

# CO414 Digital Image Processing



# Course Evaluation

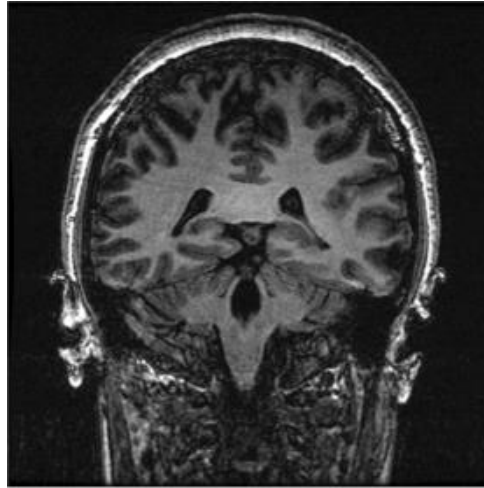
Endsem – 40%

Insem – 20%

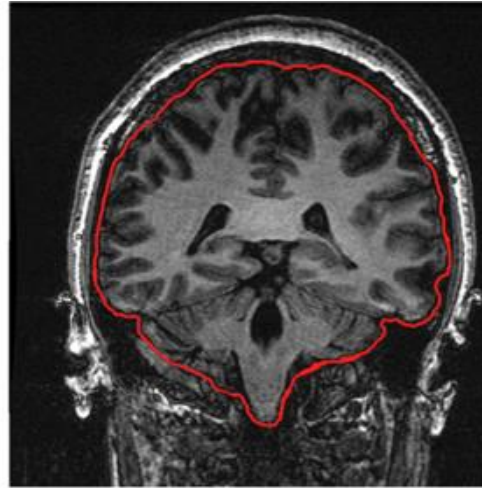
Assignments – 20%

Viva voce – 10 %

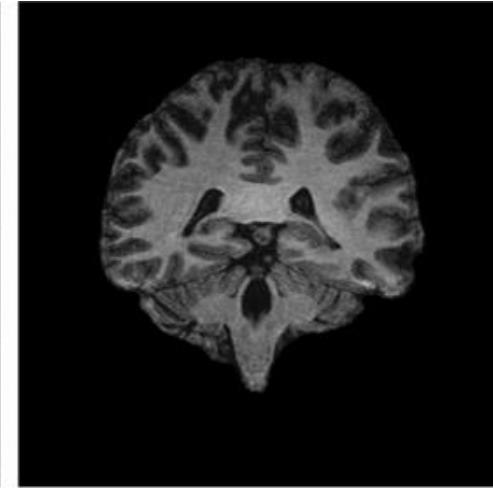
Practical exam – 10%



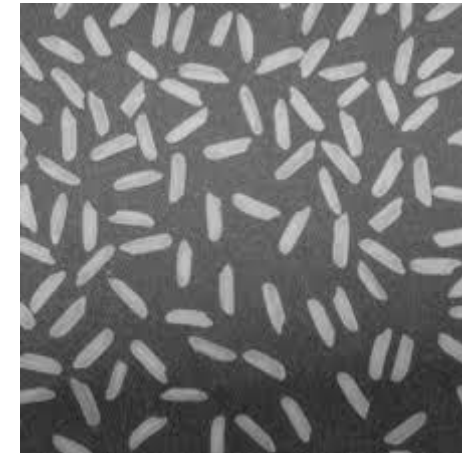
(A)



(B)



(C)

