Video Signals

LECTURER: MARCO MARCON

054318 - AUDIO AND VIDEO SIGNALS

054317 - VIDEO SIGNALS

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Conferencing with the course instructor or with the teaching assistant can be requested via email.

Remote conferencing is possible.

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

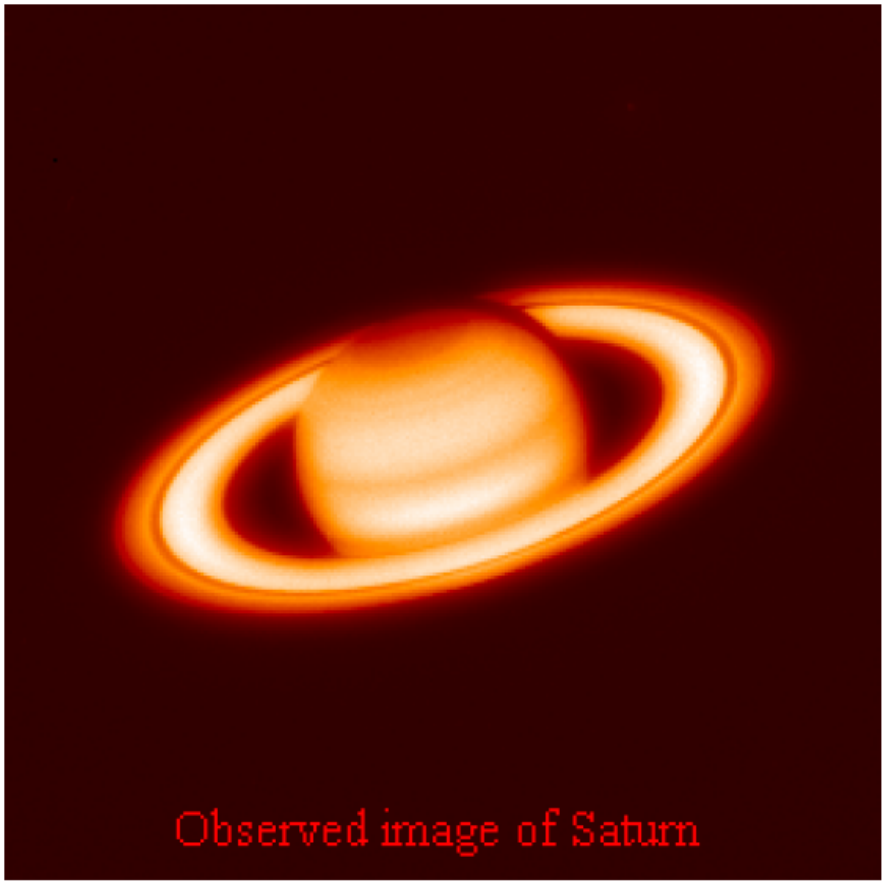
Improve visibility of tumor in a radiograph

Extract information from images

Machine Learning applications for Pattern Recognition

Image Processing Examples

Restoration of image from Hubble Space Telescope



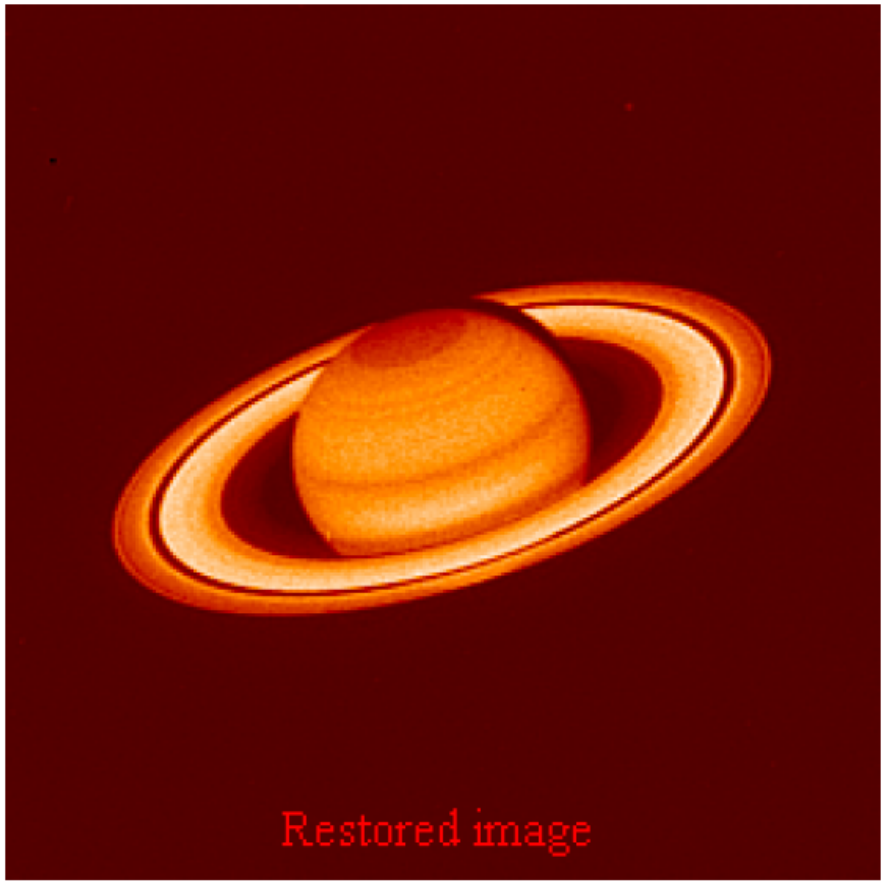
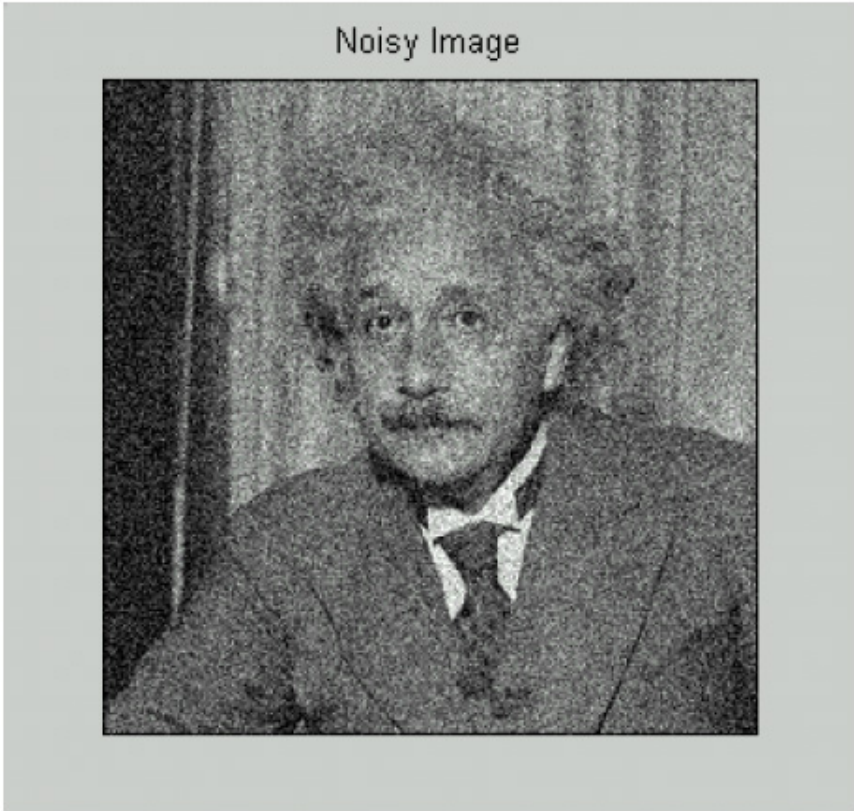


