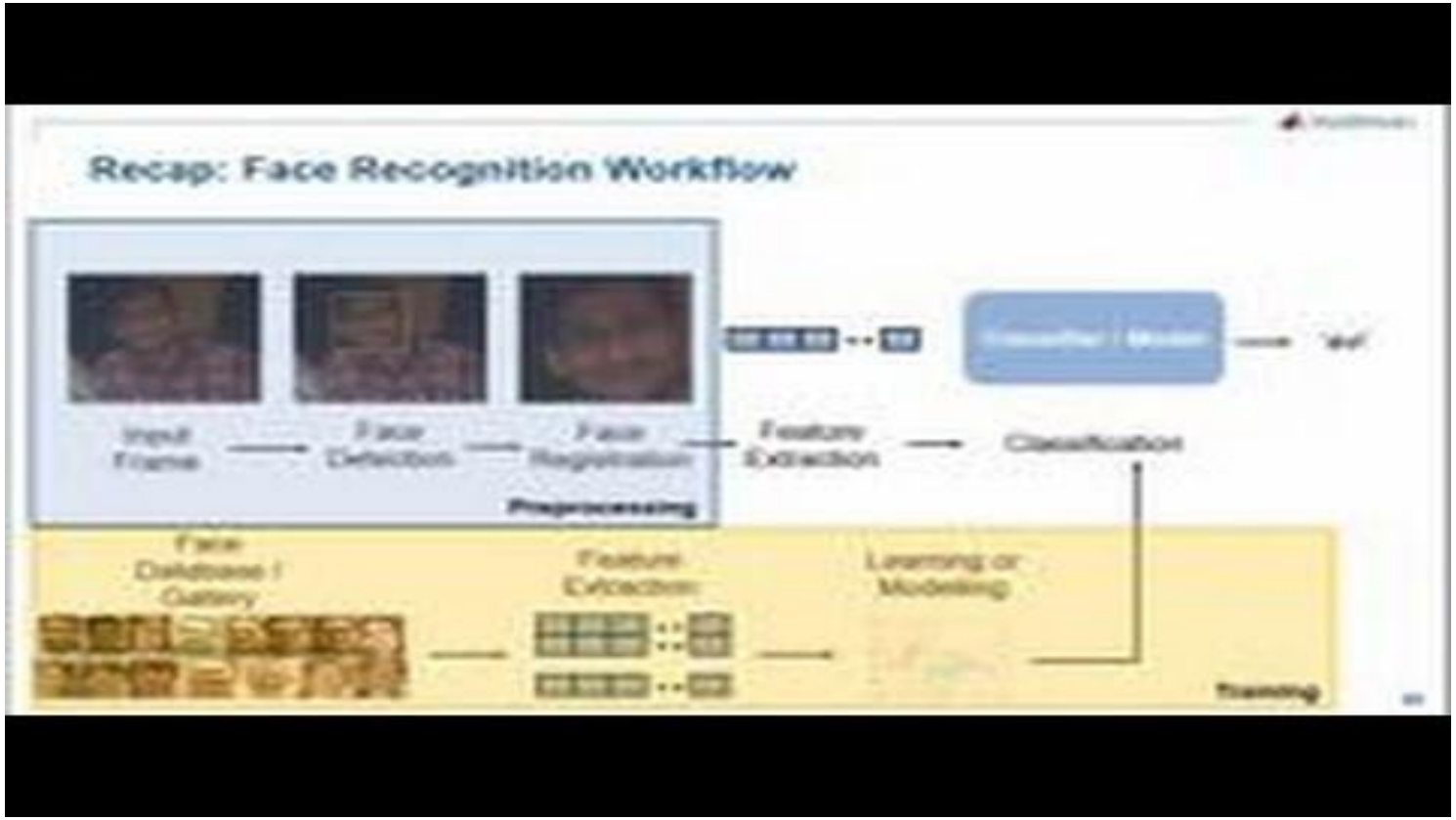



RD
AD
FA
GM
RD
AD
FA
GM

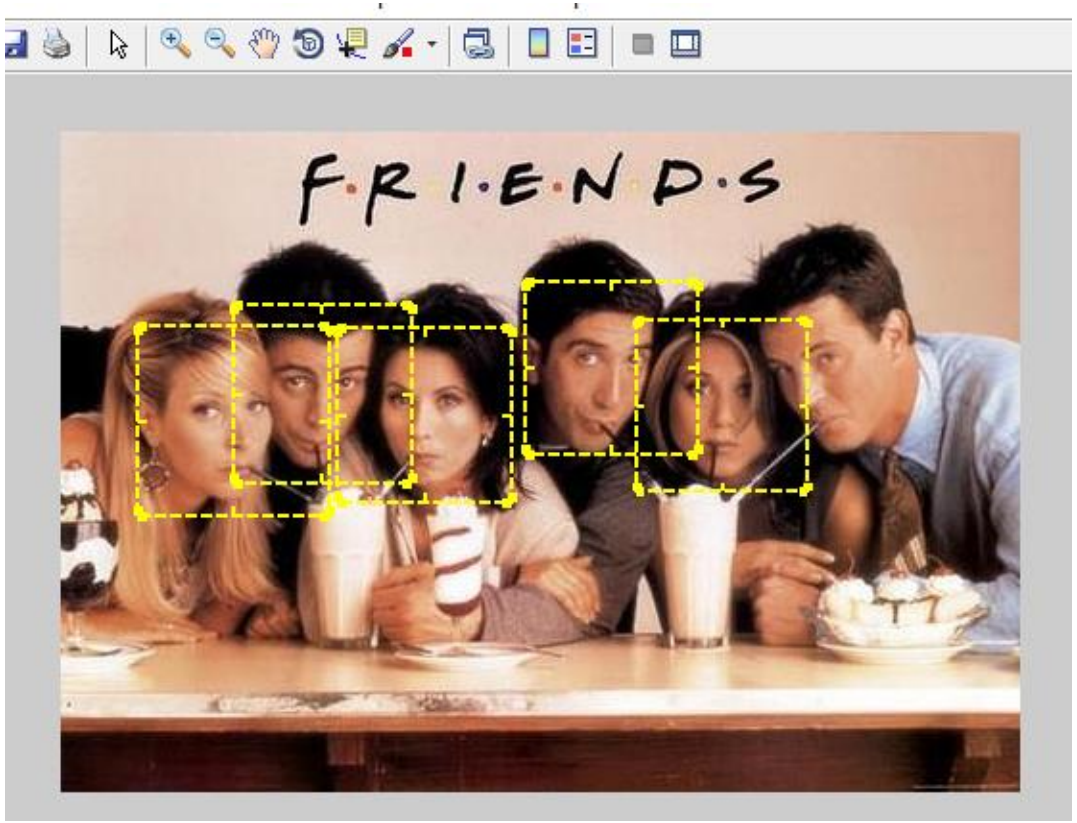

Jessica
Carrie
Nicole
Kate


Happy
Surprise
Angry
Sad

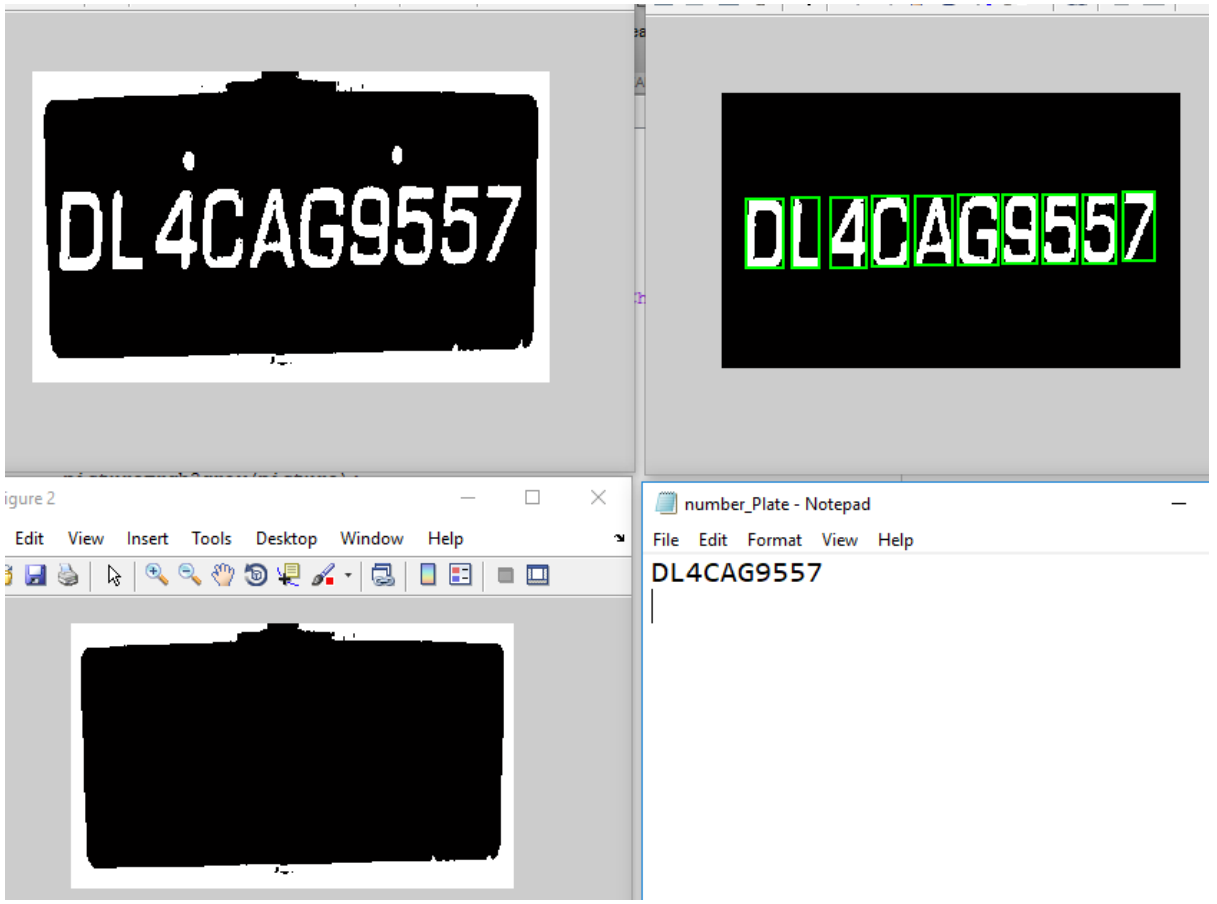
Face Recognition



Face Recognition



Number Plate Detection



More examples

https://www.pantechsolutions.net/blog/top-100-image-processing-projects-free-source-code/