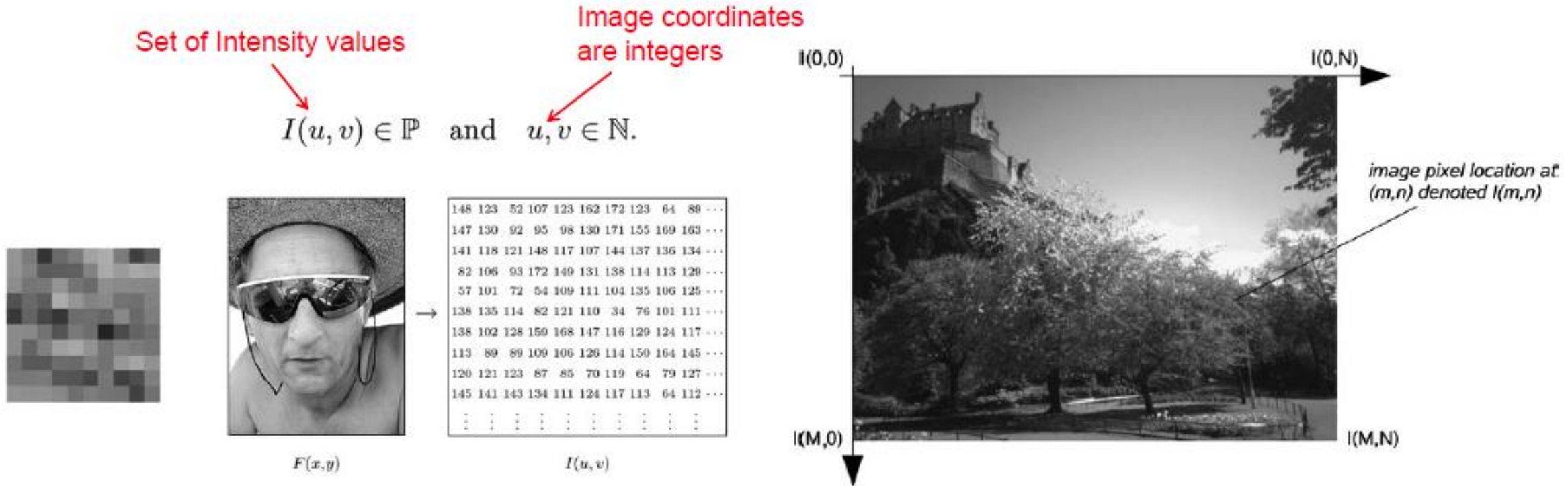




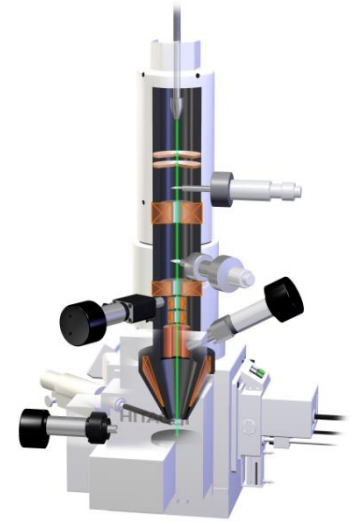
# What is an Image?

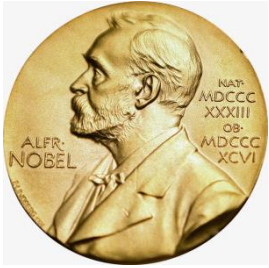


- 2-dimensional matrix of Intensity (gray or color) values



Digital image can be considered as a discrete representation of data possessing both spatial (layout) and intensity (color) information.