Image Processing Examples

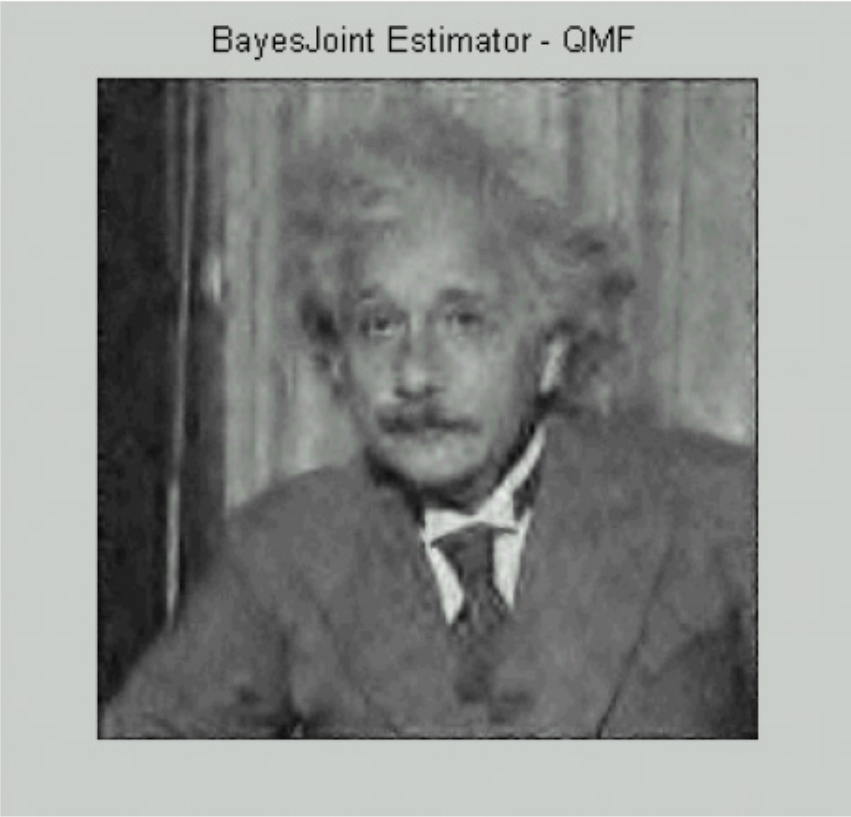
Color photo enhancement

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

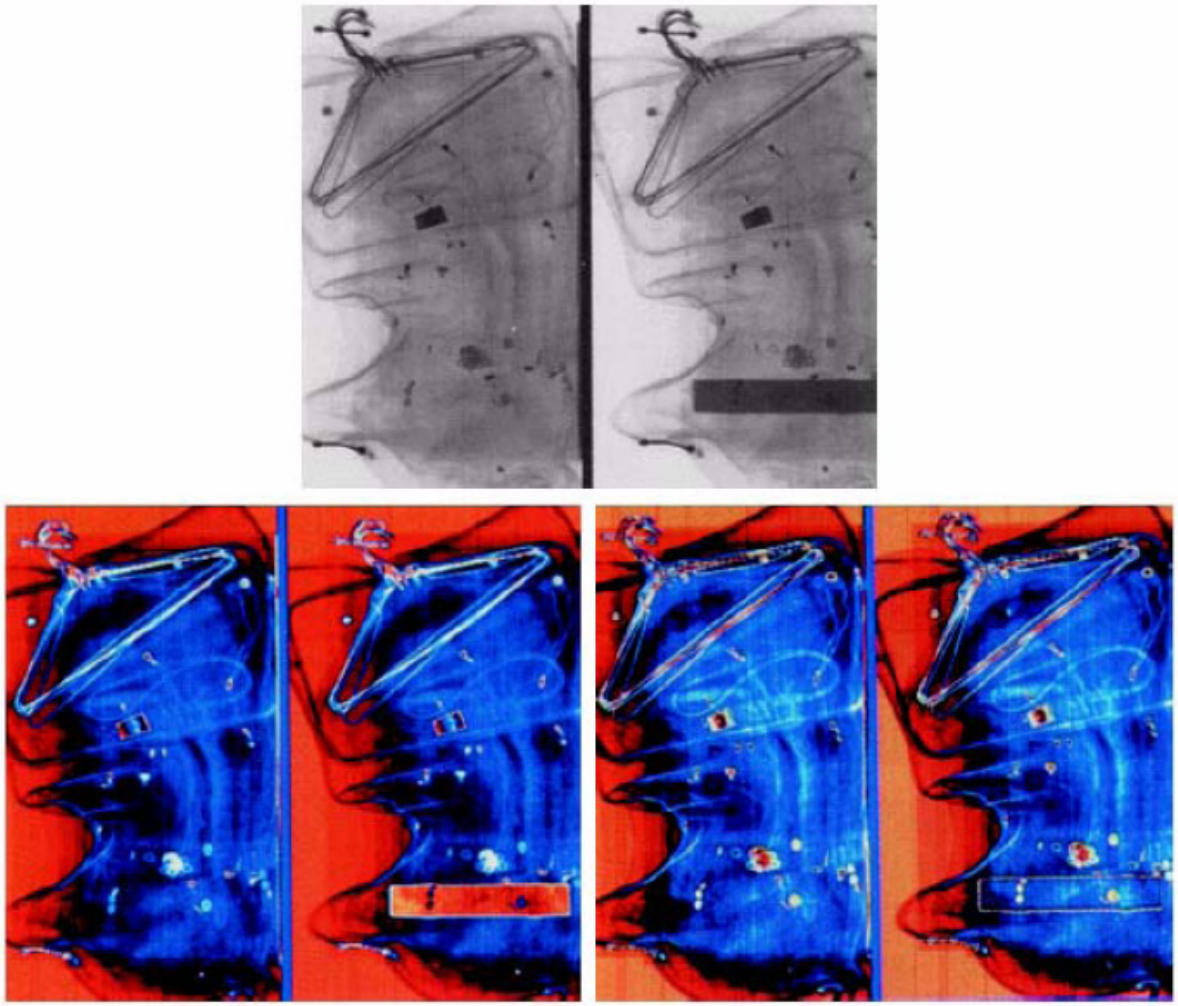


Image Processing Examples

Extraction of settlement area from an aerial image, segmentation

Image Processing Examples

Earthquake Analysis from Space

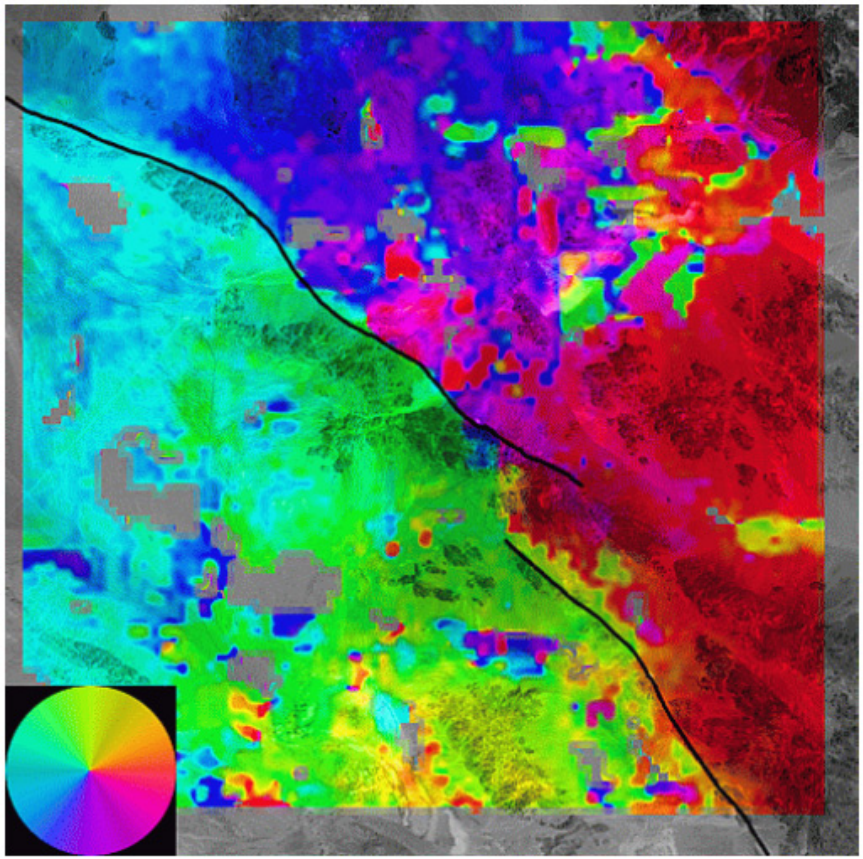


Image shows the ground displacement due to Landers earthquake in California, 1992

