

Video Signals

LECTURER: MARCO MARCON

054318 - AUDIO AND VIDEO SIGNALS

054317 - VIDEO SIGNALS

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It is possible to schedule a meeting with the professor and the teaching assistant via email. The meeting can take place in person or remotely through the Teams platform.

Why do we process images?

A few examples:

Correct aperture and color balance

Reconstruct image from projections

High-Dynamic images.

Prepare for display or printing

Adjust image size

Facilitate picture storage and transmission

Efficiently store an image in a digital camera using compression

Send an image from Mars to Earth

Enhance and restore images

Remove scratches from an old movie

Improve visibility of tumor in a radiograph

Extract information from images

Machine Learning applications for Pattern Recognition

Image Processing Examples

Restoration of image from Hubble Space Telescope

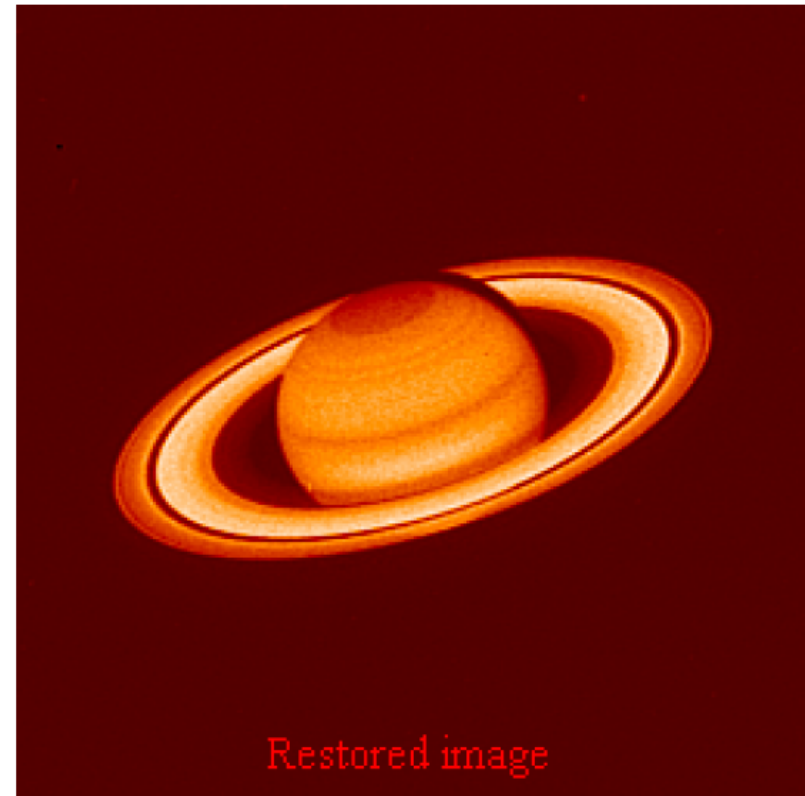
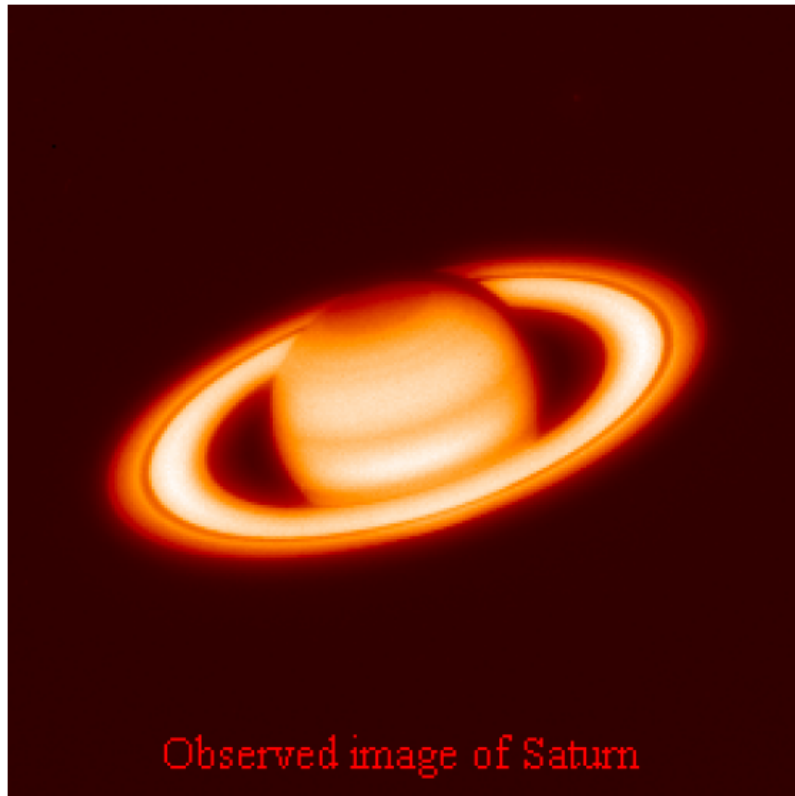


Image Processing Examples

Color photo enhancement



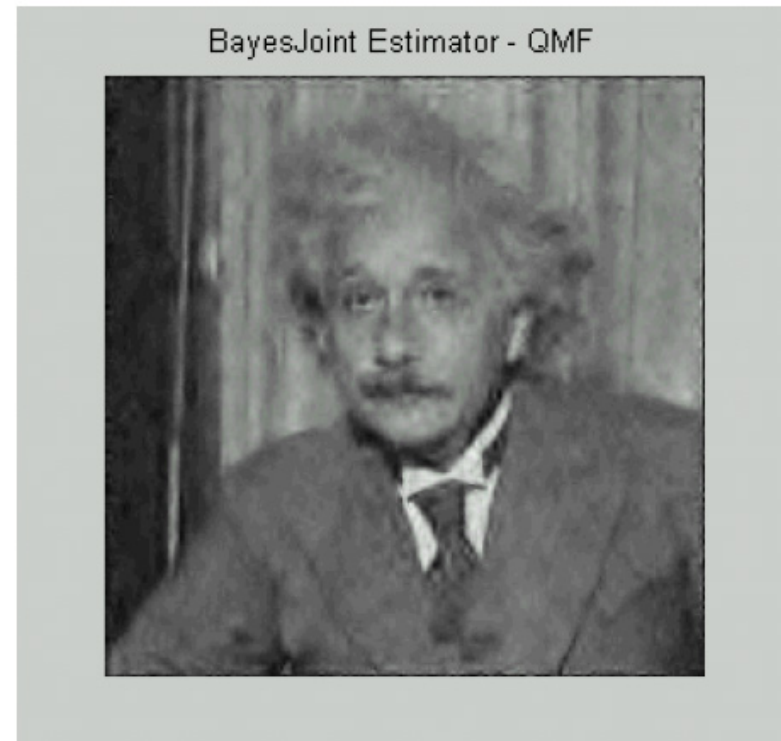
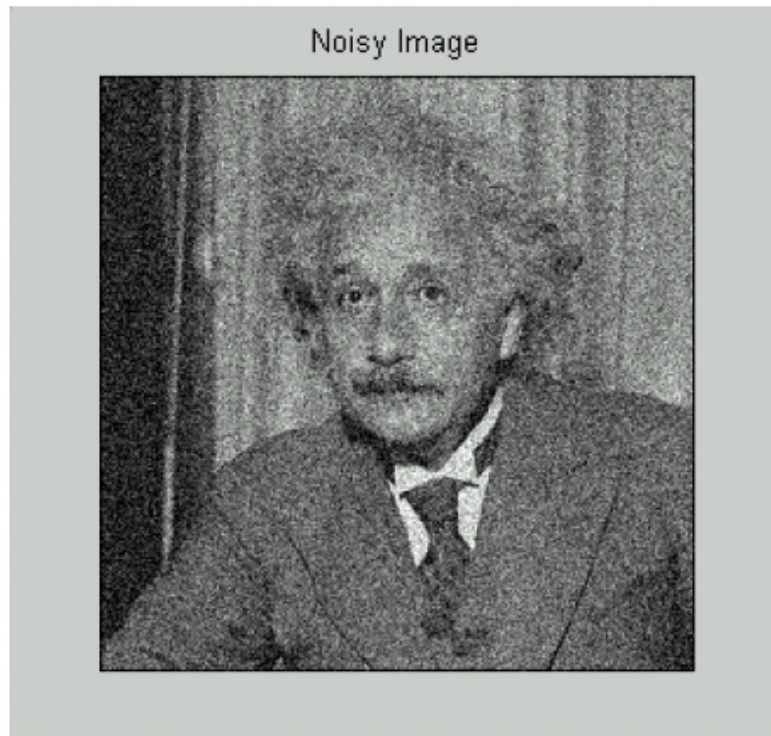
Original



