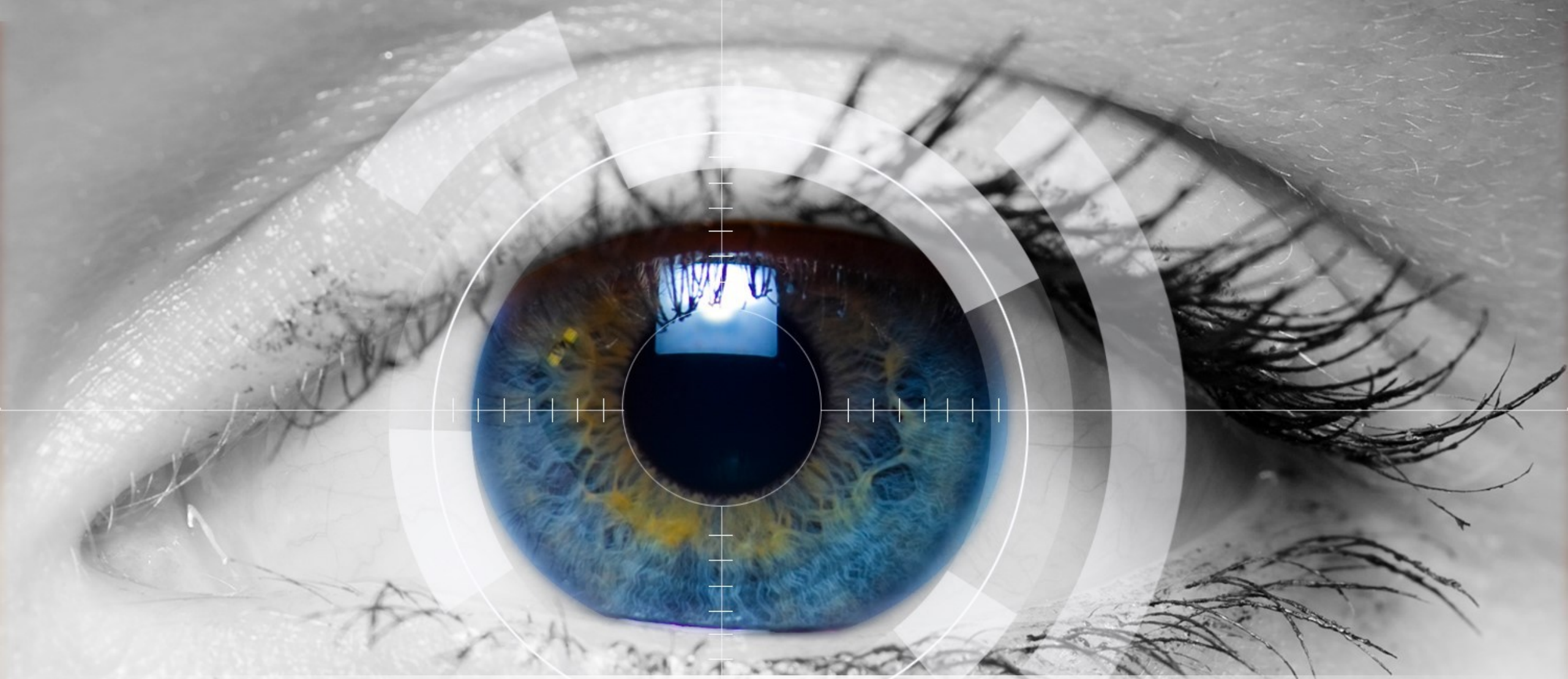
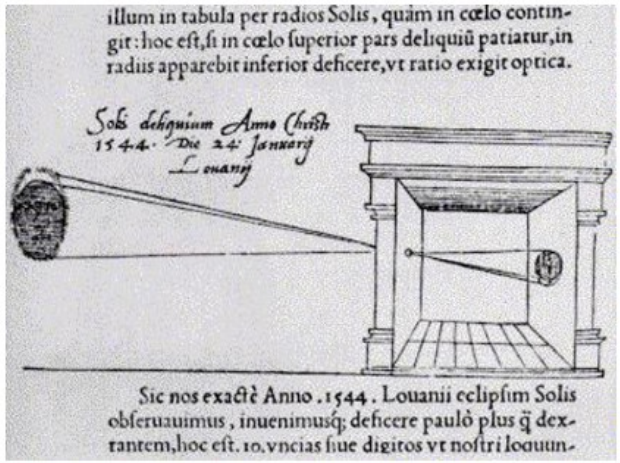
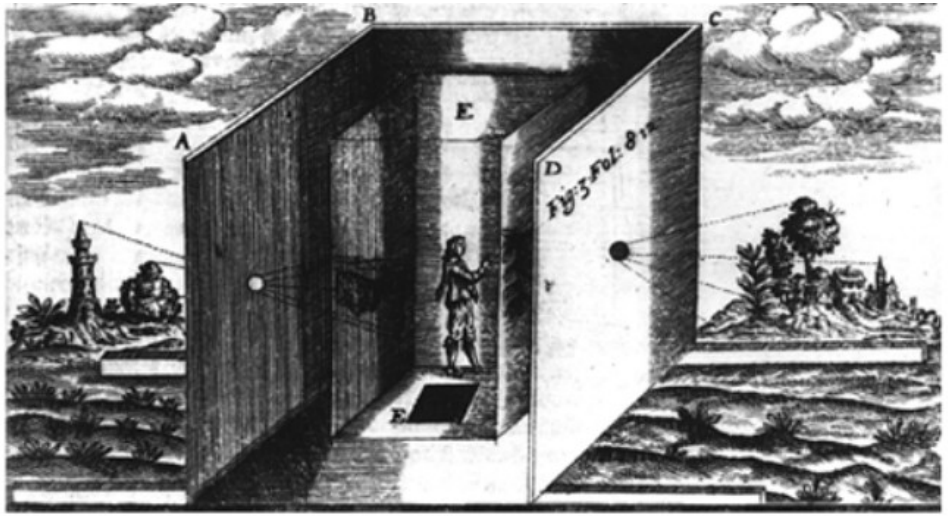