Image Processing Examples

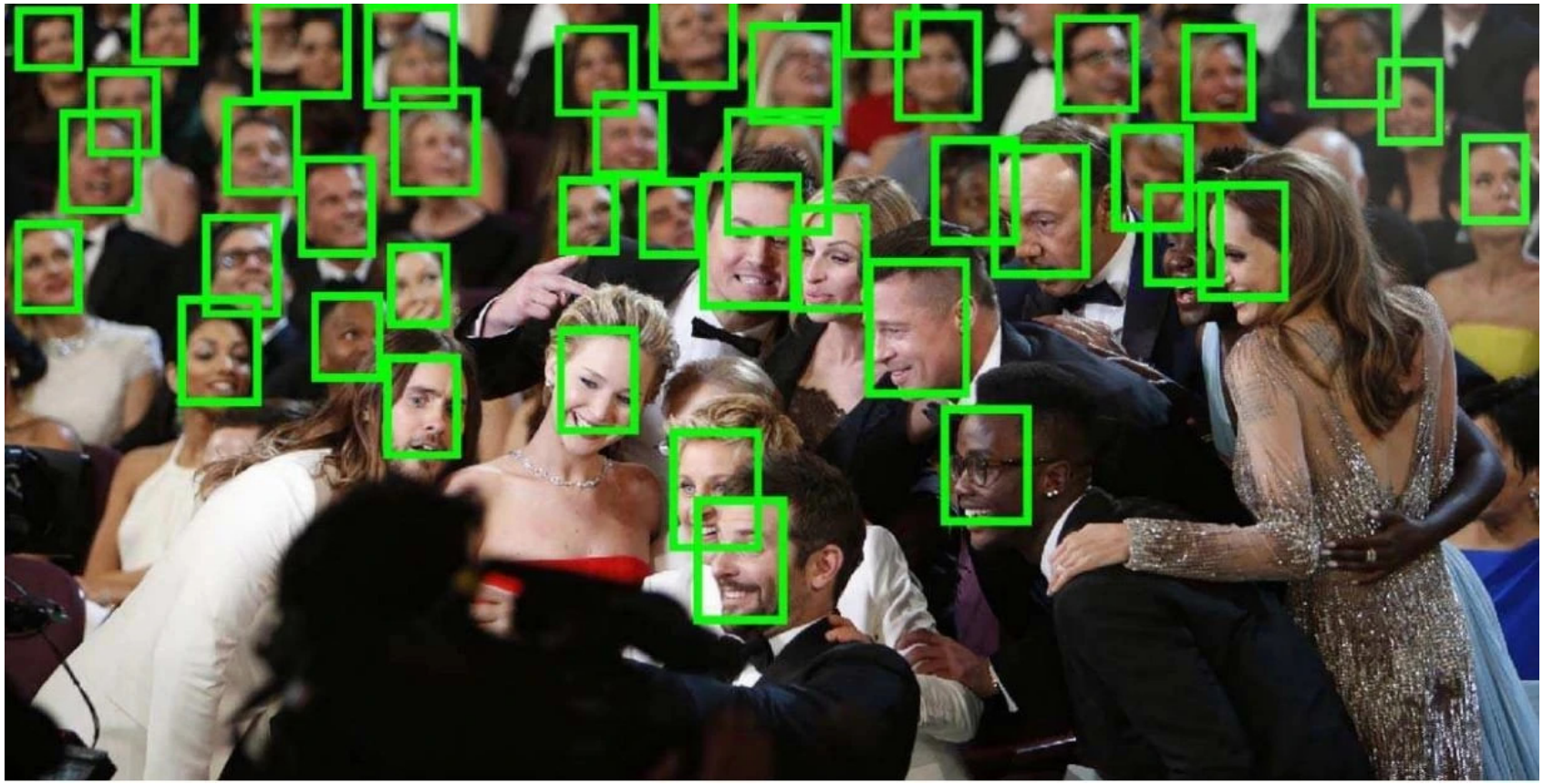
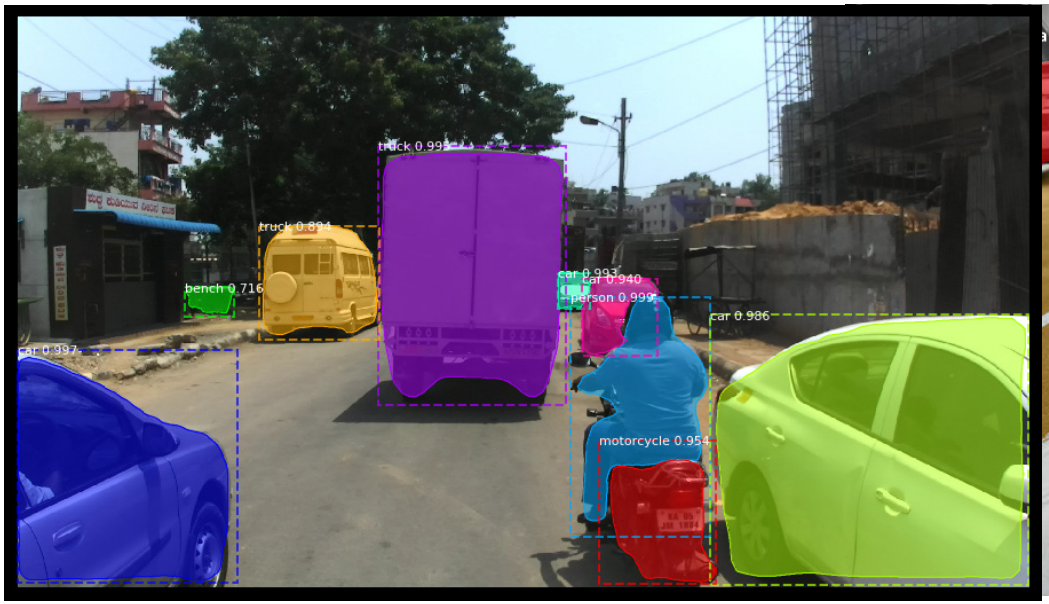
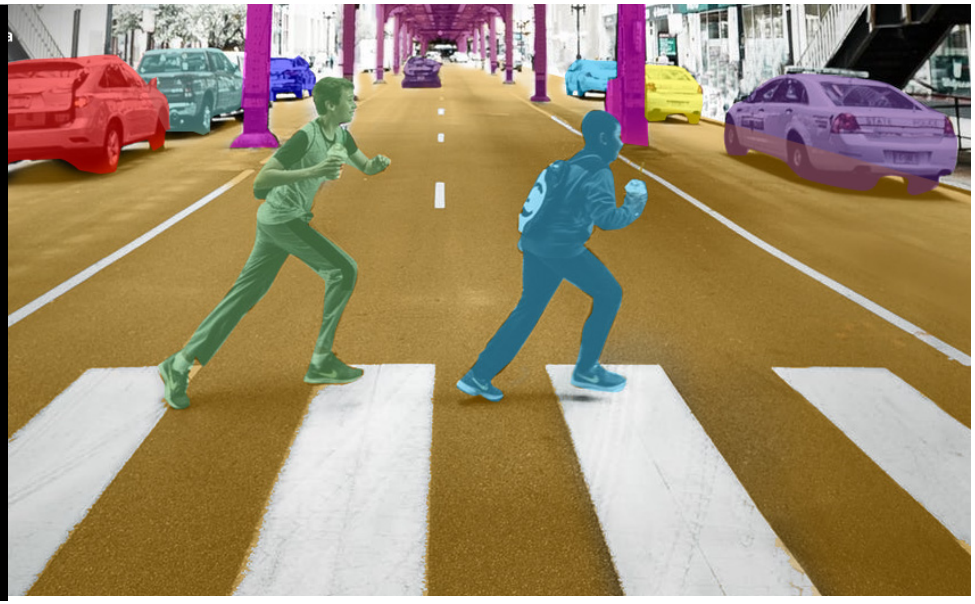
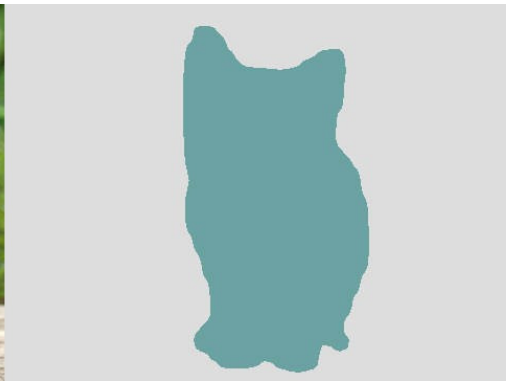