Automatic Enhancement

Image Processing Examples

Noise reduction



Degraded image

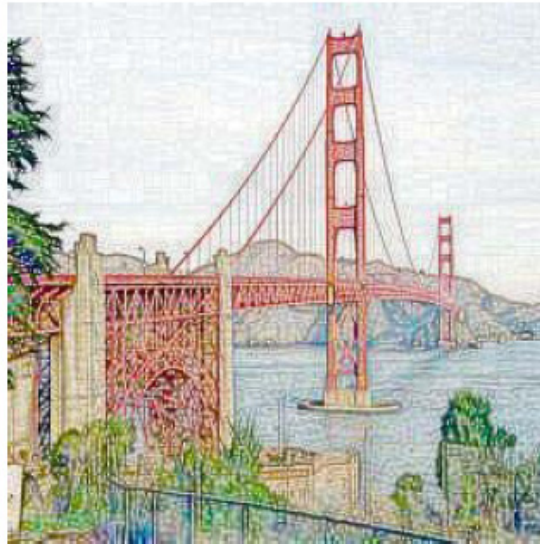
Noise-reduced image

Image Processing Examples

Special Effects



Photo



Simulated
color pencils



Simulated
oil painting

Image Processing Examples

Halftoning: i.e. emulating gray levels



Image Processing Examples

Pseudocolor enhancement for security screening

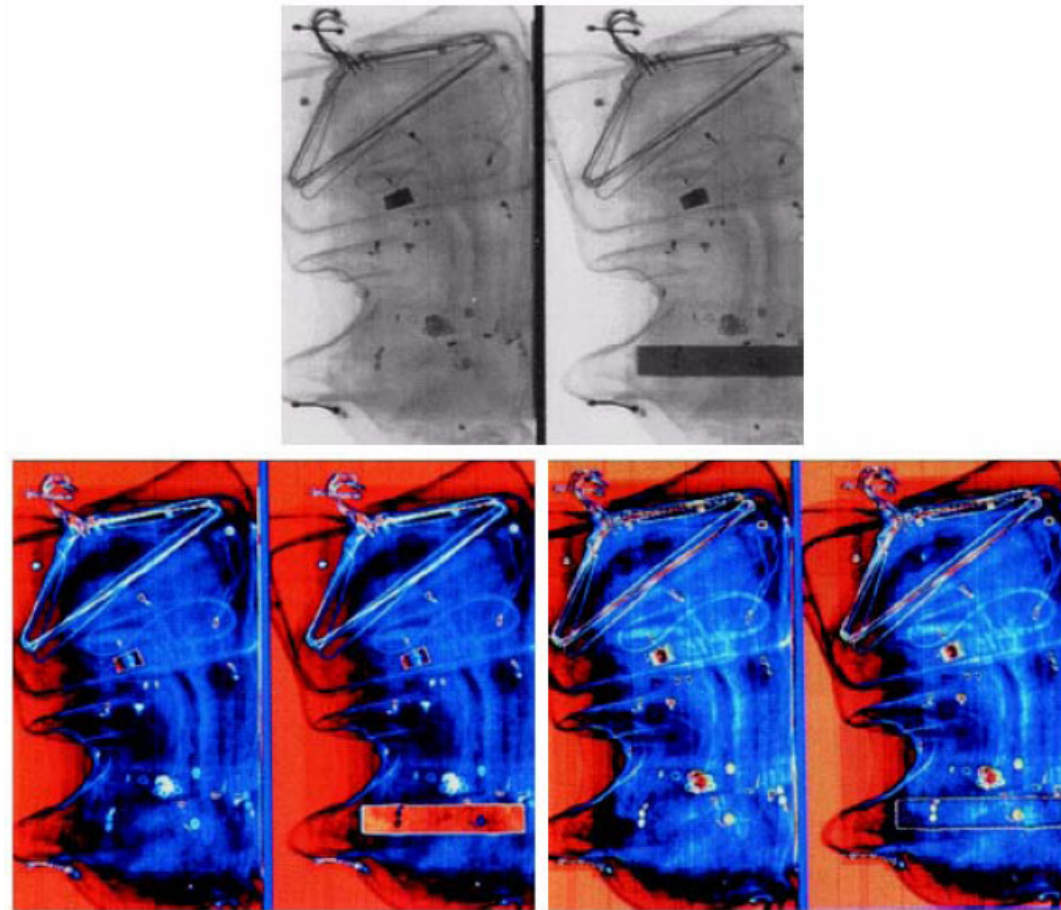


Image Processing Examples

Extraction of settlement area from an aerial image, segmentation



Image Processing Examples

Earthquake Analysis from Space

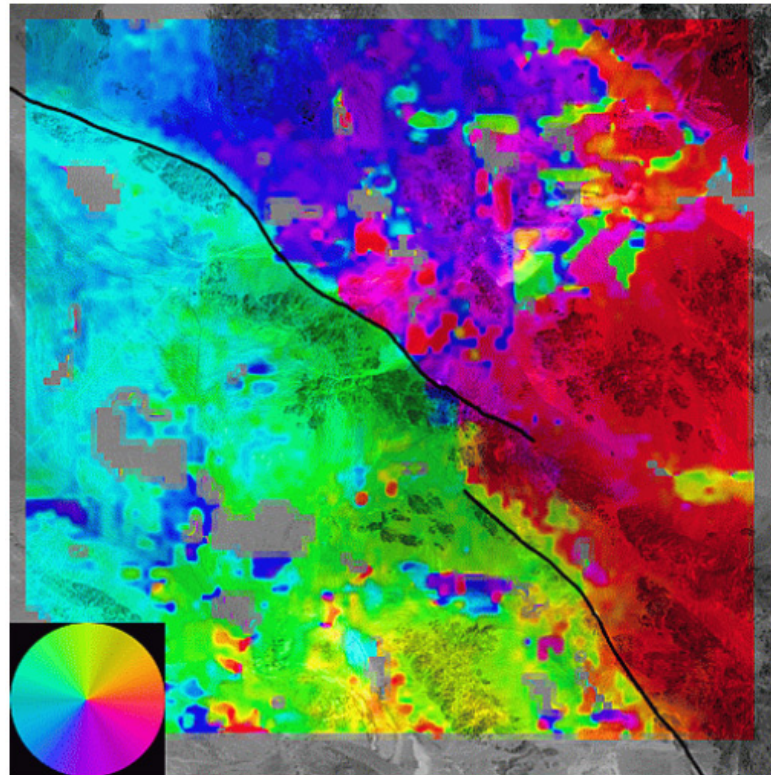


Image shows the ground displacement due to Landers earthquake in California, 1992