Image Processing in Python

Mahdi Cherakhloo

Imaging



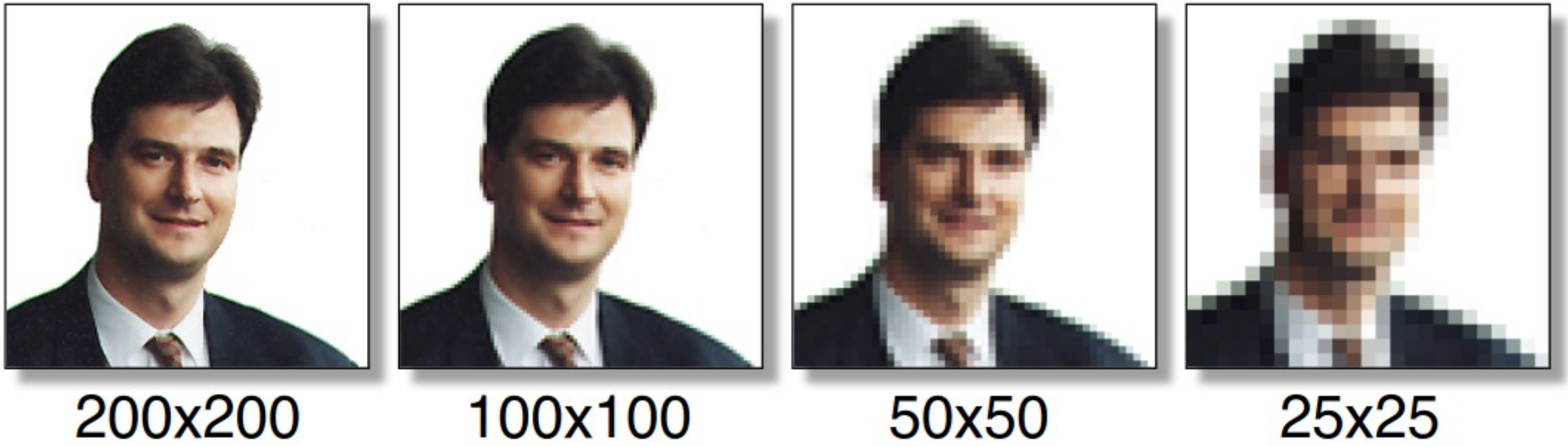


Dark chamber with lenses *[Kircher 1646]*

- Digital Image, Mathematical Definition:
  - I = f(x,y)
  - I: intensity (or color)
  - (x,y): Position or Coordination