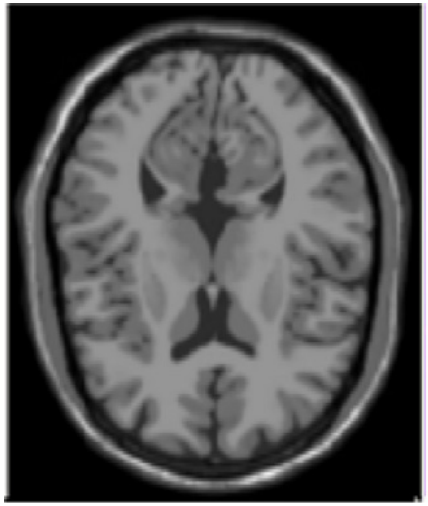
Image Processing Examples

Image Segmentation









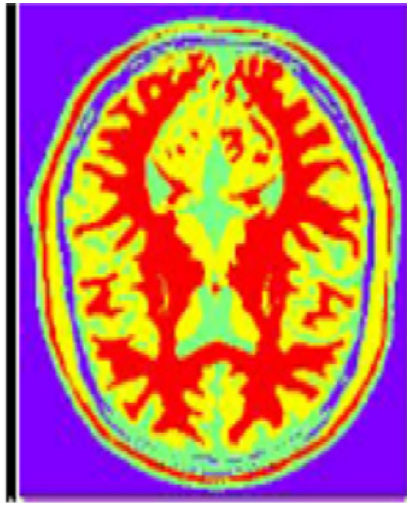
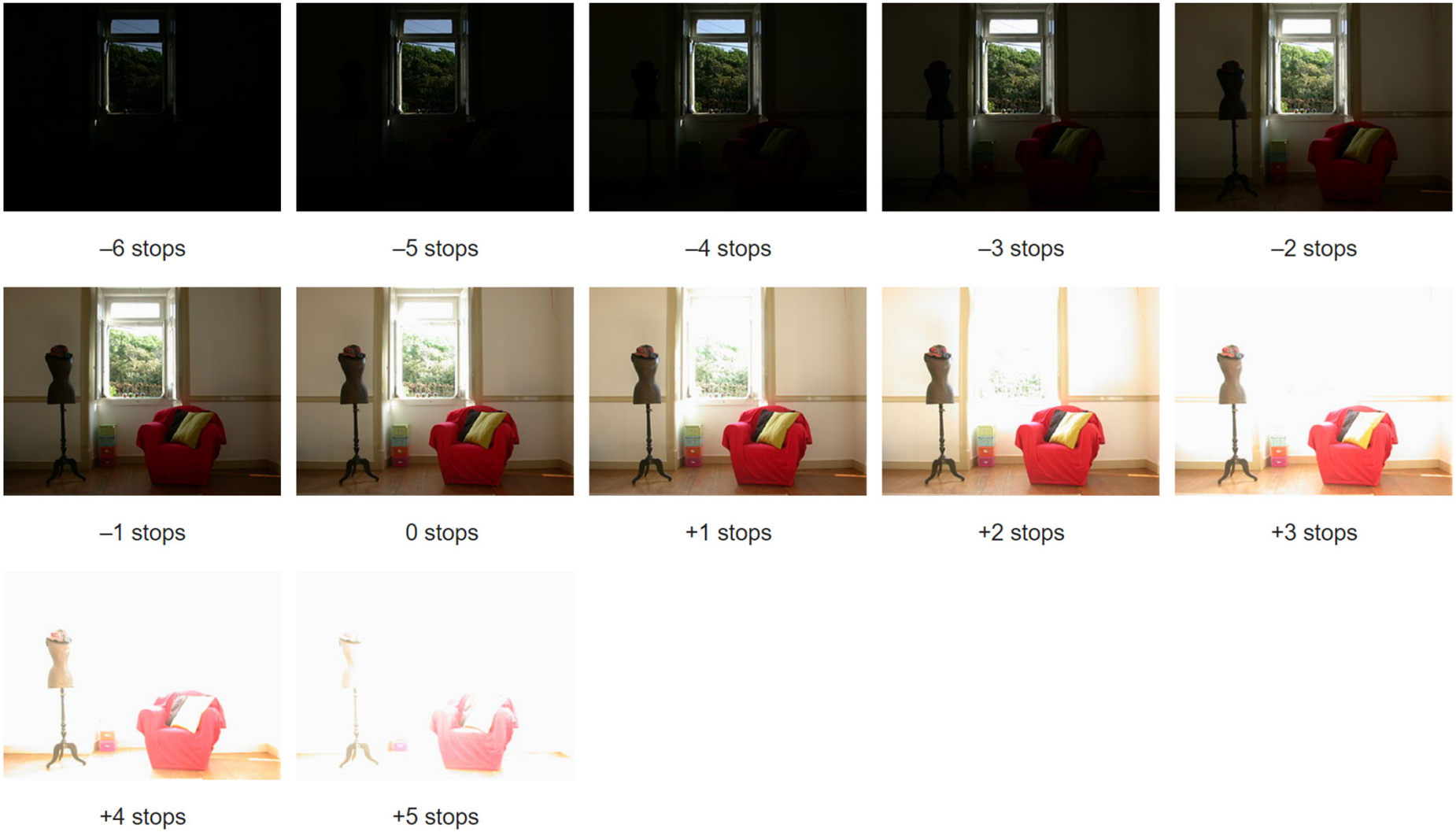