Image Processing Examples

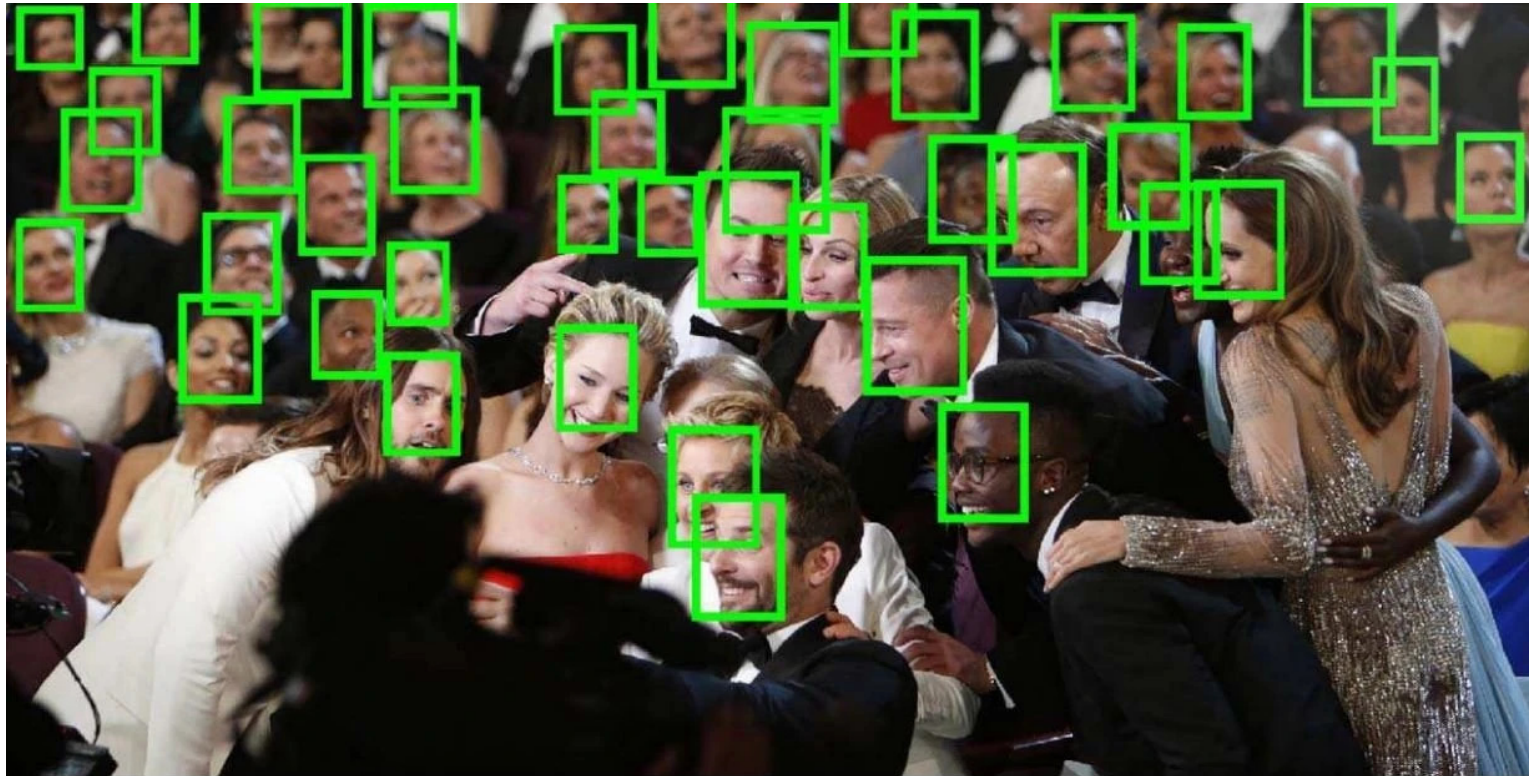


Image Processing Examples

Image Segmentation

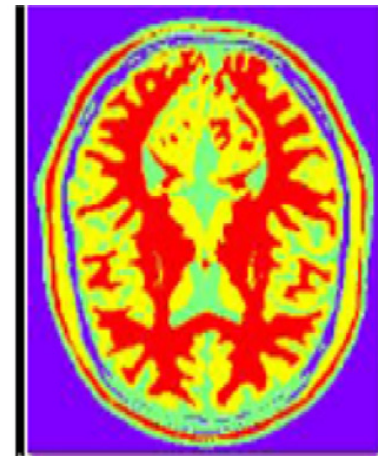
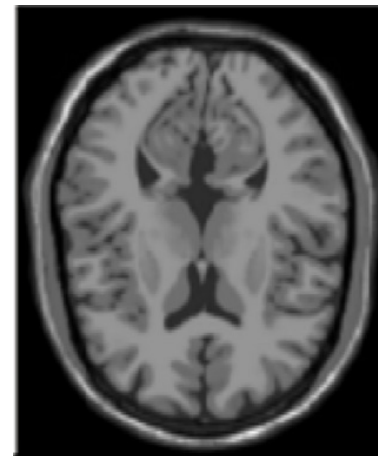
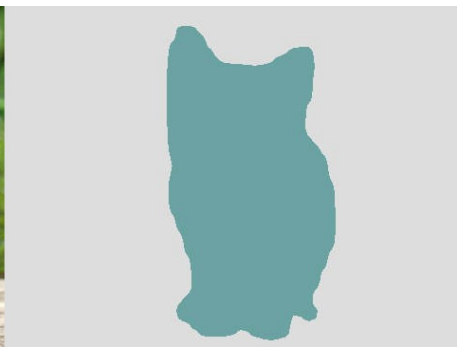
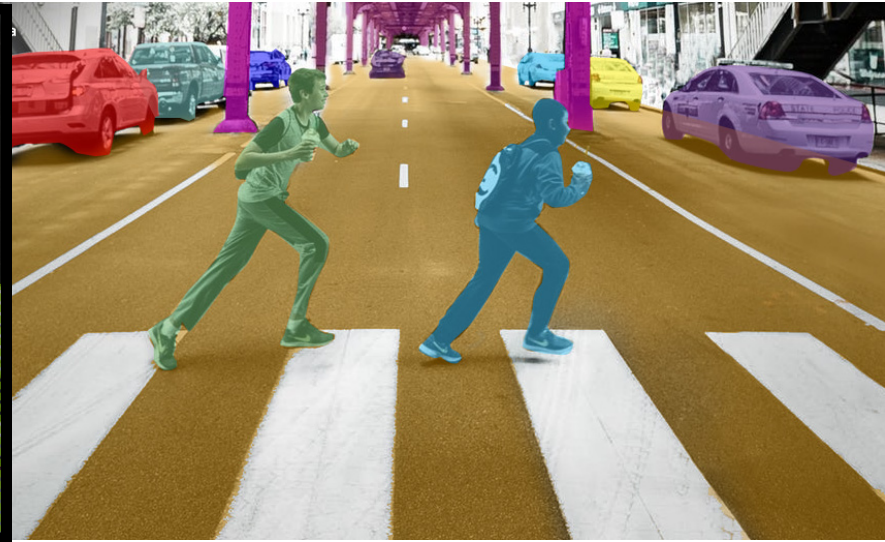
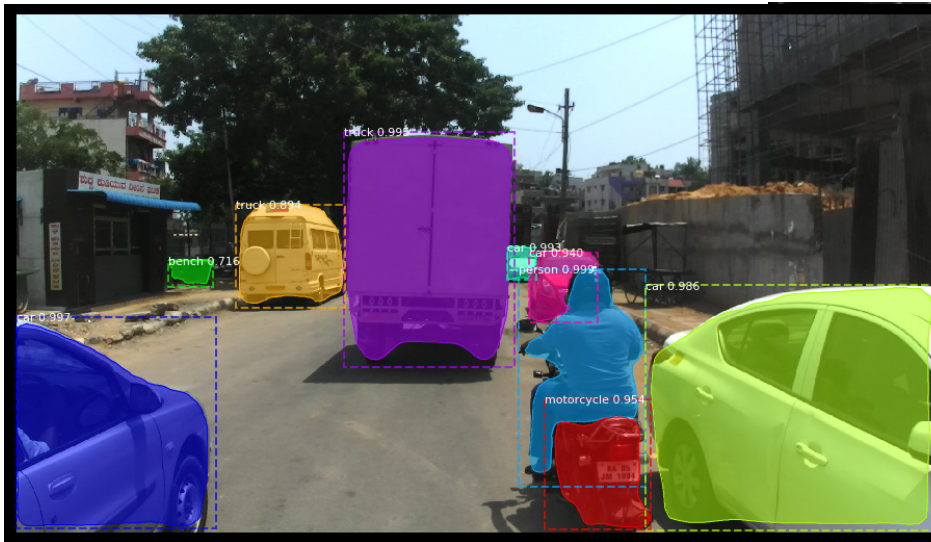
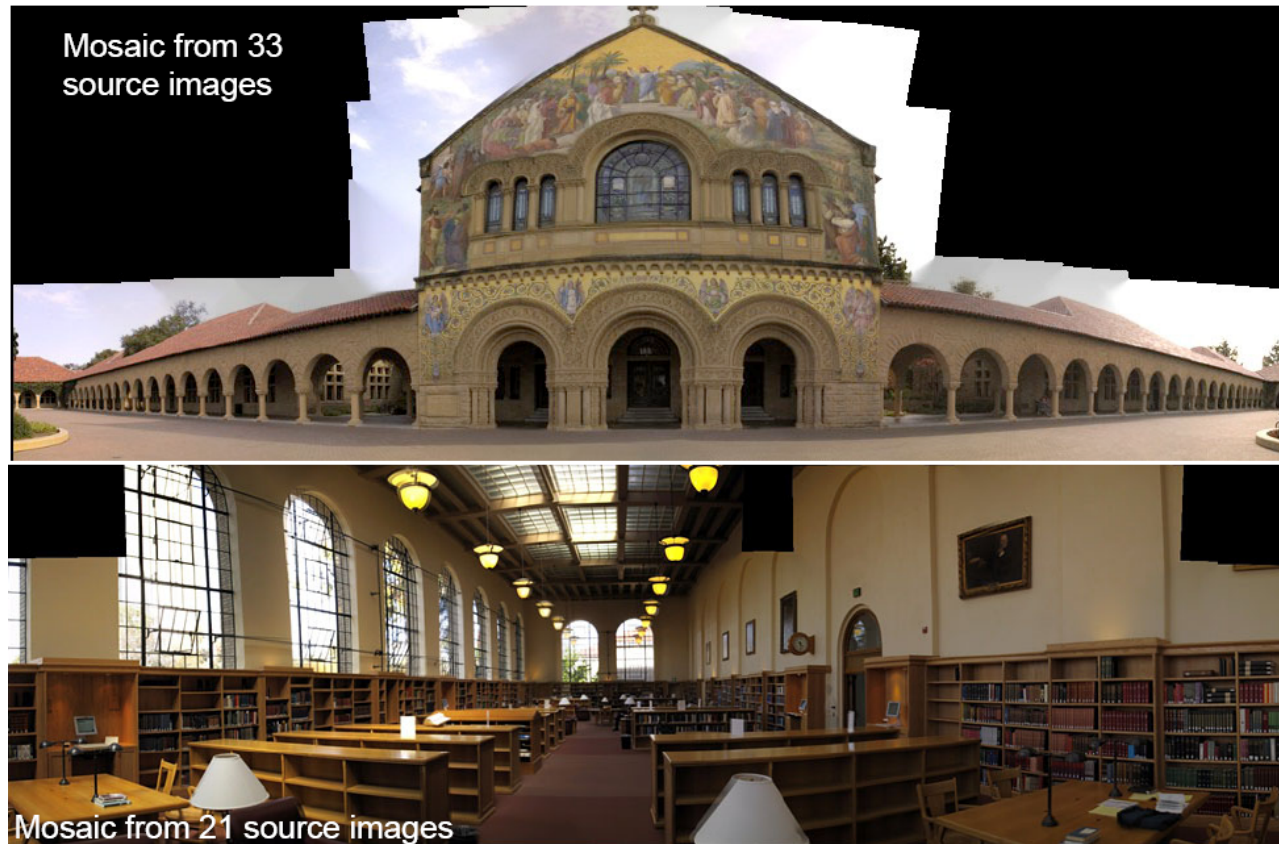


Image Processing Examples



High Dynamic Range

Exposed images:



-6 stops



-5 stops



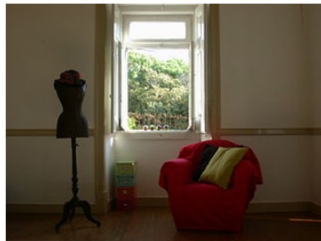
-4 stops



-3 stops



-2 stops



-1 stops



0 stops



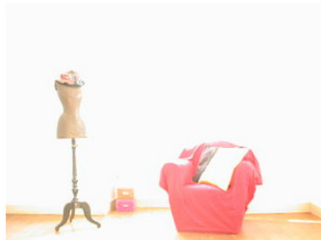
+1 stops



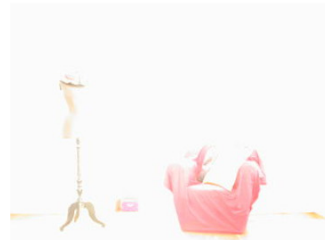
+2 stops



+3 stops



+4 stops



+5 stops

High Dynamic Range

Exposed images:



-6 stops



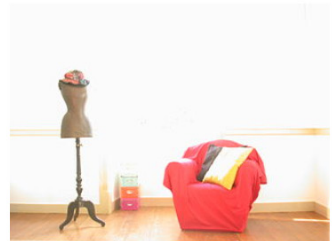
-2 stops



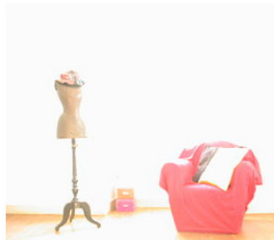
-1 stops



+5 stops



+3 stops



+4 stops

Image Processing Examples

Handwriting recognition

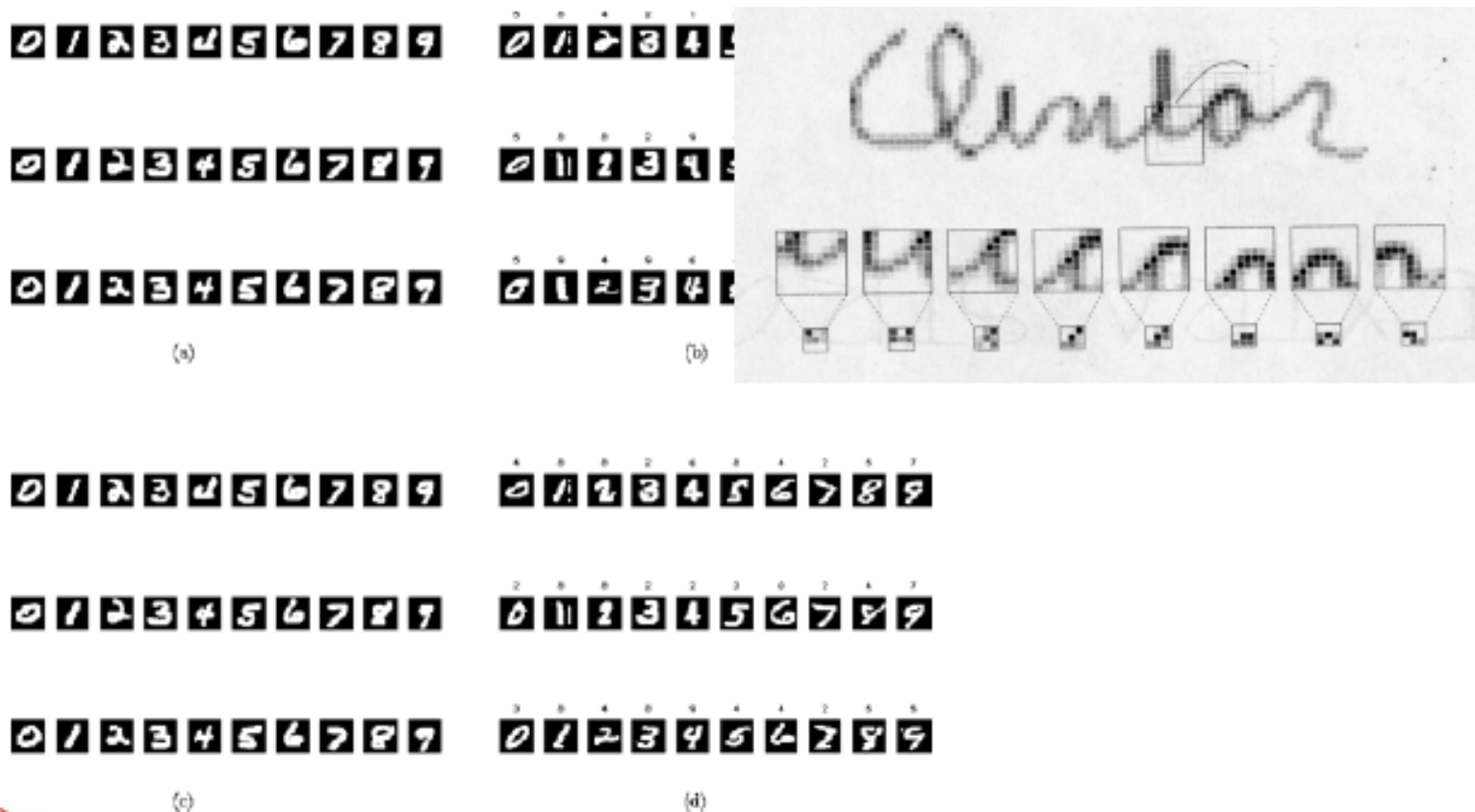


Image Processing Examples

Biometrics: Fingerprint recognition

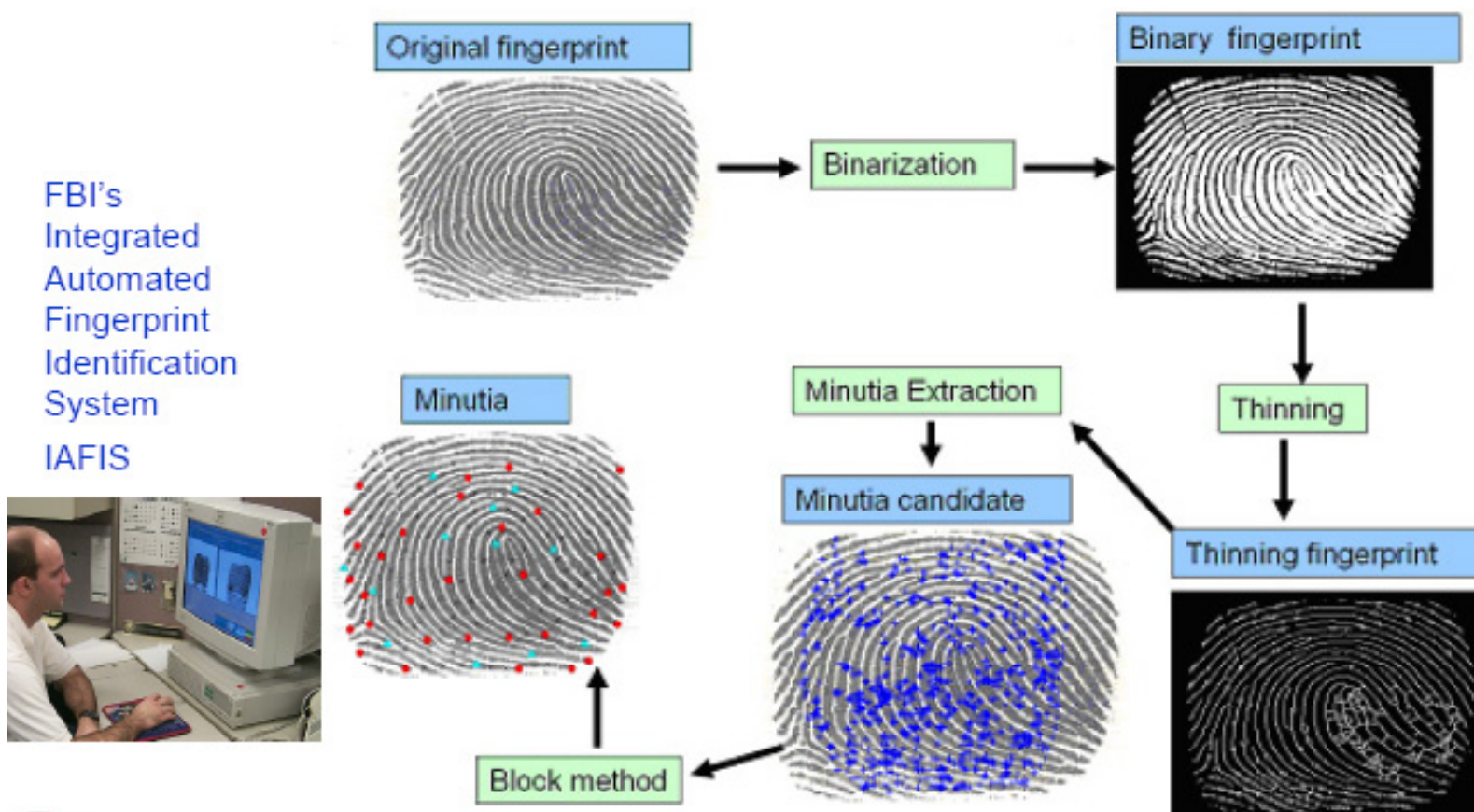


Image Processing Examples

