DMET 1001
Image Processing

Introduction

Assoc. Prof. Dr. Rimon Elias

Contents

- Administrative stuff

- Feature detectors
  - Edges and lines
  -

Course Staff

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Class Time

Schedule retrieved on Jan 26th.

- Course components (2+2+0):

	1st 8:30-10:00	2nd 10:30-12:00	3rd 12:15-13:45	4th 14:15-15:45	5th 16:00-17:30
Saturday					
Sunday			DMET 1001 H9		
Monday					
Tuesday		T01 (CSEN) C6.104			
Wednesday					
Thursday		T13 (DMET) C5.301	T14 (DMET) C5.305		

Marking Scheme

- Students will be evaluated based on the following:
  - Assignments/Project (20%)
  - 2 out of 3 Quizzes (15%)
  - Final exam (40%)
  - Midterm exam (25%)

Textbook

- "**Digital image processing**" by Rafael C. Gonzalez and Richard E. Woods, Third edition, Pearson Education, 2008

- "**Image processing, analysis and machine vision**" by Milan Sonka, Vaclav Hlavac and Roger Boyle, Third edition, Thomson Learning, London, 2008
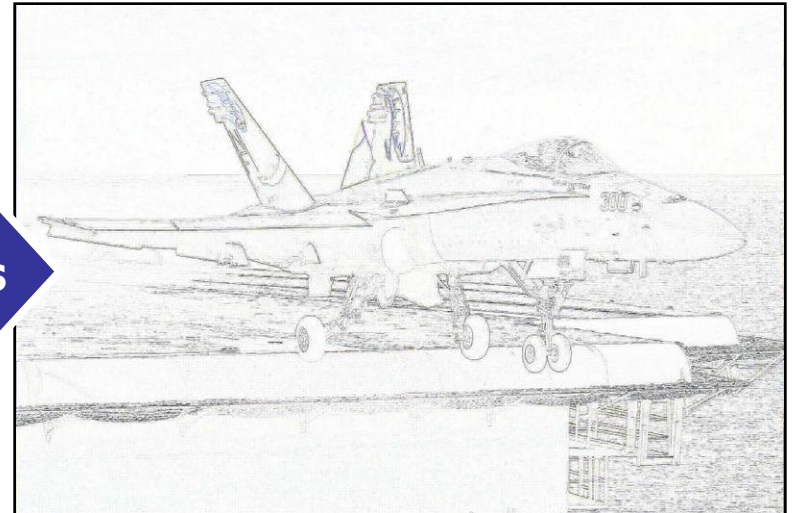
Topics Covered: Edge Detectors

- An **edge** can be defined as the location of a sharp transition in intensity level between two regions.

- There are different ways (detectors) to detect edges in images.

- Roberts Cross detector is an example of these detectors.