Image Processing Examples

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

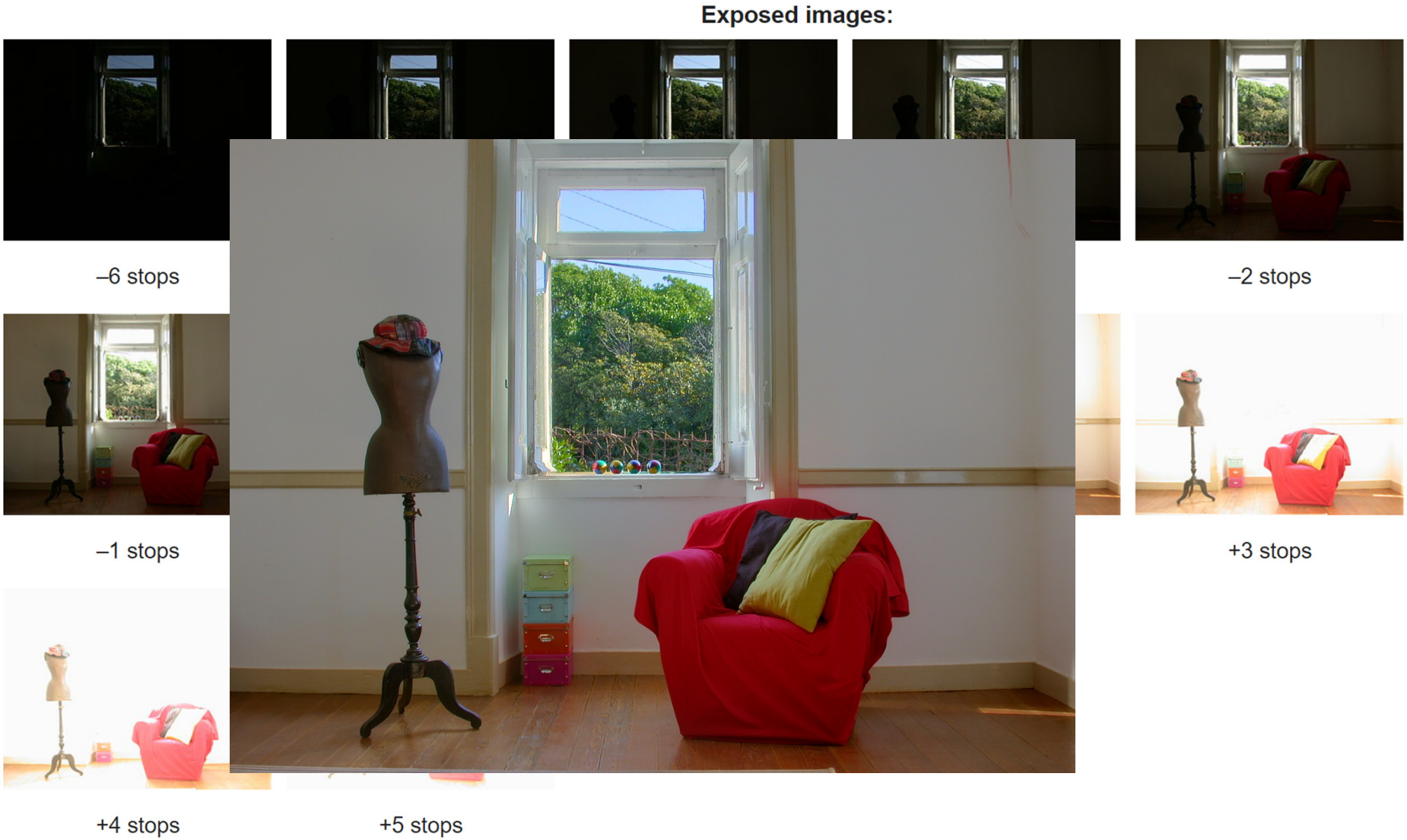


Image Processing Examples

Handwriting recognition