Biometrics: Iris recognition



Automotive Assistant

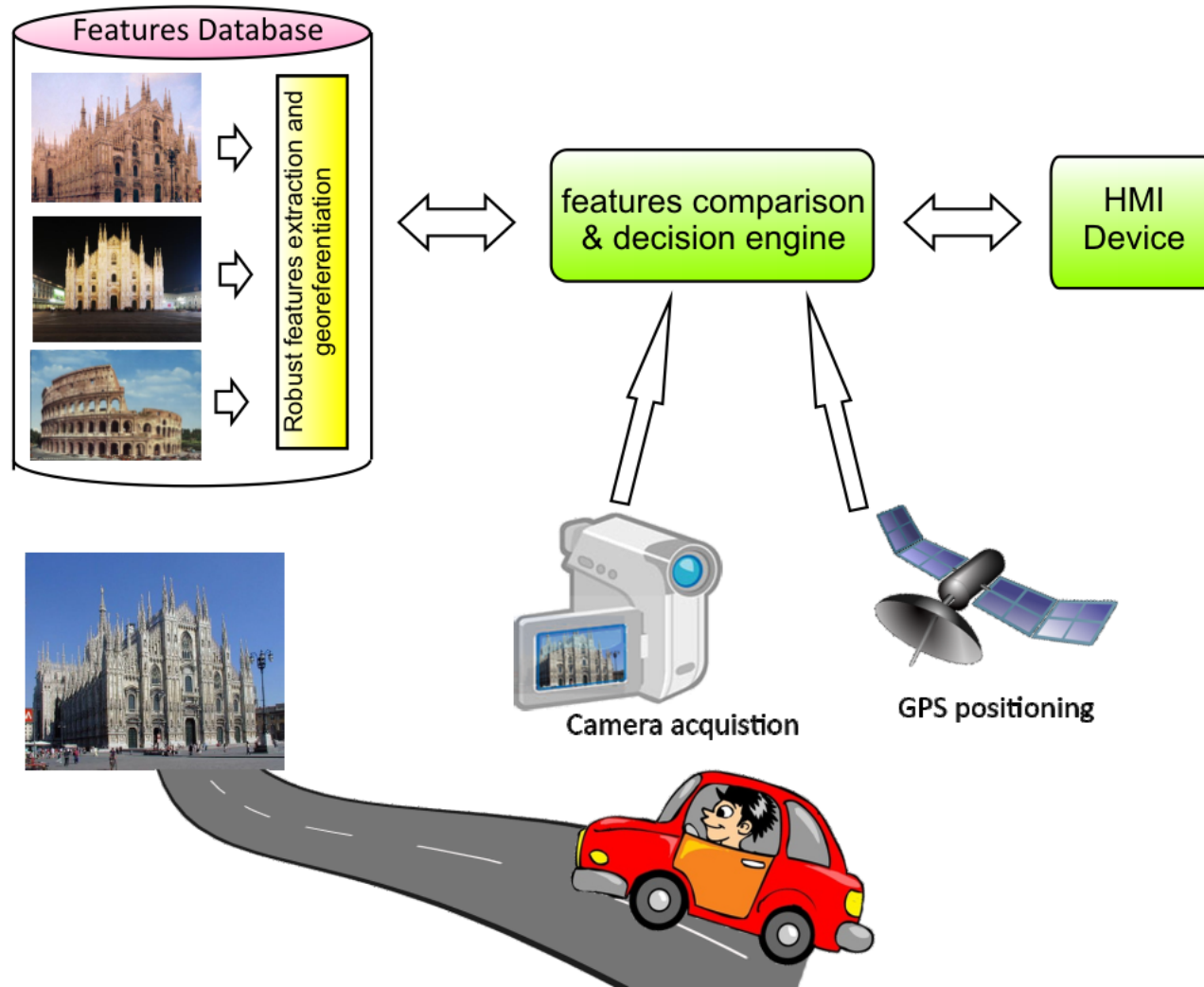
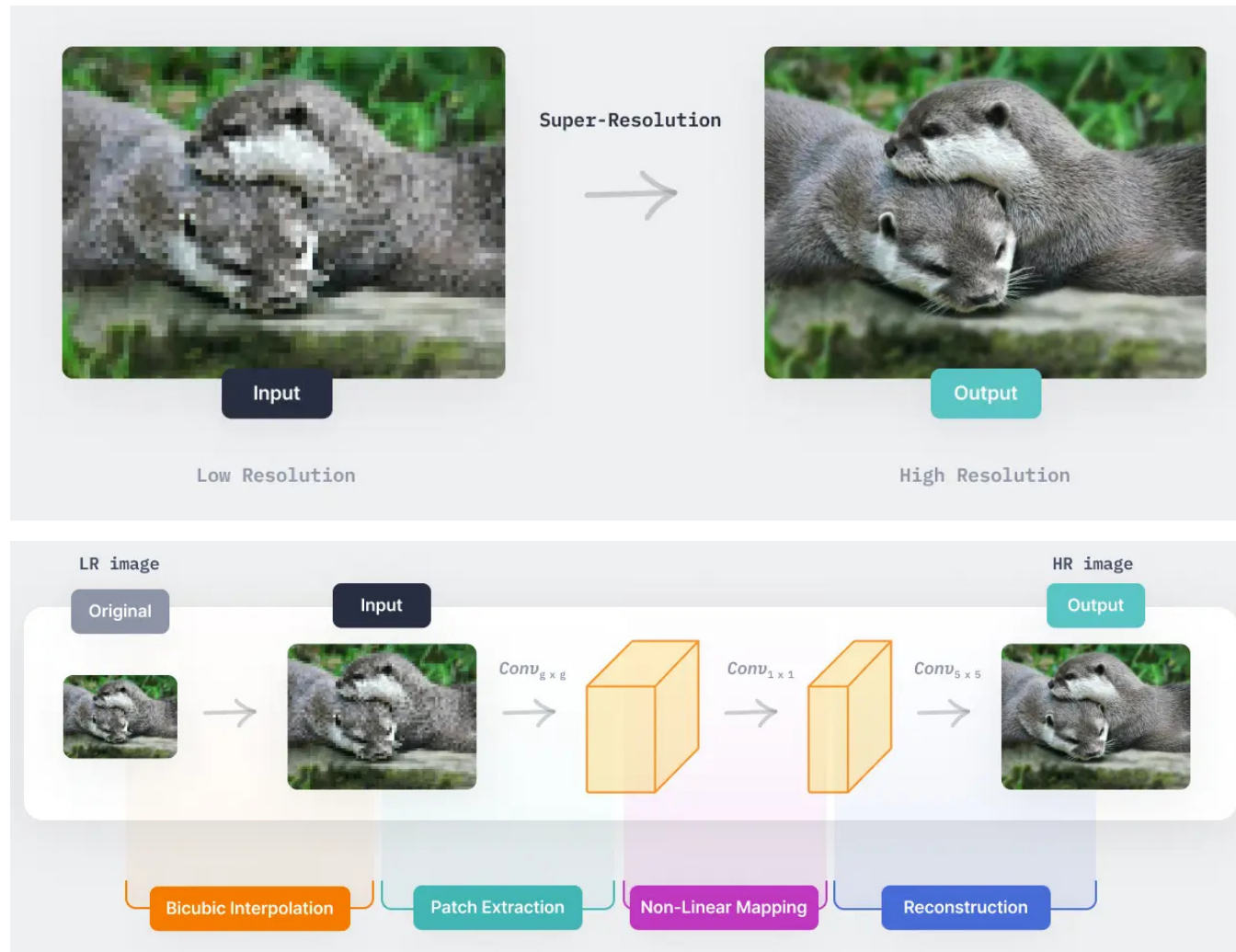
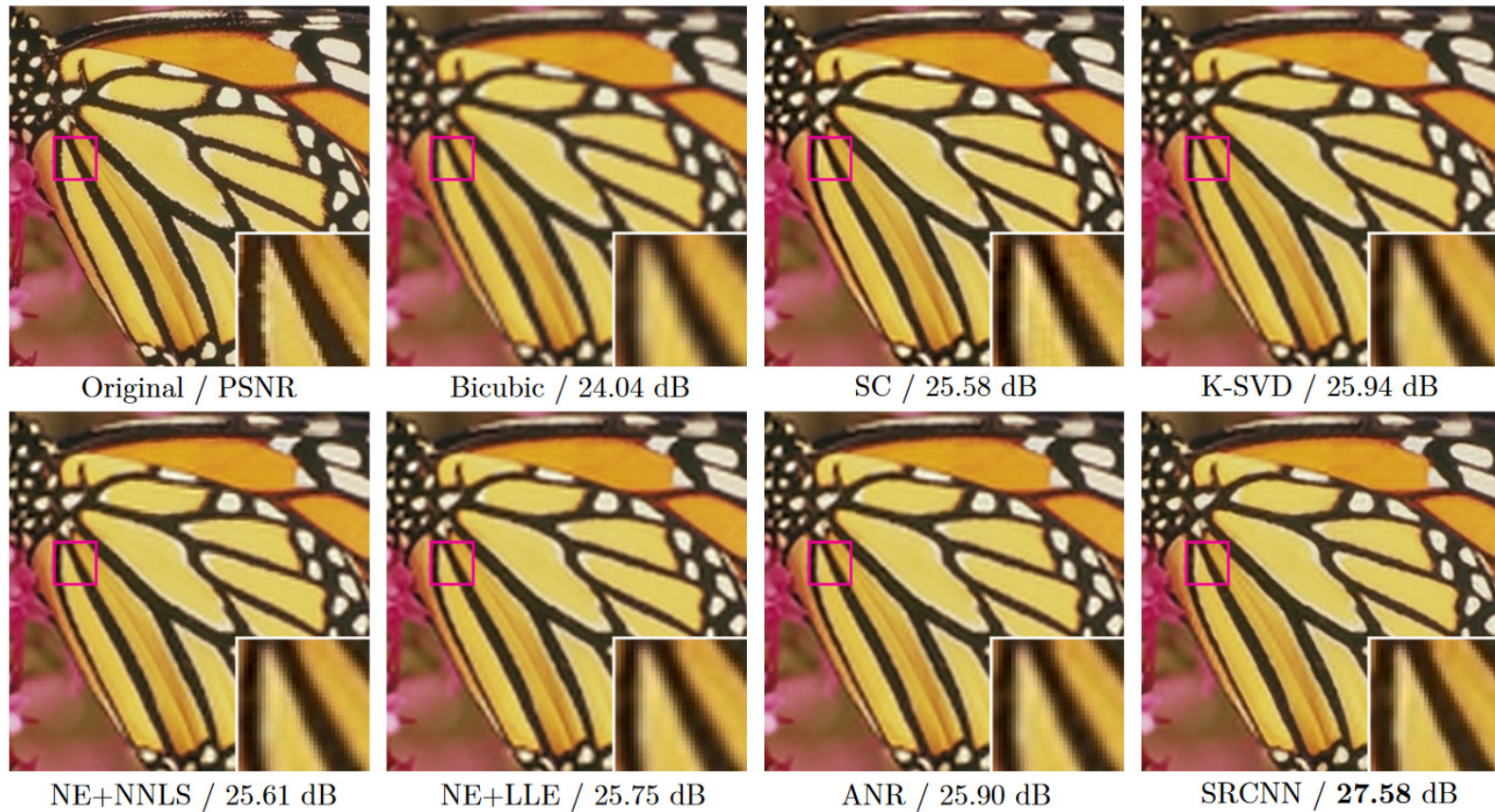