Imaging

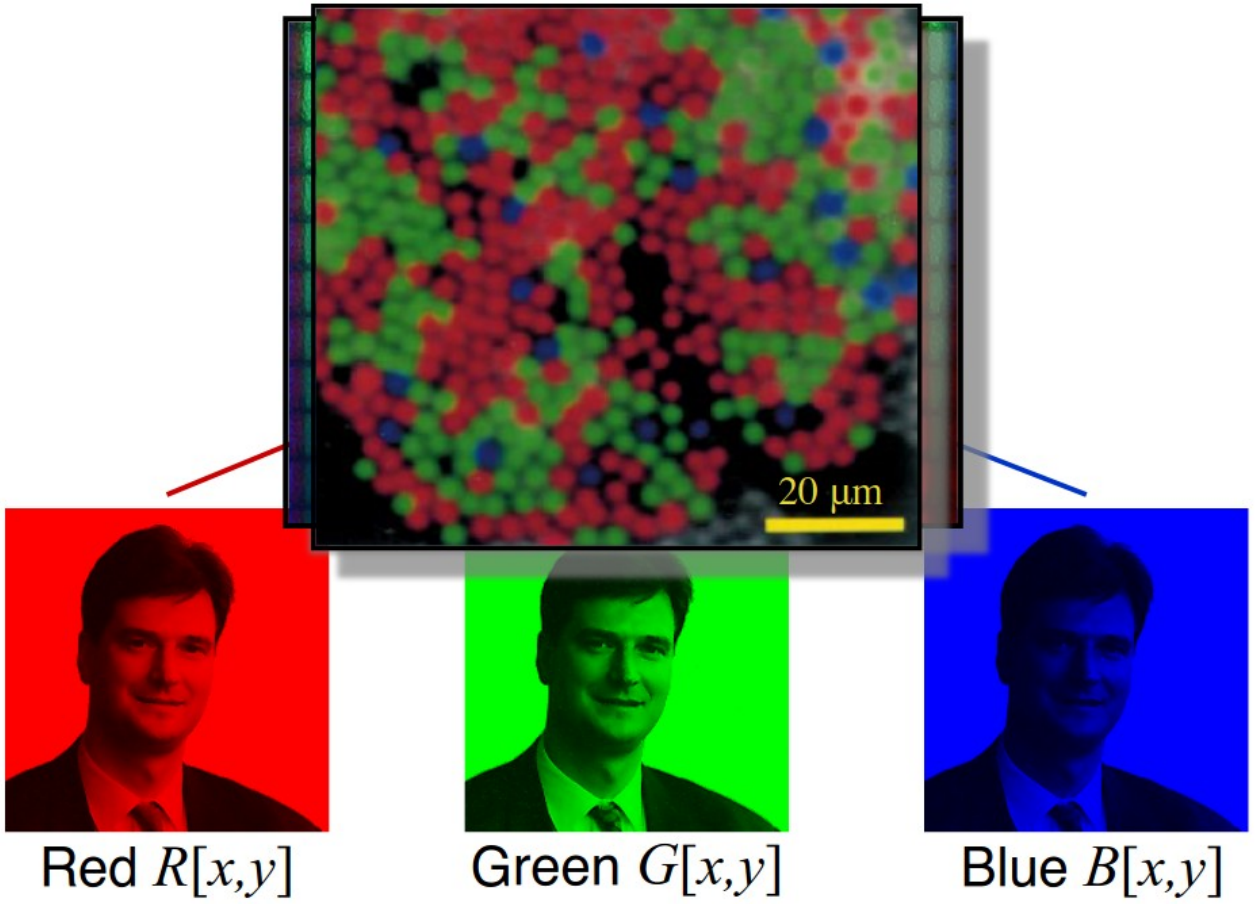
Digital Image



- When (x,y) and I are finite and discrete quantities →
  - digital image
  - Digital image: discrete samples f [x,y] representing continuous image f (x,y)
  - Each element of the 2-d array f [x,y] is called a pixel or pel
  - (from “picture element“)

Imaging

Digital Image



Monochrome image

$R[x,y] = G[x,y] = B[x,y]$

Why do we process images?