**Paul C. Lauterbur, 2003**



**Sir Peter Mansfield,  
2003**



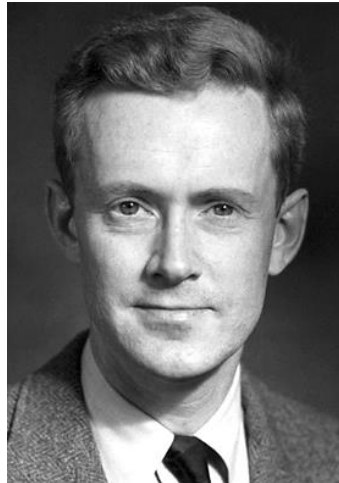
**Allan M. Cormack, 1979**



**Godfrey N. Hounsfield,  
1979**



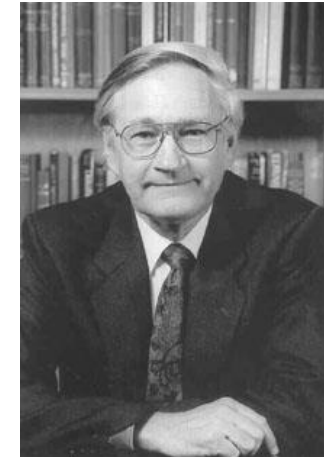
**Felix Bloch, 1952**



**Edward Mills Purcell,  
1952**



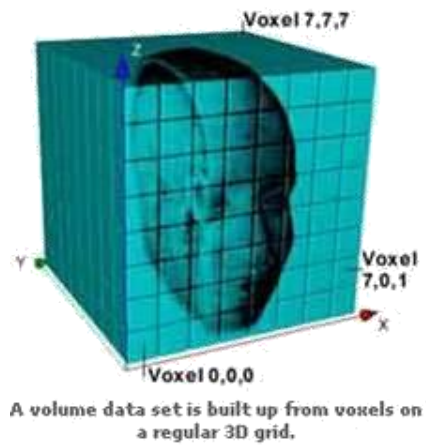
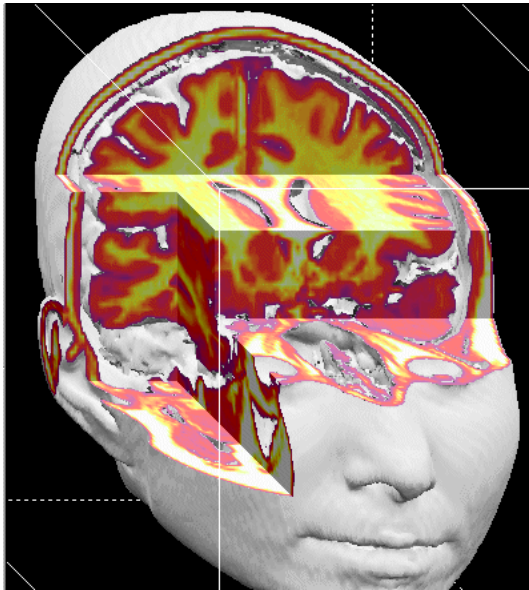
**Wilhelm Conrad  
Röntgen, 1901**



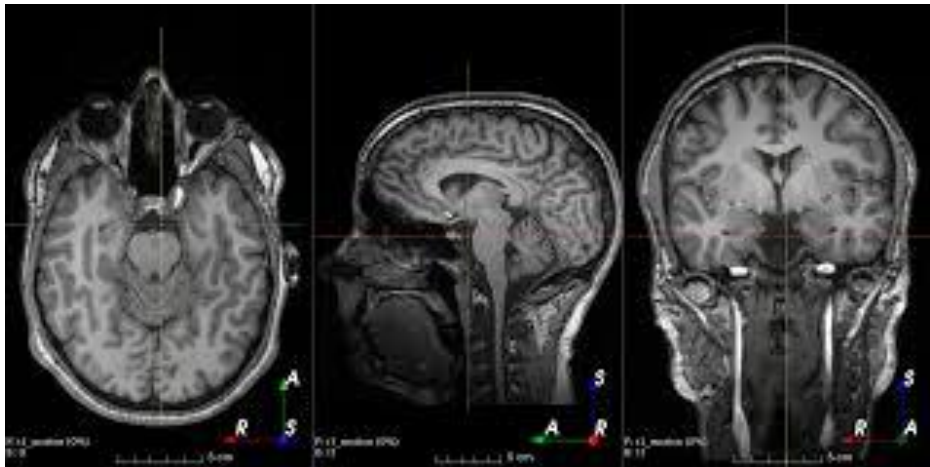
**Richard R. Ernst, 1991**



# Pixel and Voxel



A volume data set is built up from voxels on a regular 3D grid.