Image super-resolution



Super-resolution based on SRCNN



“Butterfly” image from Set5 with an upscaling factor 3

Image restoration

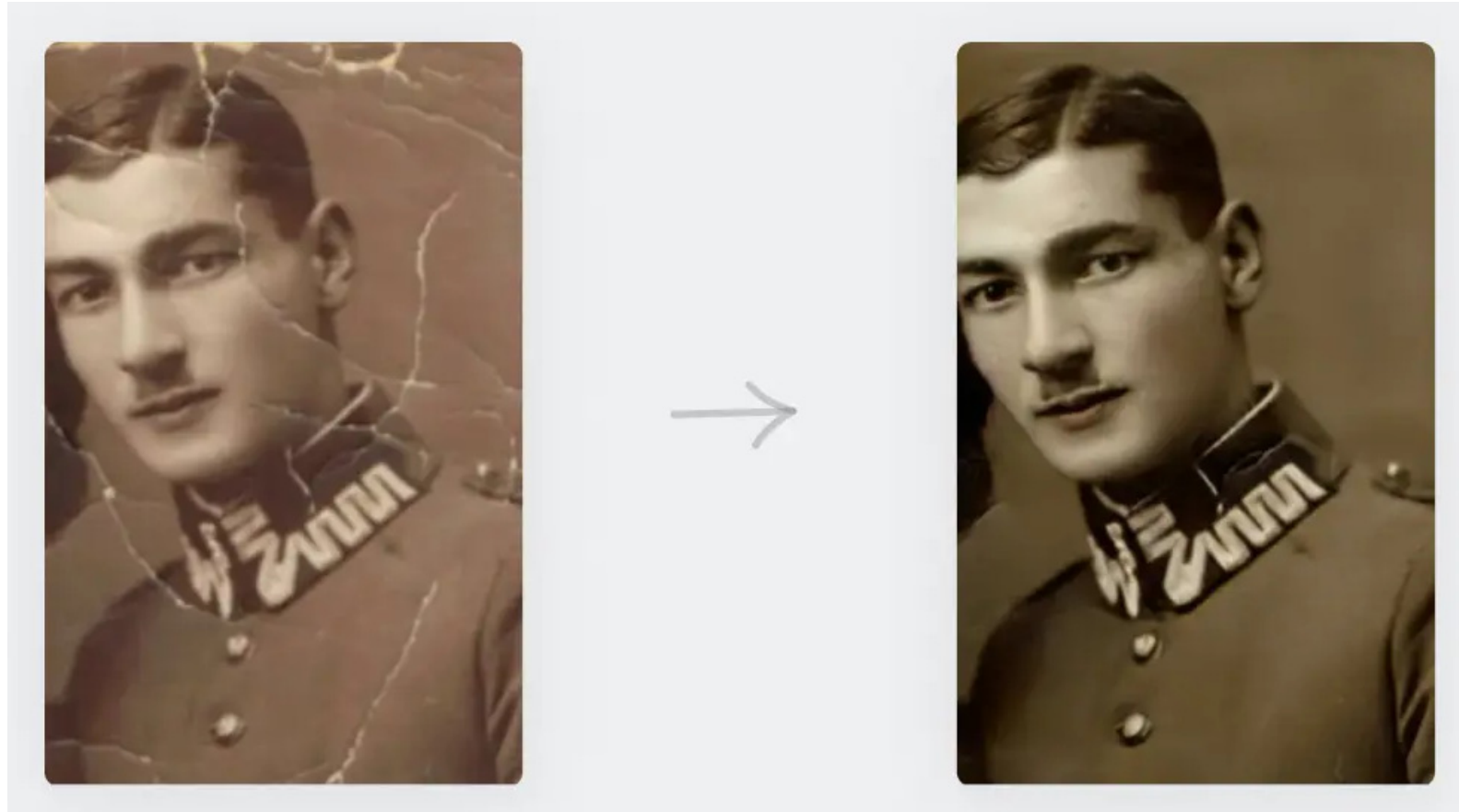


Image inpainting

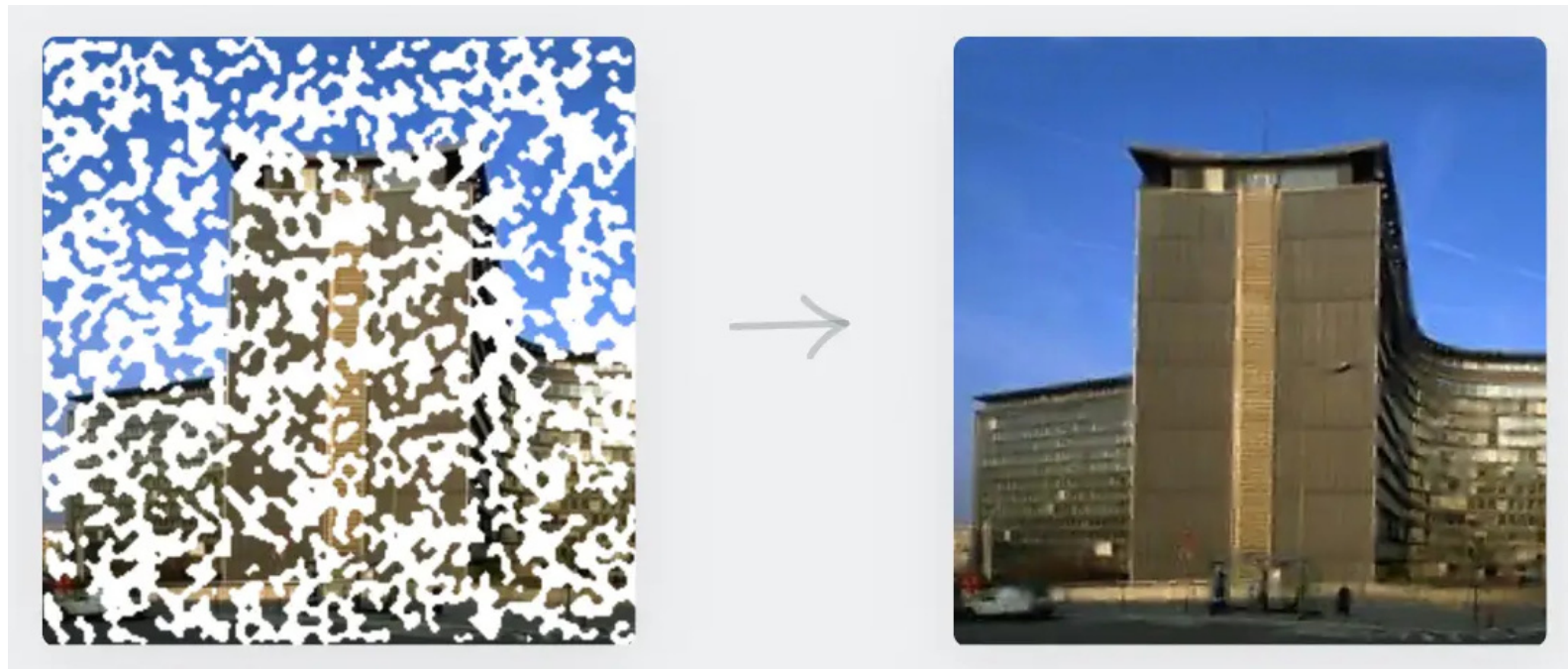


Image inpainting



Input (a)



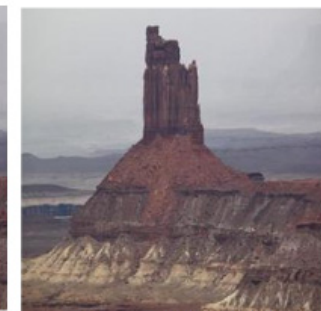
Shift-net (b)



Contextual Attention (c)



Our Result (d)



Ground Truth (e)



Input(f)



Partial Conv (g)



Gated Conv(h)



Our Result (i)



Ground Truth (j)

Suggested Textbooks

Digital Image Processing Using MATLAB

Authors: Rafael Gonzalez, Richard Woods, Stevens Eddins

Publisher: Gatesmark Publishing, Year: 2020

ISBN: 0982085419 ,9780982085417

Multidimensional Signal, Image, and Video Processing and Coding

Author: John W. Woods

Publisher: Academic Press

ISBN: 9780123814203