Digital Image Processing - Lect 1

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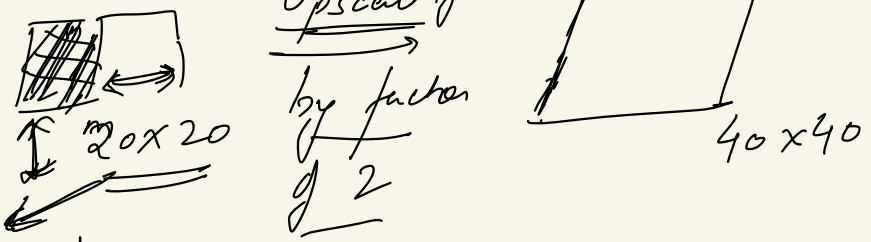
DIP:

Spatial Domain

Gray Domain

Image Resolution →

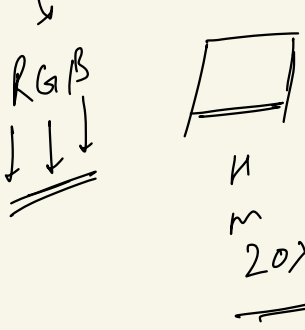
Interpolation → Spatial Domain



400

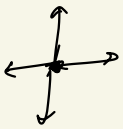
Downscaling by factor —

pixel ⇒ smallest element of any image



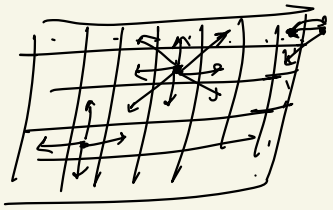
Neighborhood

4-neighborhood



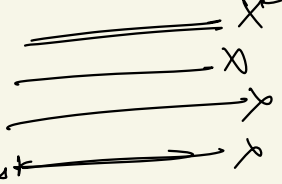
8-neighborhood

Matrix



Grayscale Resolution

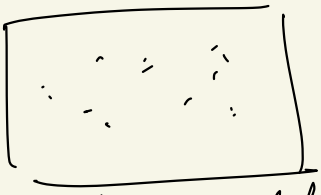
Bit Levels



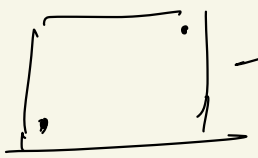
Pre-Processing Steps

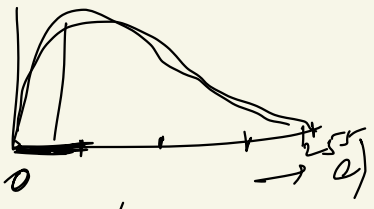
↳ Noise Removal

↳ Image Enhancement ⇒



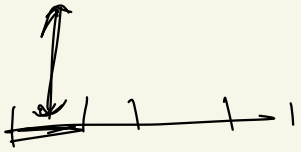
↳ Digital signal processing





Intensity values

0 – 255

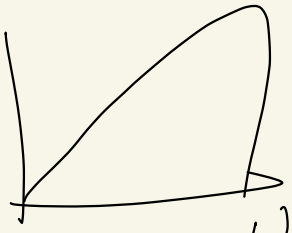


Contrast Enhancement

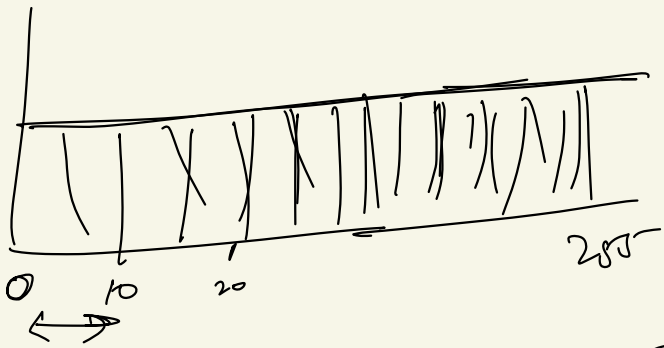
Histogram Equalization

× histogram ✓

imhist



→ brighter

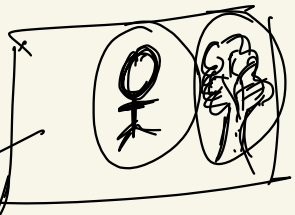


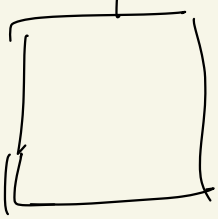
Lena → Edgemap of Lena

Lena

Cameraman → Edge Detection

pixel





Contour

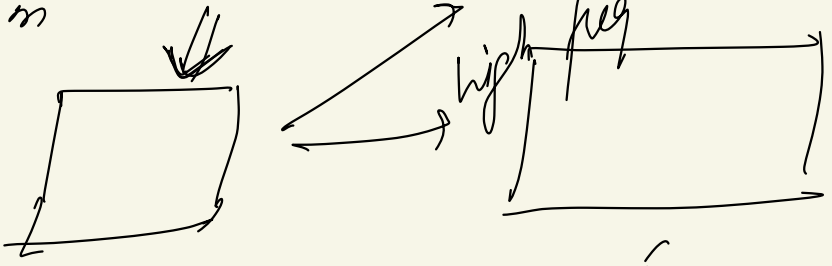
edge magnitude

→ Fourier Transform

Geometric Transforms

- Scaling
- Rotation
- Affine transform
- Shearing
- Cropping

Image Transform

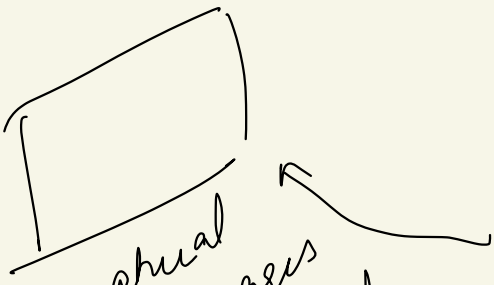


color
&