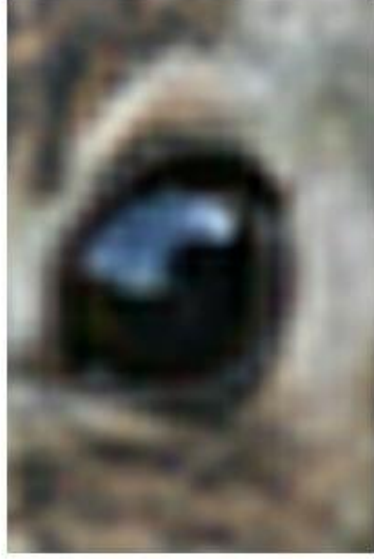
# Optical zoom and digital zoom



Original



10x Optical



10x Digital



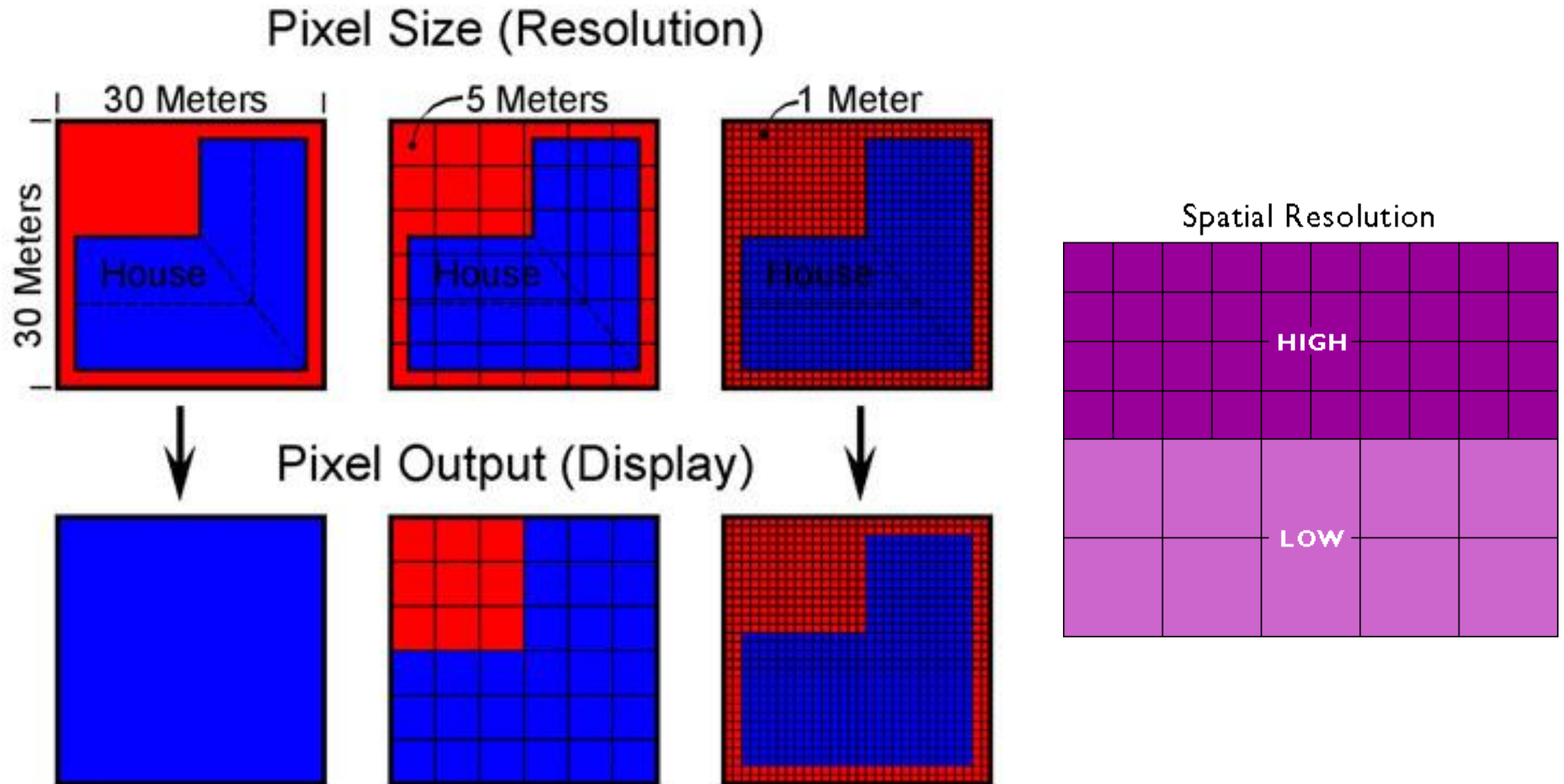
OPTICAL ZOOM



DIGITAL ZOOM



# Spatial resolution





# Spatial resolution



# What is image Processing?

- Algorithms that alter an input image to create new image
- Input is image, output is image