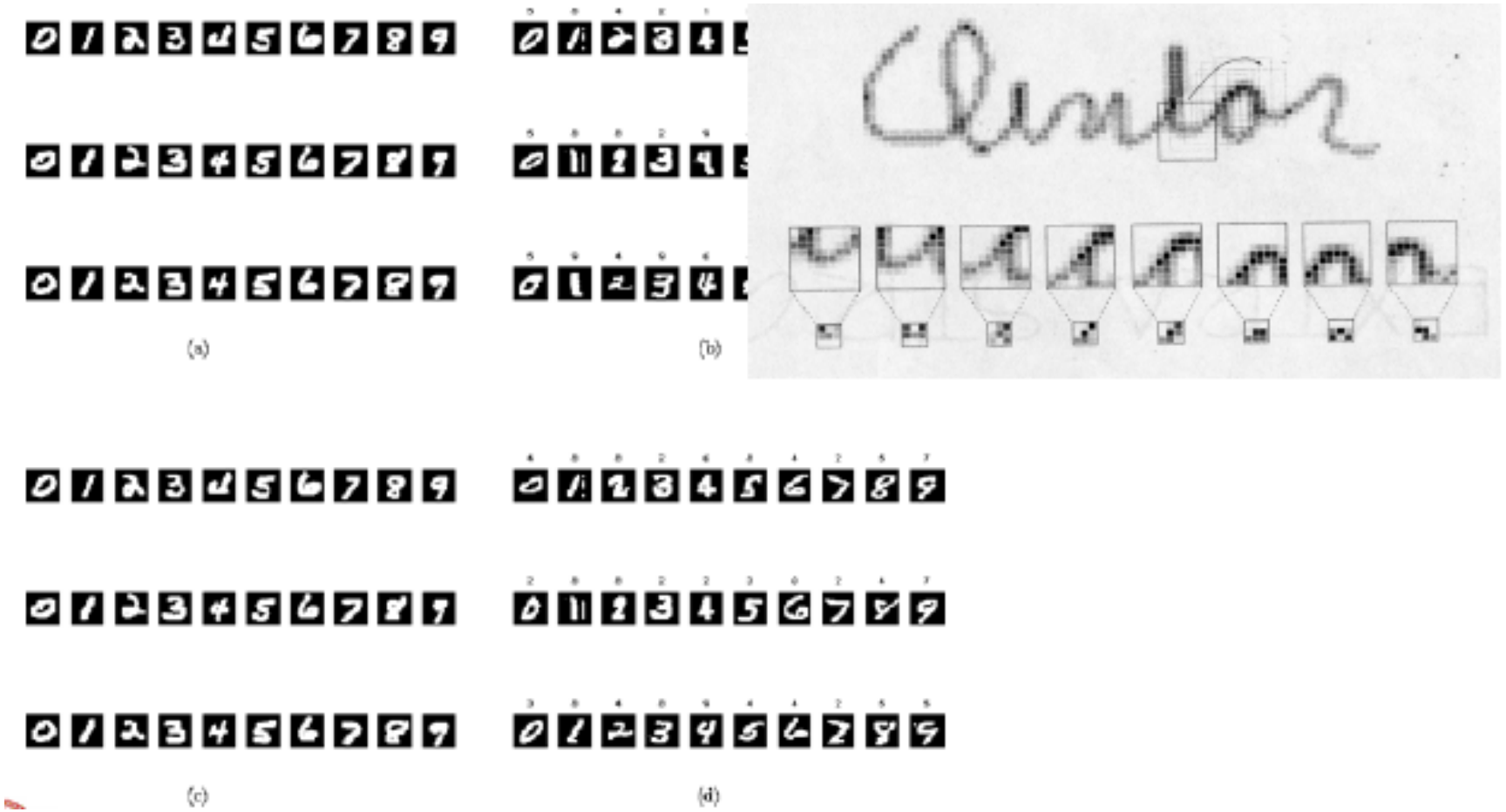


Image Processing Examples

Biometrics: Fingerprint recognition

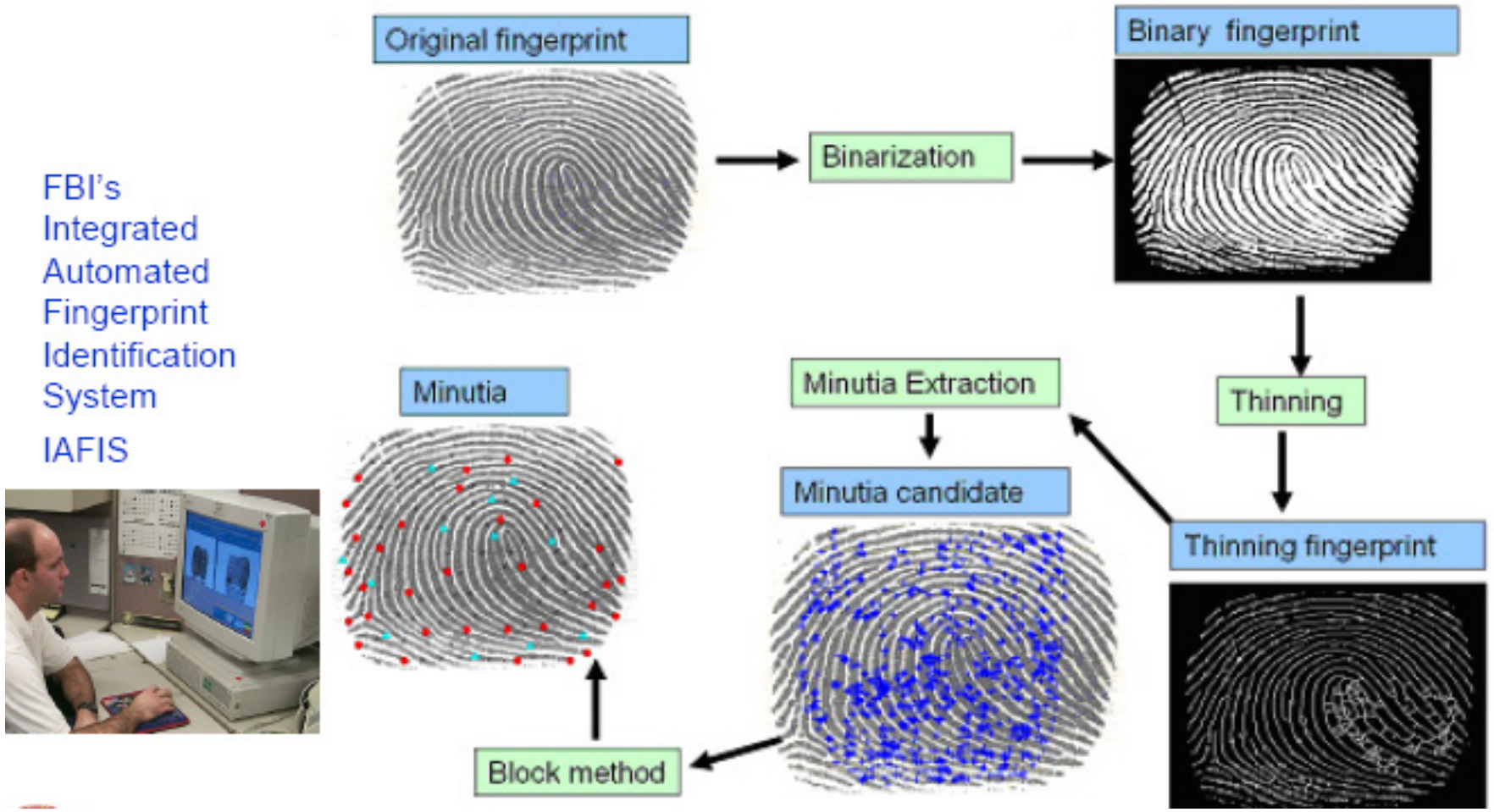
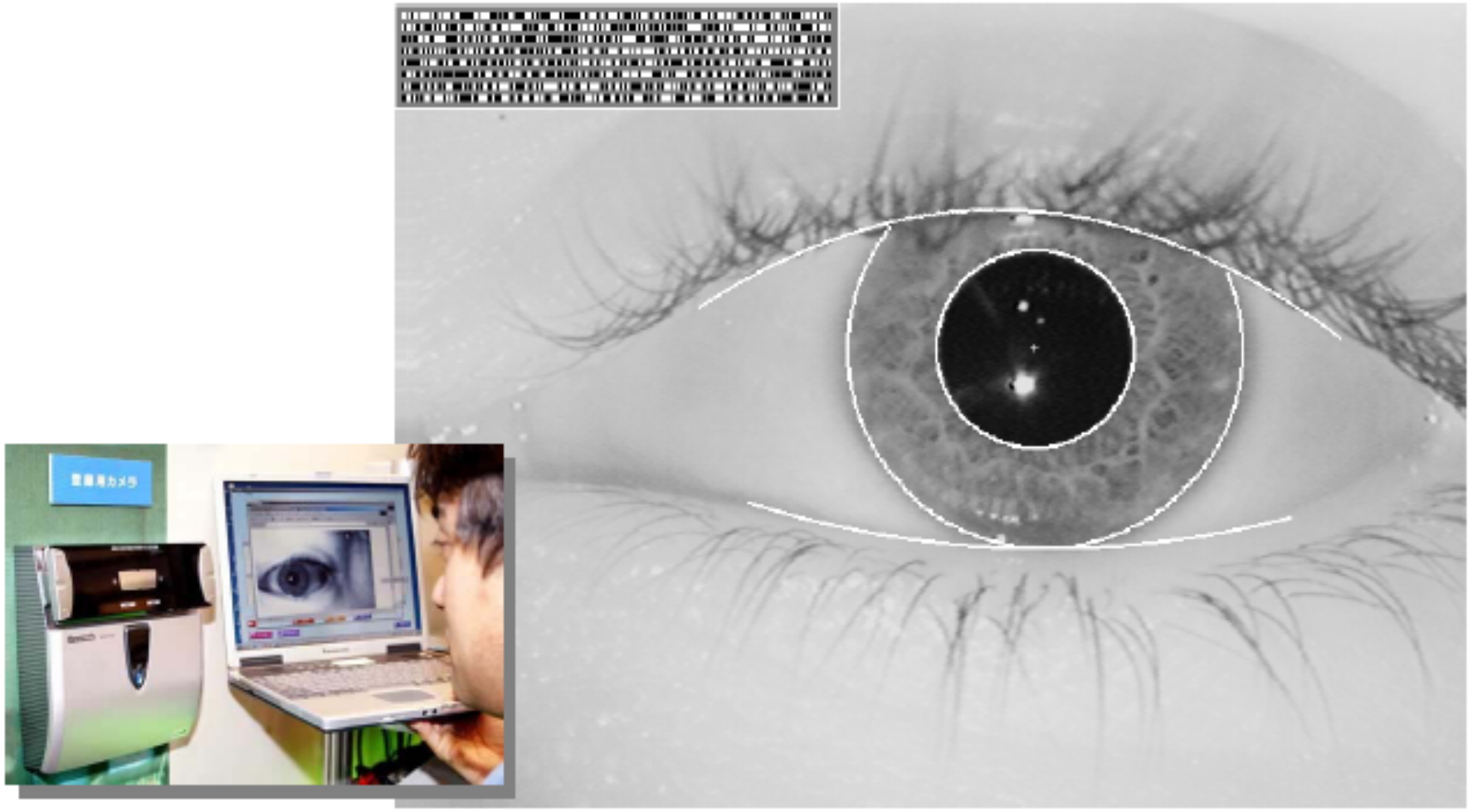