brightness

Spatial domain

RGB values
↓
intensity values

frequency domain



natural images

background color
foreground color

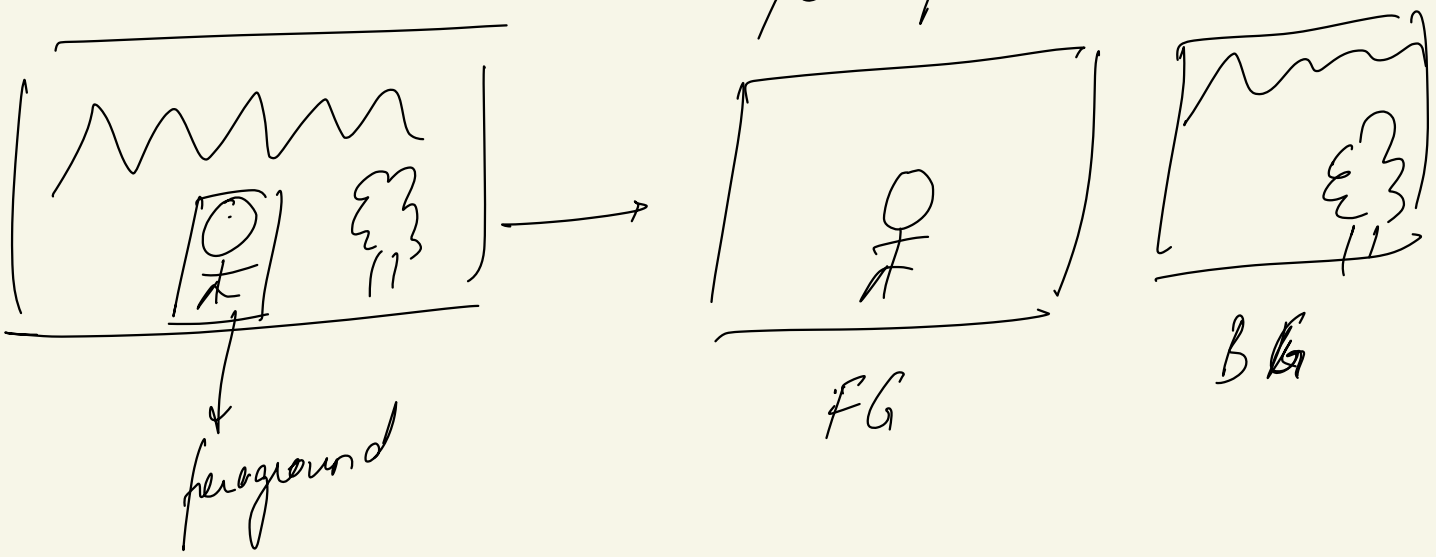
low frequency →

high frequency → noise, edge

→ Image Segmentation

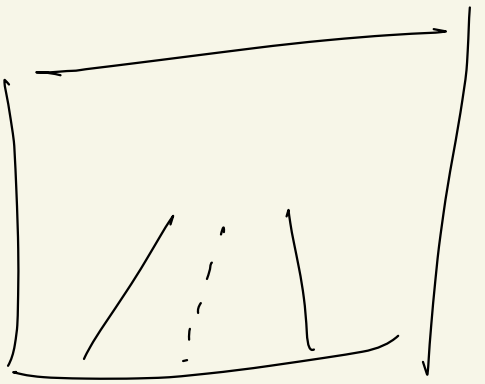
↳ foreground / background

↳ object of interest



→ Hough Transform

↳ Line, Circle



Hough transform

↓

Lane detection

→ Image compression

Medical image processing

Image formats

→ JPEG → lossy & loss less compression

→ PNG → loss less compression

→ BMP

→ SVG

→ TIFF

→ HEVF

→ ~~Webp~~

{ Arithmatic coding
  Huffman Coding
  LZW Coding

→ Woods & Gonzalez → DIP

→ //

→ Digital Image Processing: Processing of digital images using digital computers
(discrete values)

Motivated by 2 major applications
- Improvement of pictorial information for human perception
- Image processing for autonomous machine applications
- Efficient storage & transmission

Human perception:
Employ methods capable of enhancing pictorial information for human interpretation & analysis
- Noise filtering
- Content enhancement
  - Contrast
- Deblurring
  - Motion Blur
  - Defocus

Typical Applications

- Industrial machine vision for product assembly & inspection
- Automated target detection & tracking
- → Fingerprint recognition
- → Machine processing of aerial & satellite imagery for weather prediction & crop assessment.