Acquire an image
– Correct aperture and color balance
– Reconstruct image from projections

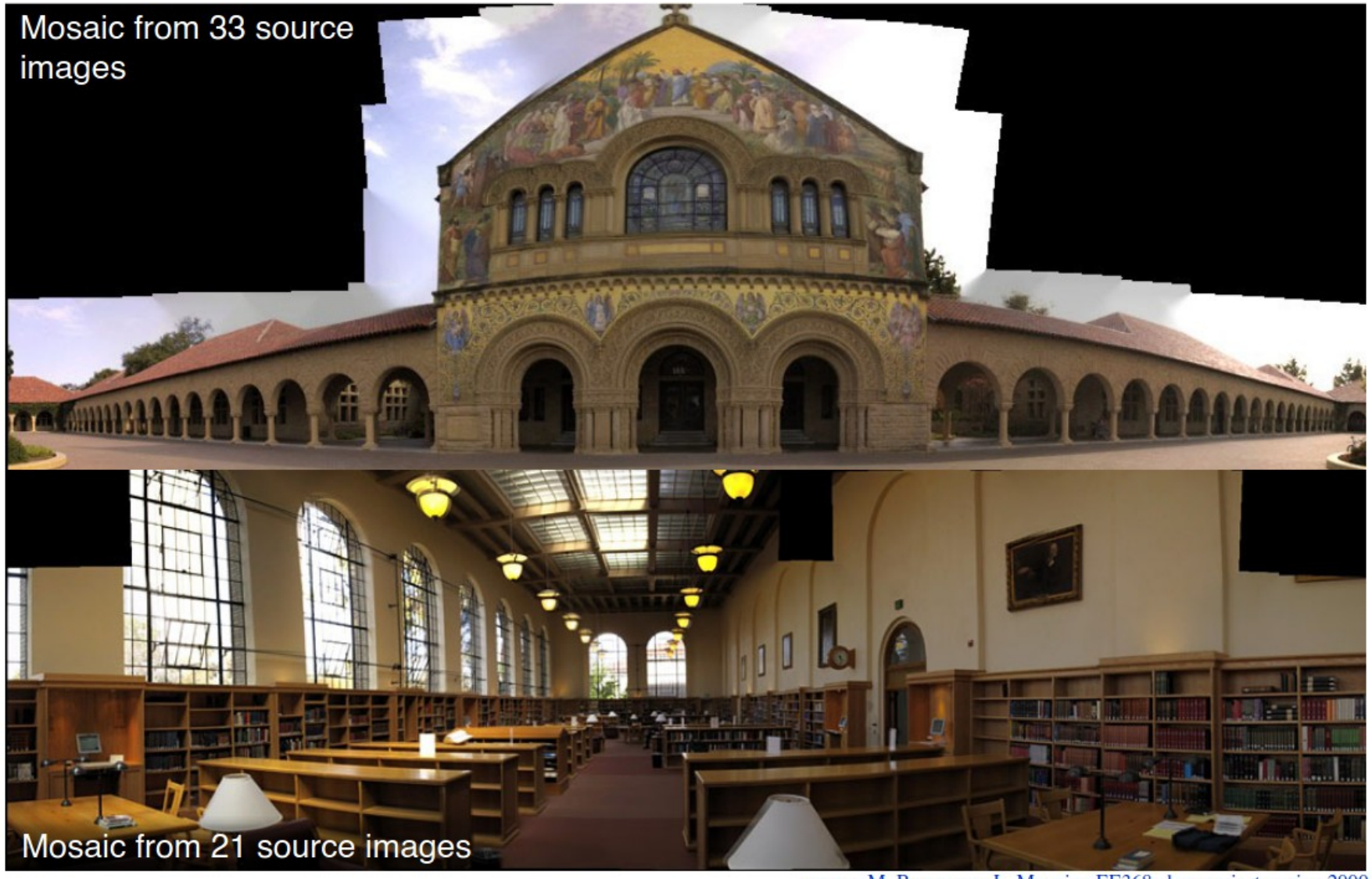
Prepare for display or printing
– Adjust image size
– Color mapping, gamma-correction

Facilitate picture storage and transmission
– Efficiently store an image in a digital camera
– Send an image from space

Enhance and restore images
– Touch up personal photos
– Color enhancement for security screening