Image Processing Examples

Biometrics: Iris recognition



Automotive Assistant

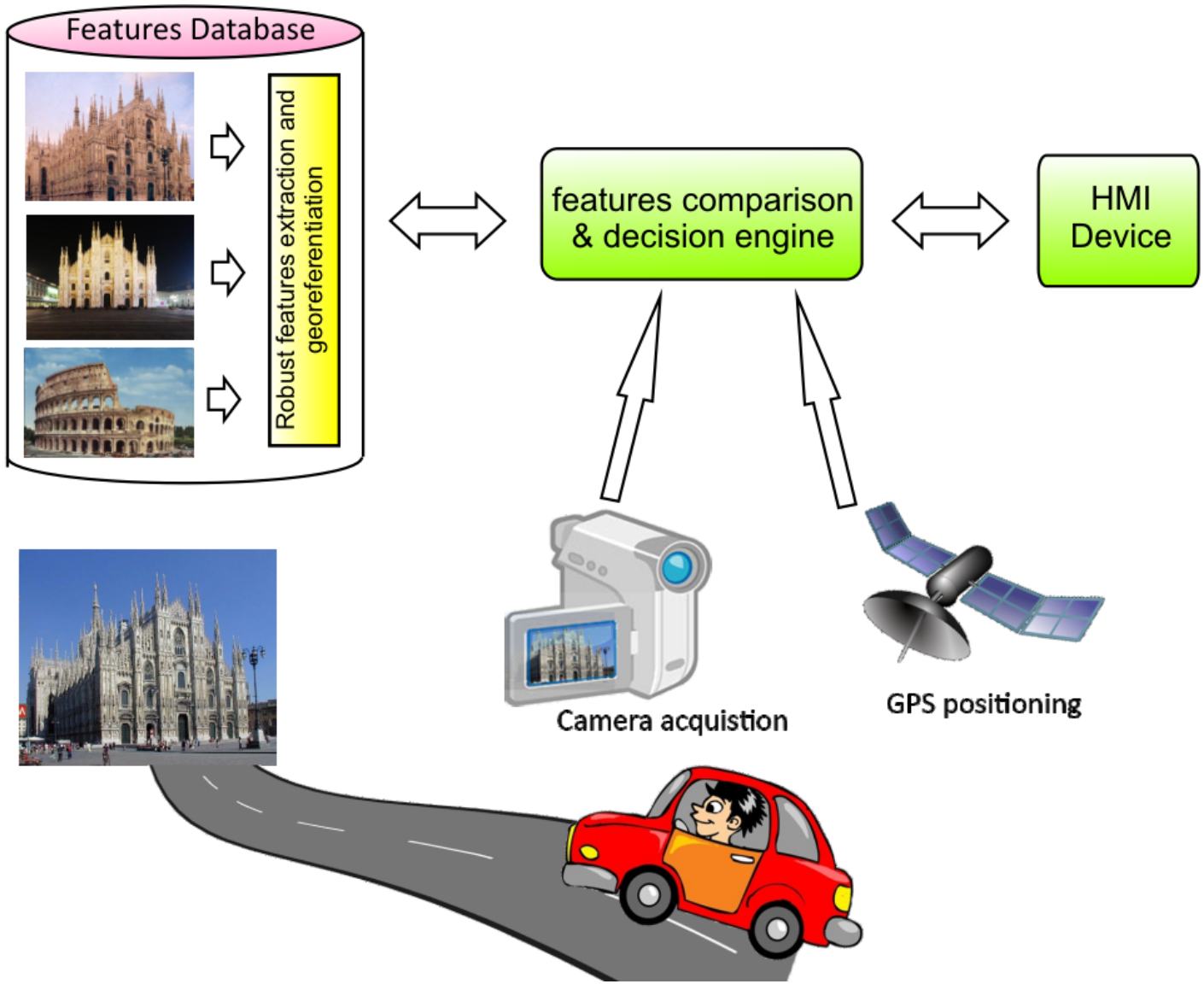
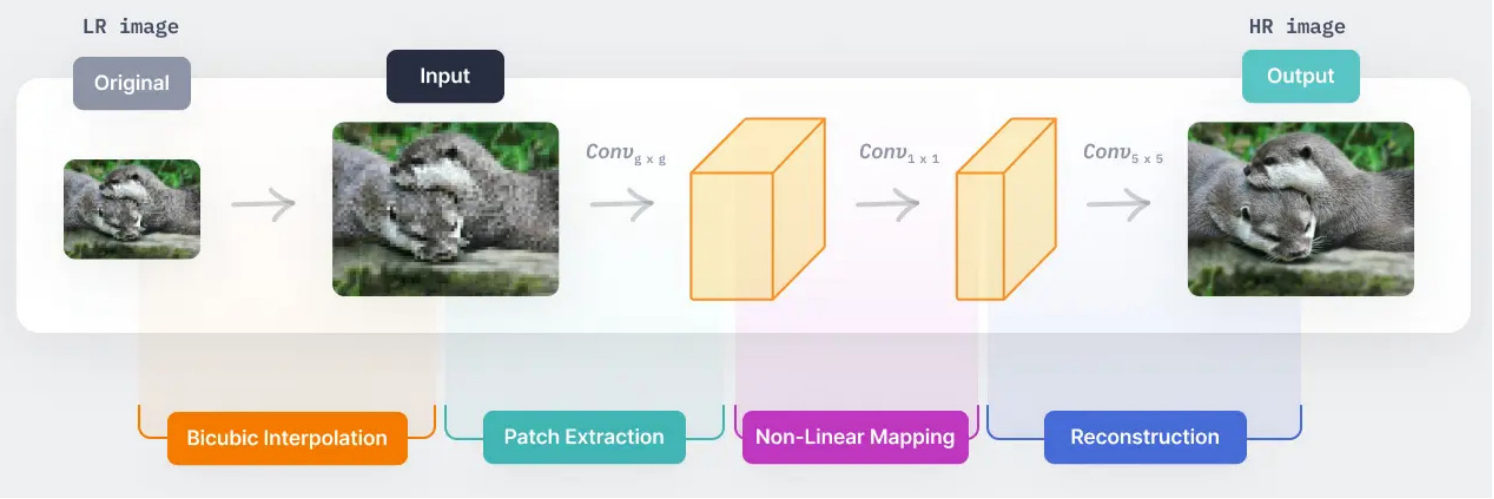
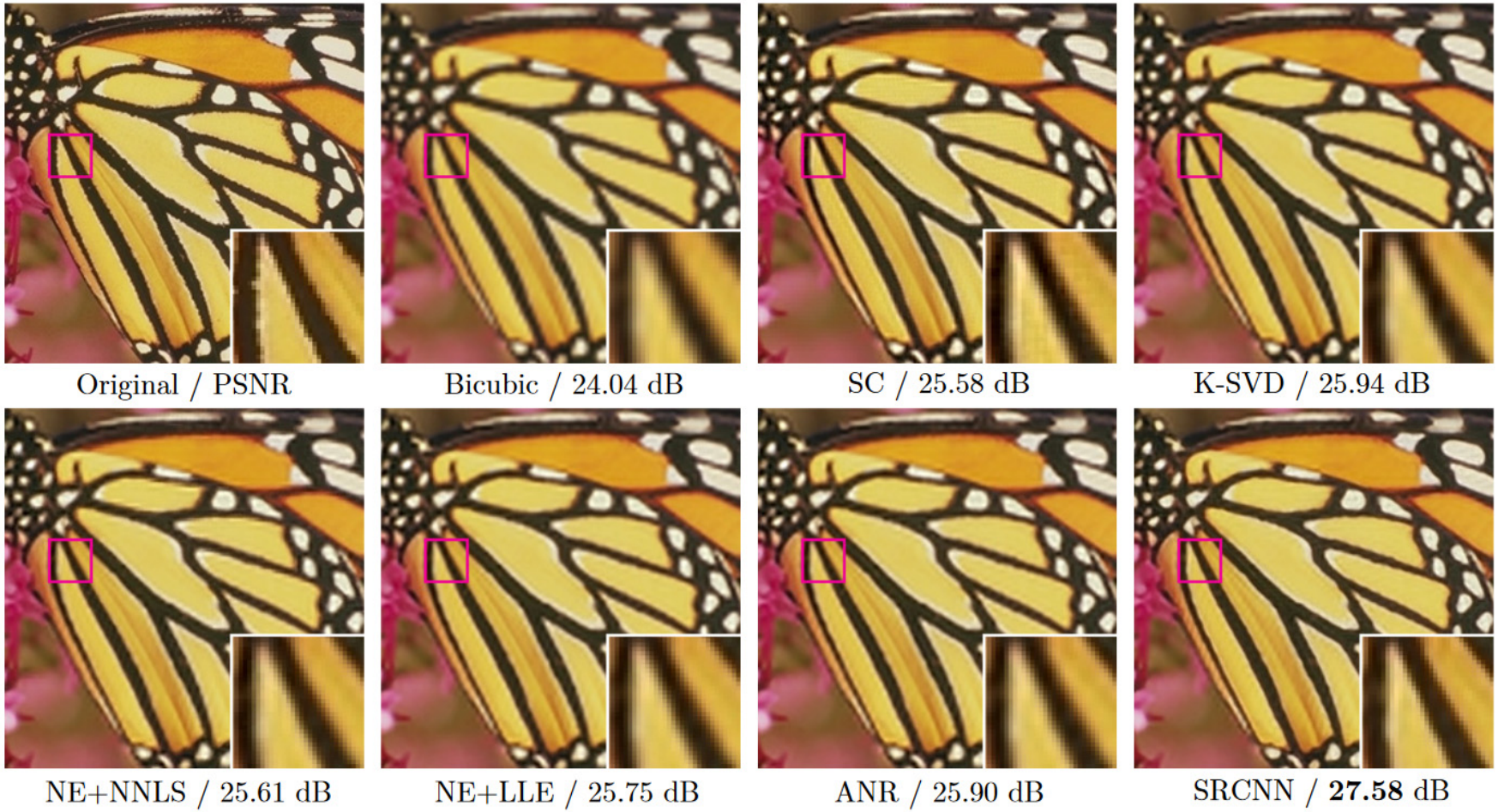