*Original Image*

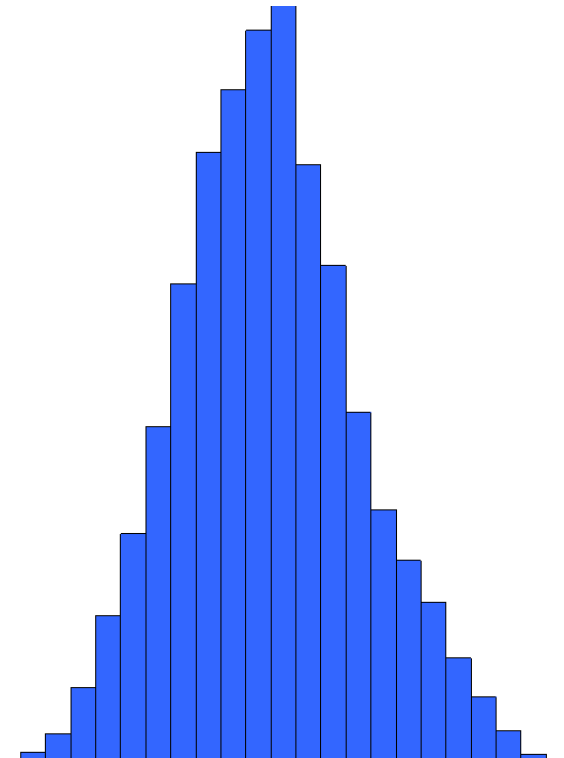


Image Processing  
Algorithm  
(e.g. Sobel Filter)



*Processed Image*

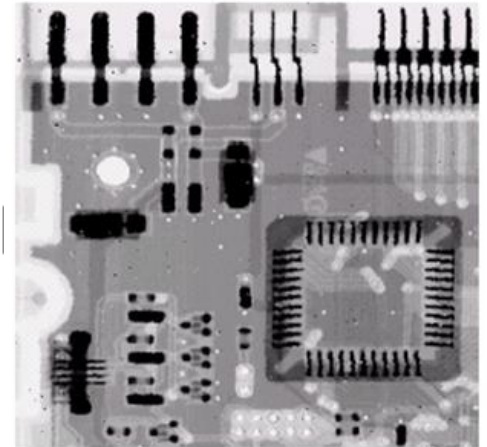
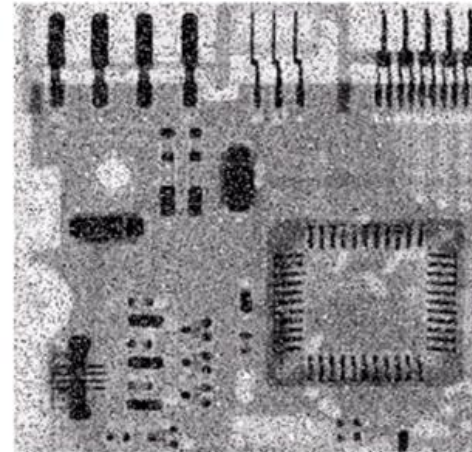
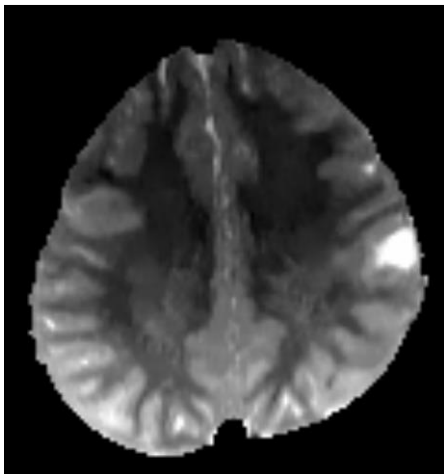
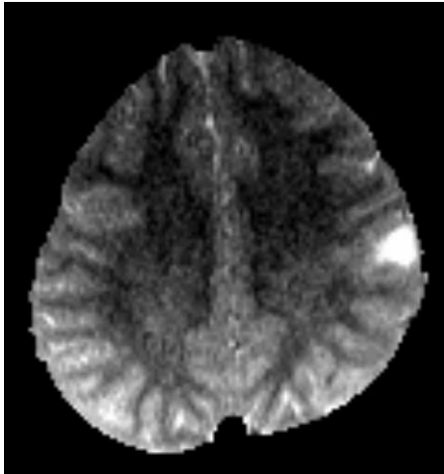
- Improves an image for human interpretation in ways including:
  - Image display and printing
  - Image editing
  - Image enhancement
  - Image compression





# Why Image Processing ?

- Improvement of pictorial information for human perception.