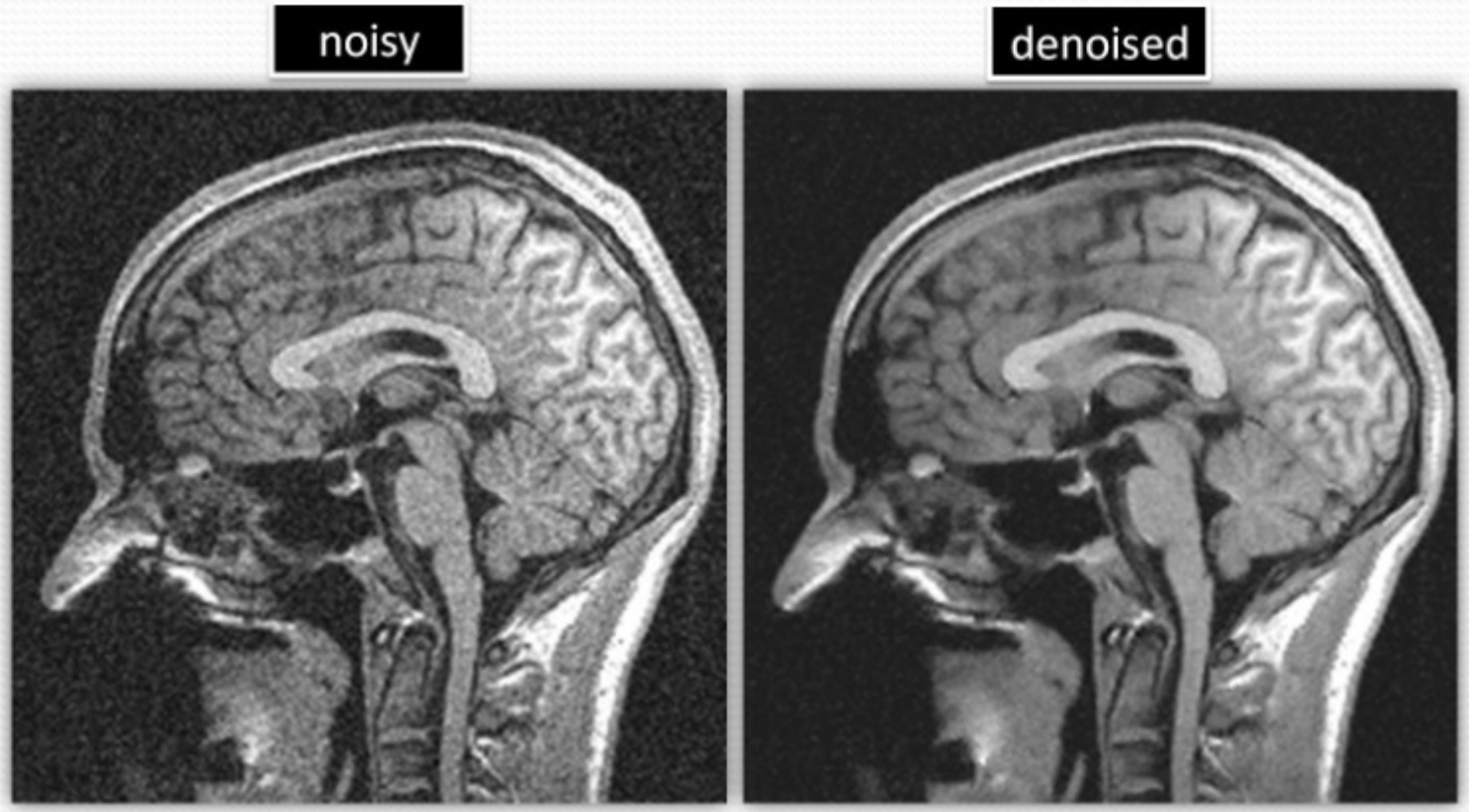
Extract information from images
– Read 2-d bar codes
– Character recognition
Many more ... image processing is ubiquitous

Image Processing Examples



source: M. Borgmann, L. Meunier, EE368 class project, spring 2000.