Image super-resolution



Super-resolution based on SRCNN



"Butterfly" image from Set5 with an upscaling factor 3

Image restoration

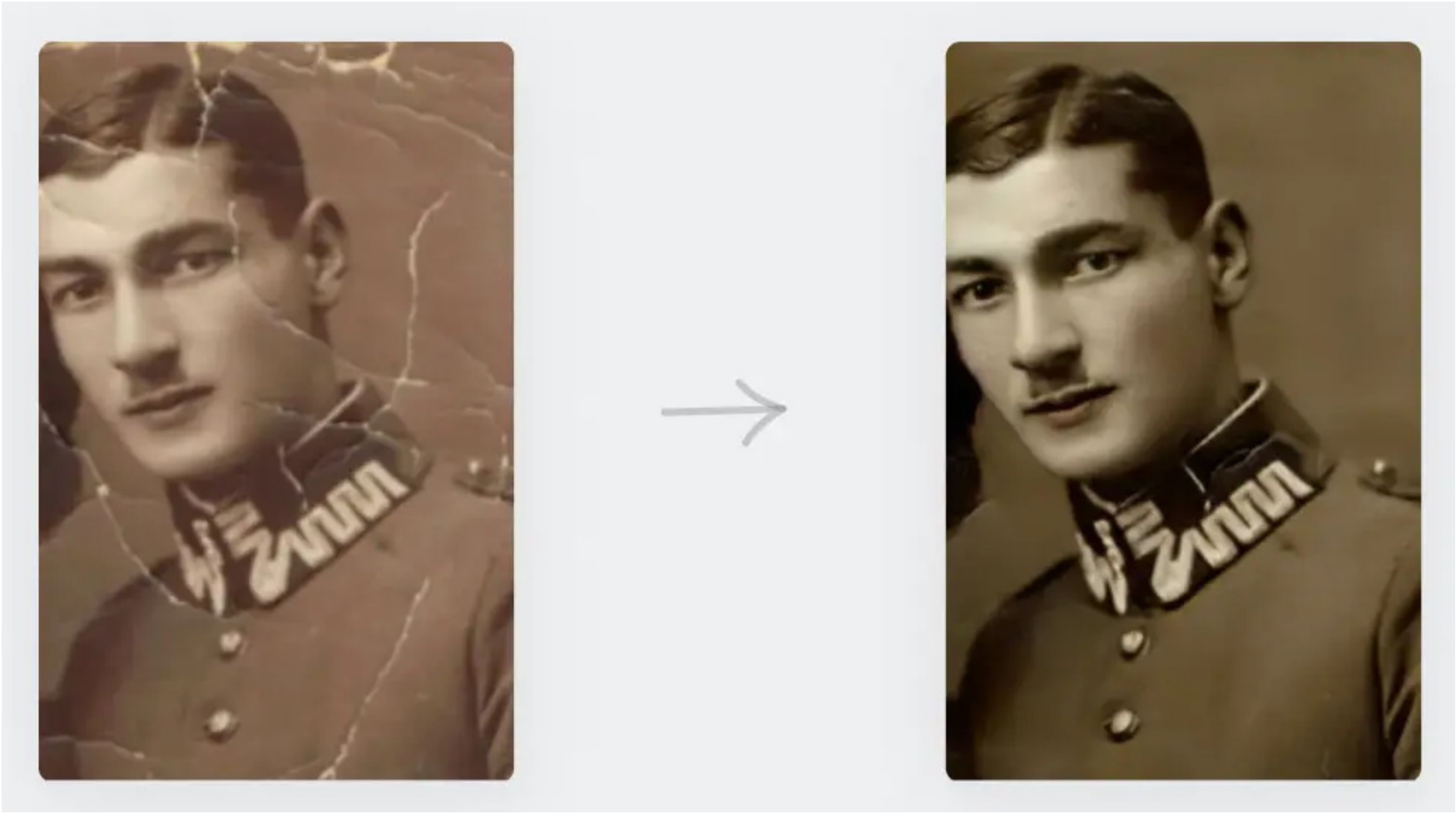


Image inpainting

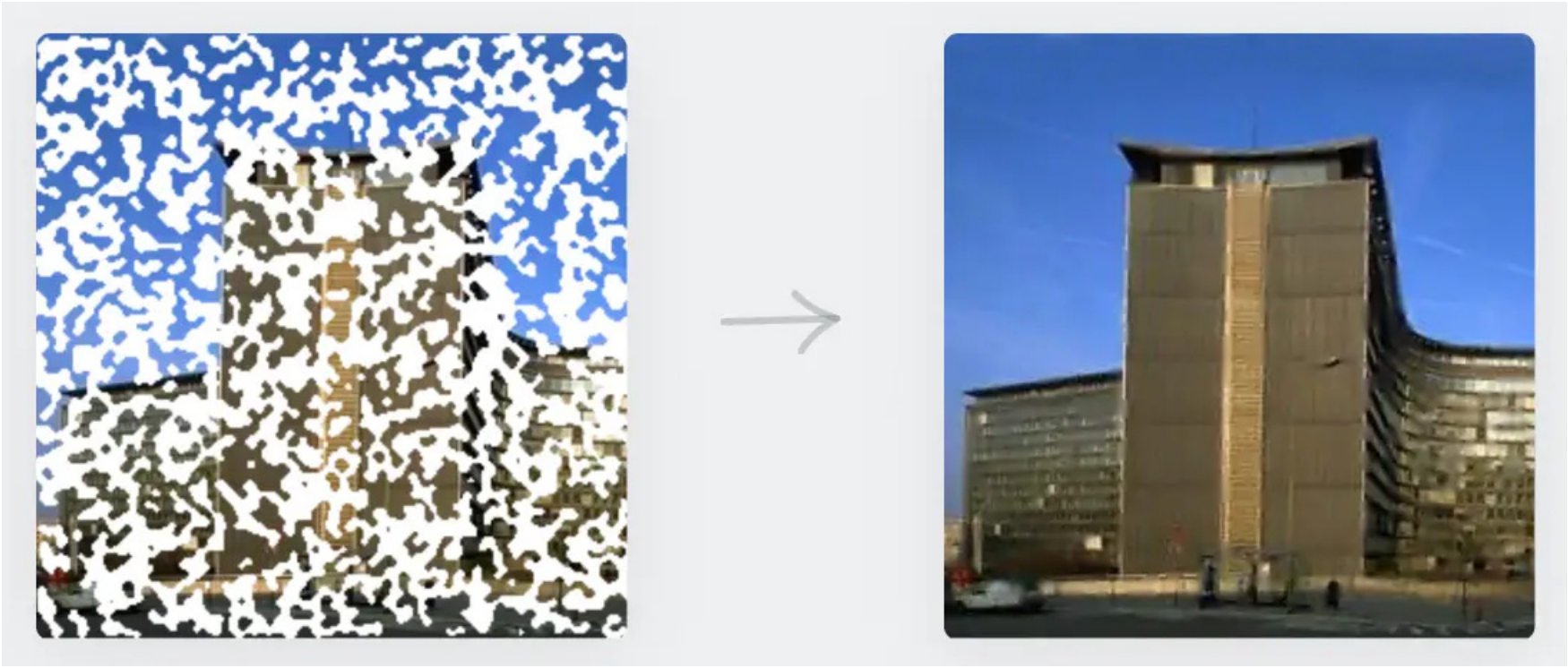
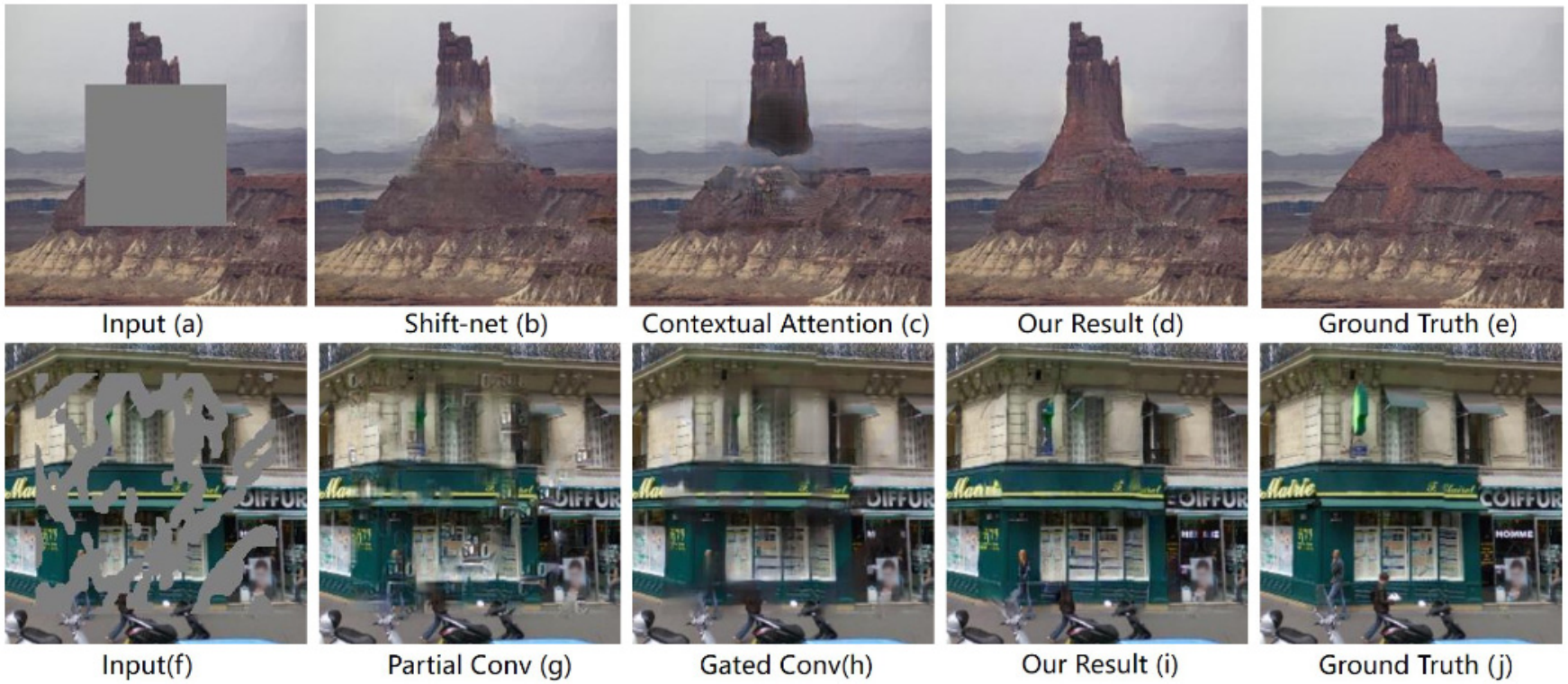


Image inpainting



Suggested Textbooks

Digital Image Processing / R.C. Gonzales, R. E. Woods.

Digital Image Processing / Kenneth R. Castleman. Prentice Hall,

Feature Extraction and Image Processing / Nixon, Mark Aquado, Alberto S Book.

Handbook of Image and Video Processing / Bovik, Al.

Handbook of Medical Imaging / Bankman, Isaac.

Wavelet Tour of Signal Processing / Mallat.