# Contrast Enhancement





## Example: Image Compression



Original, 2.1MB



JPEG Compression, 308KB (15%)

## Example: Image Inpainting



Damaged Image



Restored Image



*Credit: M. Bertalmio, G. Sapiro, V. Caselles, C. Ballester: Image Inpainting, SIGGRAPH 2000*

**Inpainting? Reconstruct corrupted/destroyed parts of an image**

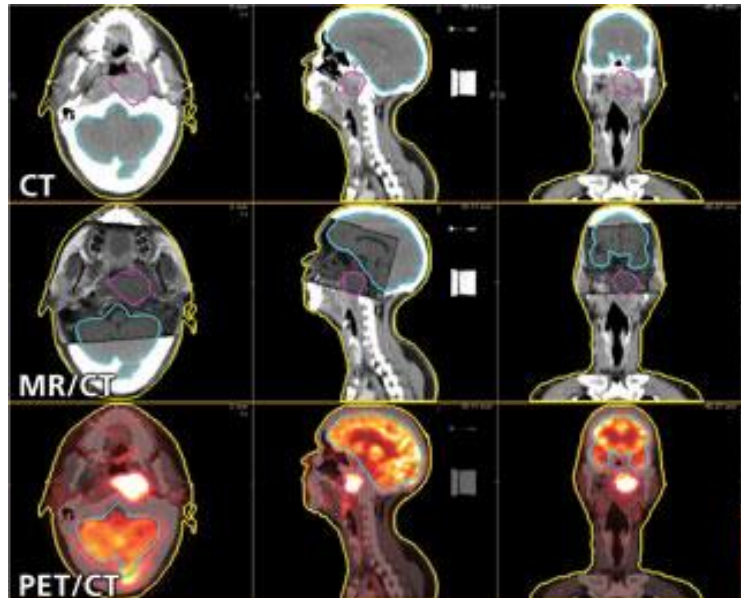


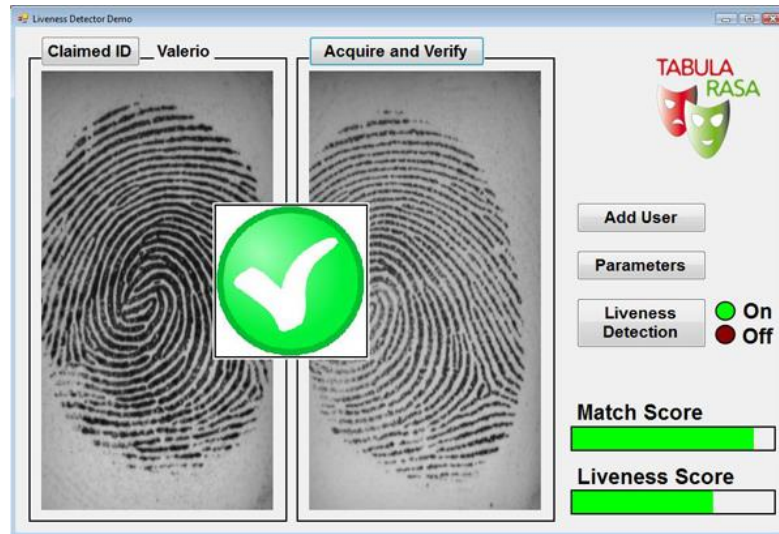
Image Fusion



Pseudo Coloring

# Machine Vision Applications

- ▶ Industrial machine vision for product assembly and inspection.
- ▶ Automated target detection and tracking.
- ▶ Fingerprint recognition.
- ▶ Machine processing for aerial and satellite imagery for whether prediction and crop assessment.
- ▶ Face detection.





# Relationship with other Fields



High-level

## Computer Vision

Object detection, recognition, shape analysis, tracking  
Use of Artificial Intelligence and Machine Learning

## Image Analysis

Segmentation, image registration, matching

Low-level

## Image Processing

Image enhancement, noise removal, restoration,  
feature detection, compression



*Thank You*