Image Processing Examples



http://www.cs.utah.edu/~suyash/pubs/denoising_mri/

Image Processing Examples

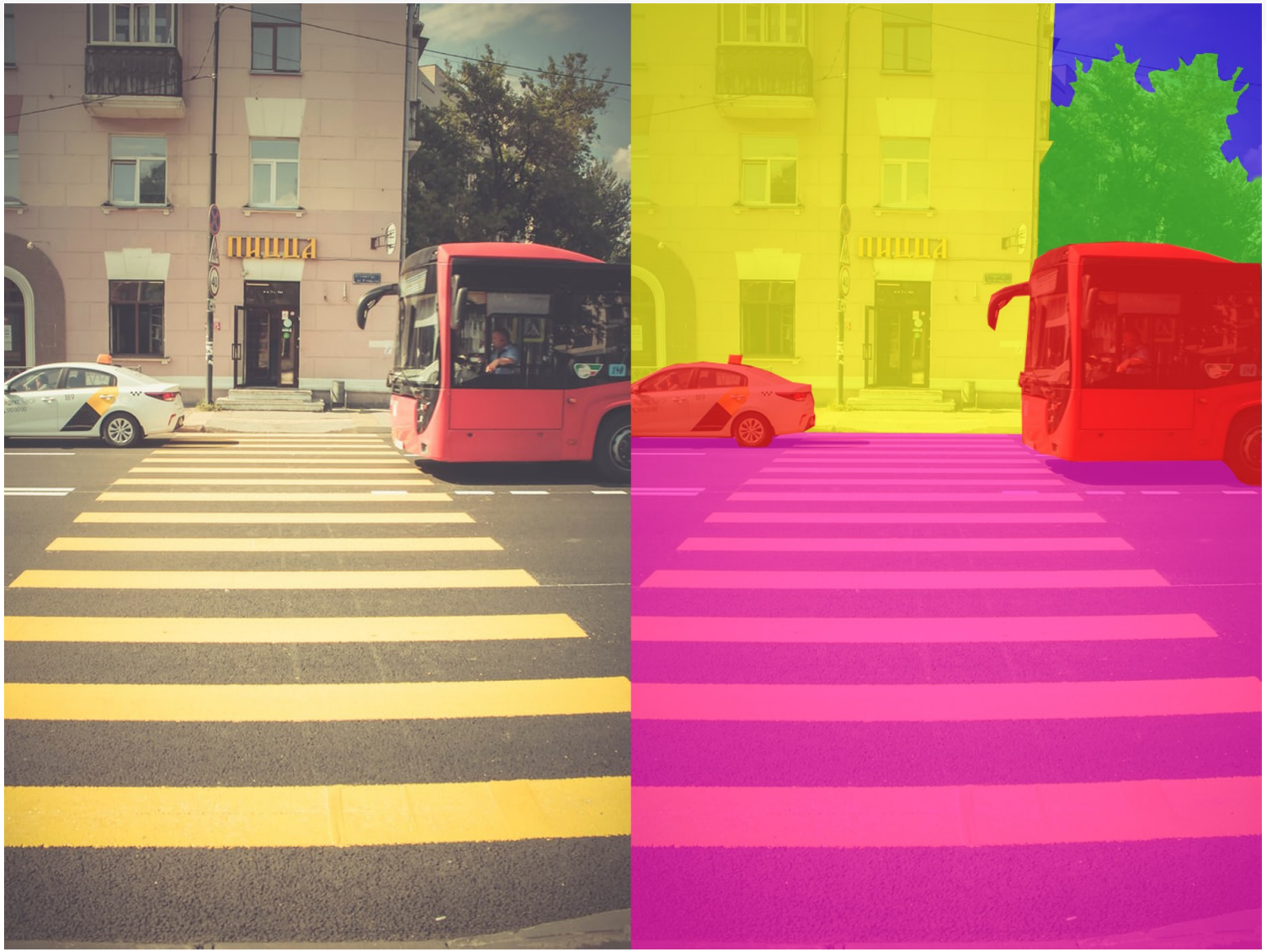


Image Processing Examples

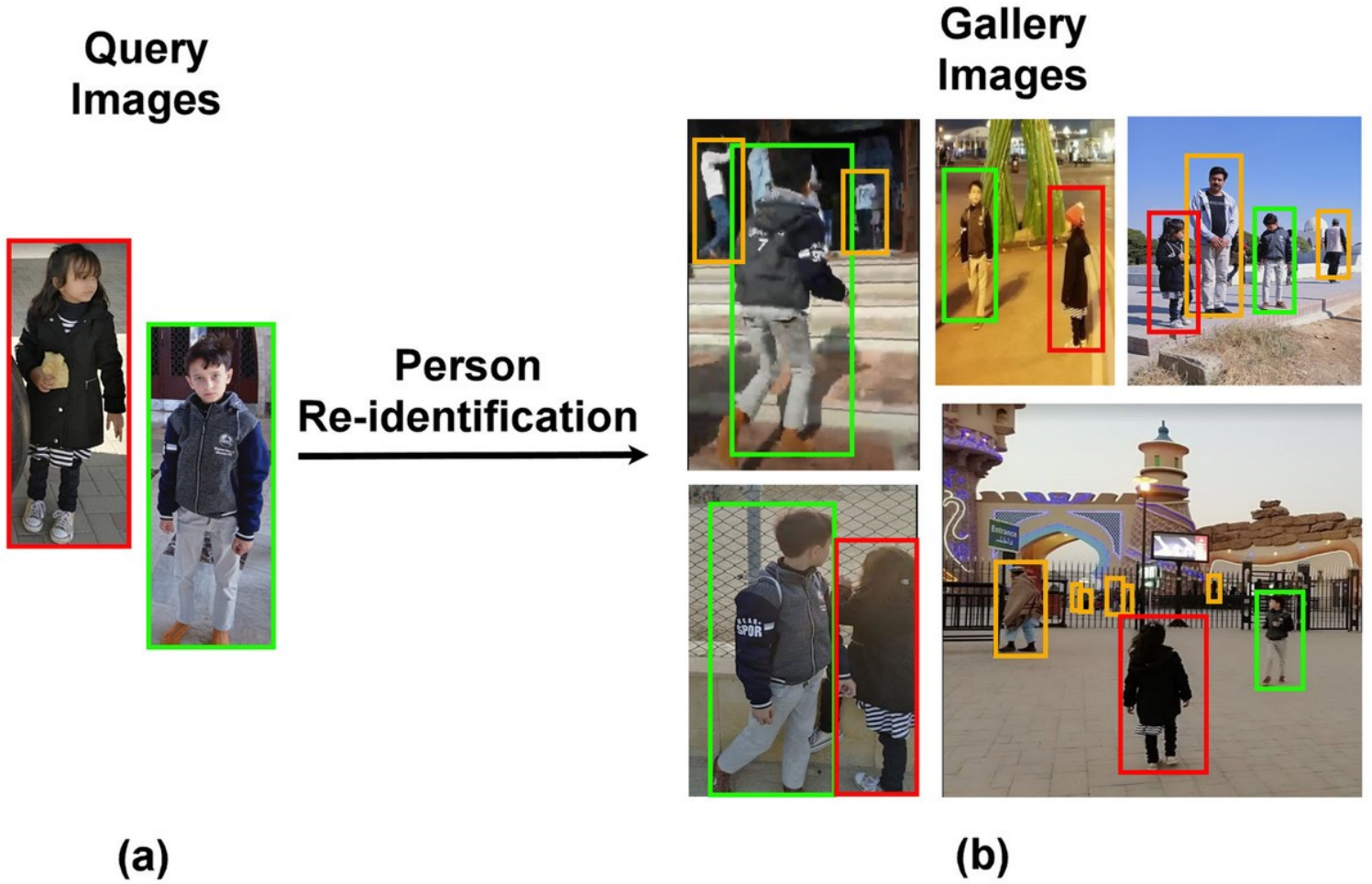
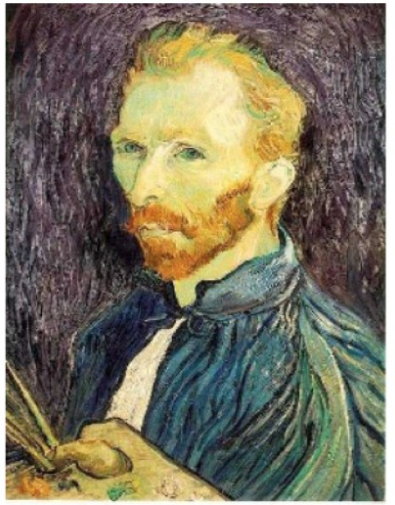


Image Processing Examples

De-noising

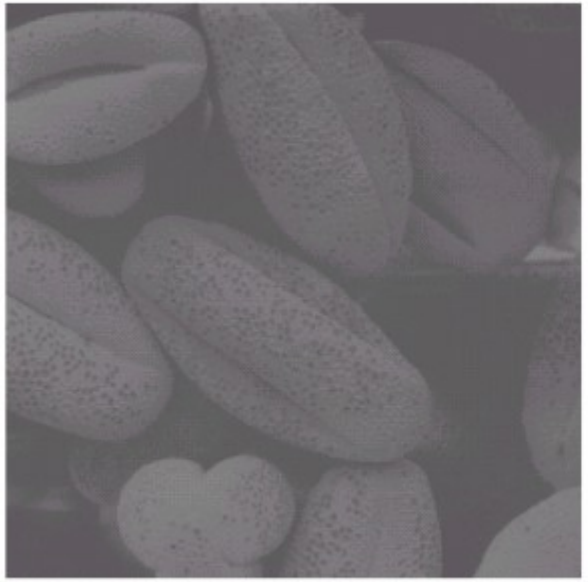
Salt and pepper noise

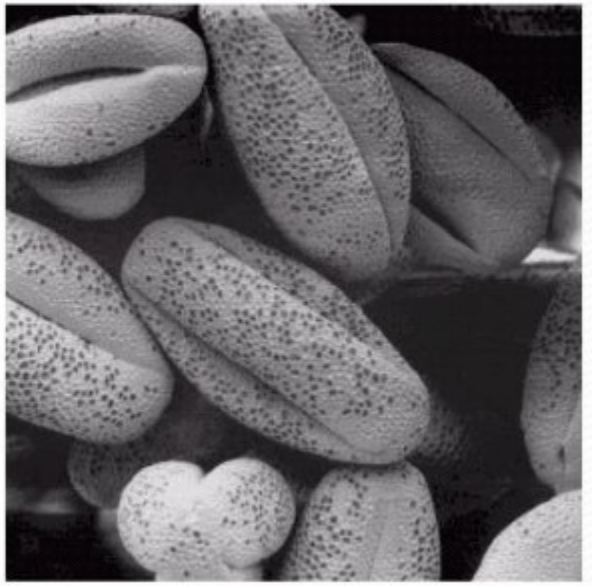
Super-resolution

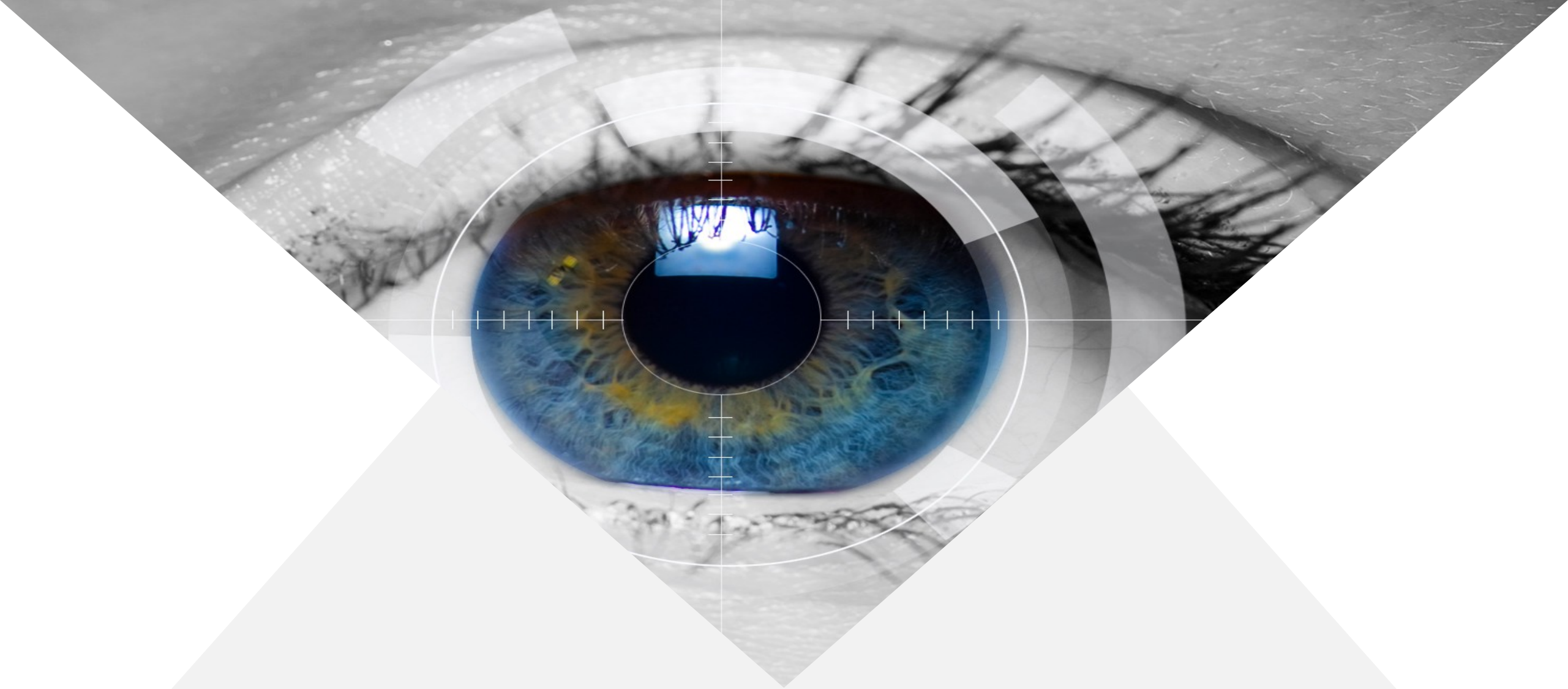


In-painting

Image Processing Examples







Thank you!