Roberts

Input

Output

Topics Covered:
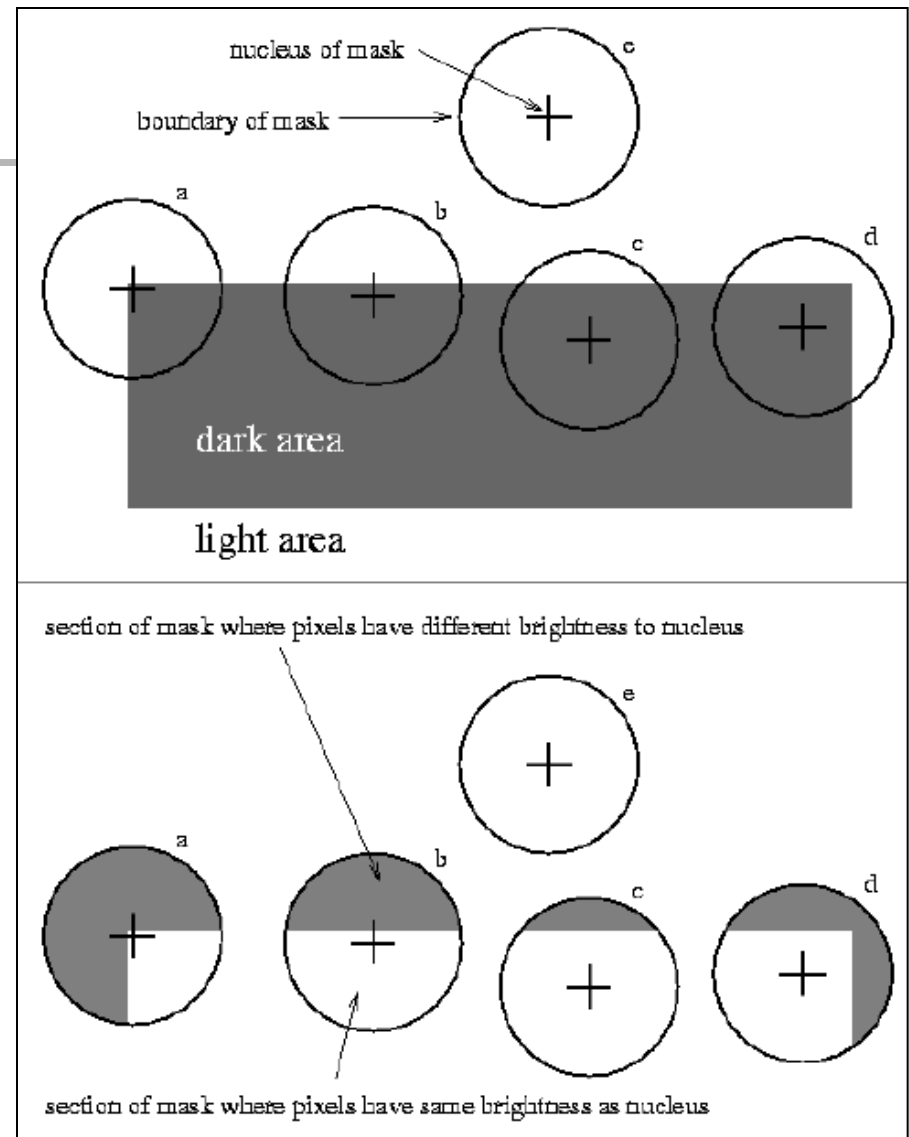# Edge Detectors

Input → **Canny** → **Output**

Topics Covered: Corner Detectors

- SUSAN: **S**mallest **U**nivalue **S**egment **A**ssymilating **N**ucleus.
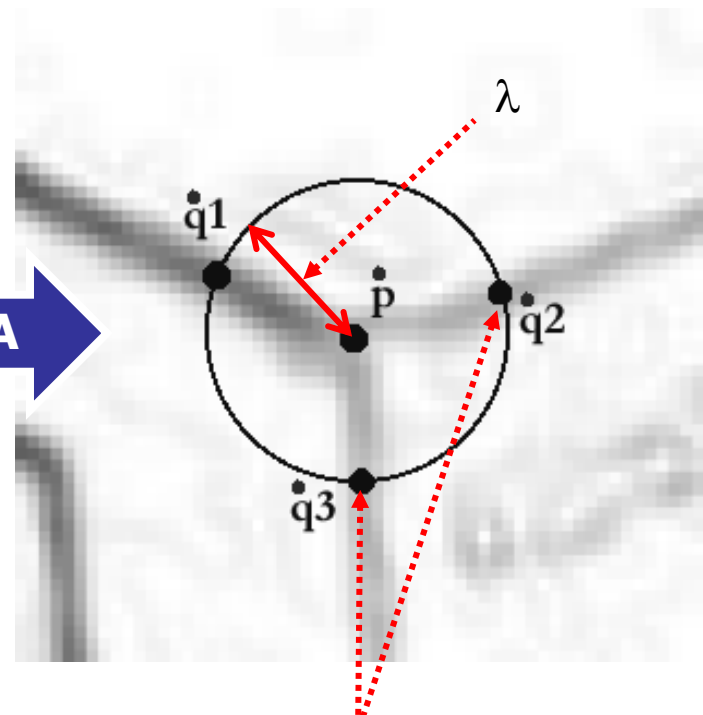
Topics Covered:
Junction Detectors

- JUDOCA: A **JU**nction **D**etection **O**perator based on **C**ircumferential **A**nchor

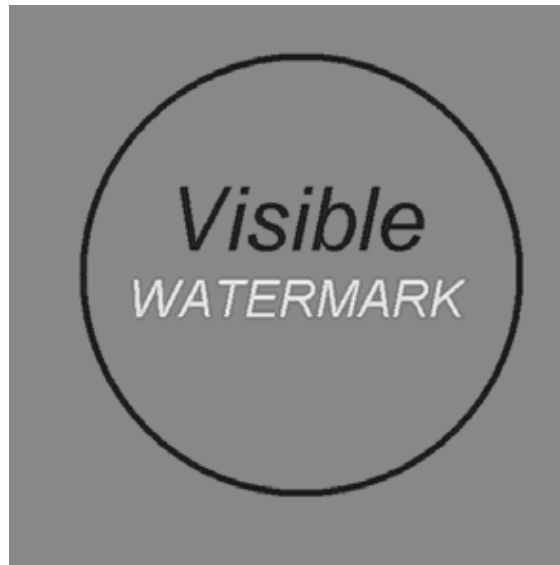

JUDOCA

Circumferential Anchor (CA)

Topics Covered: Watermarking
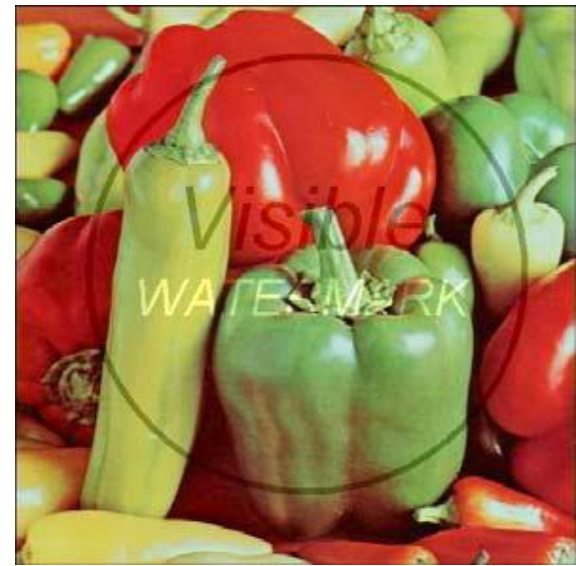
- A **visible watermark** is opaque or semi-transparent that is placed on top of the original image (i.e., watermarked image).

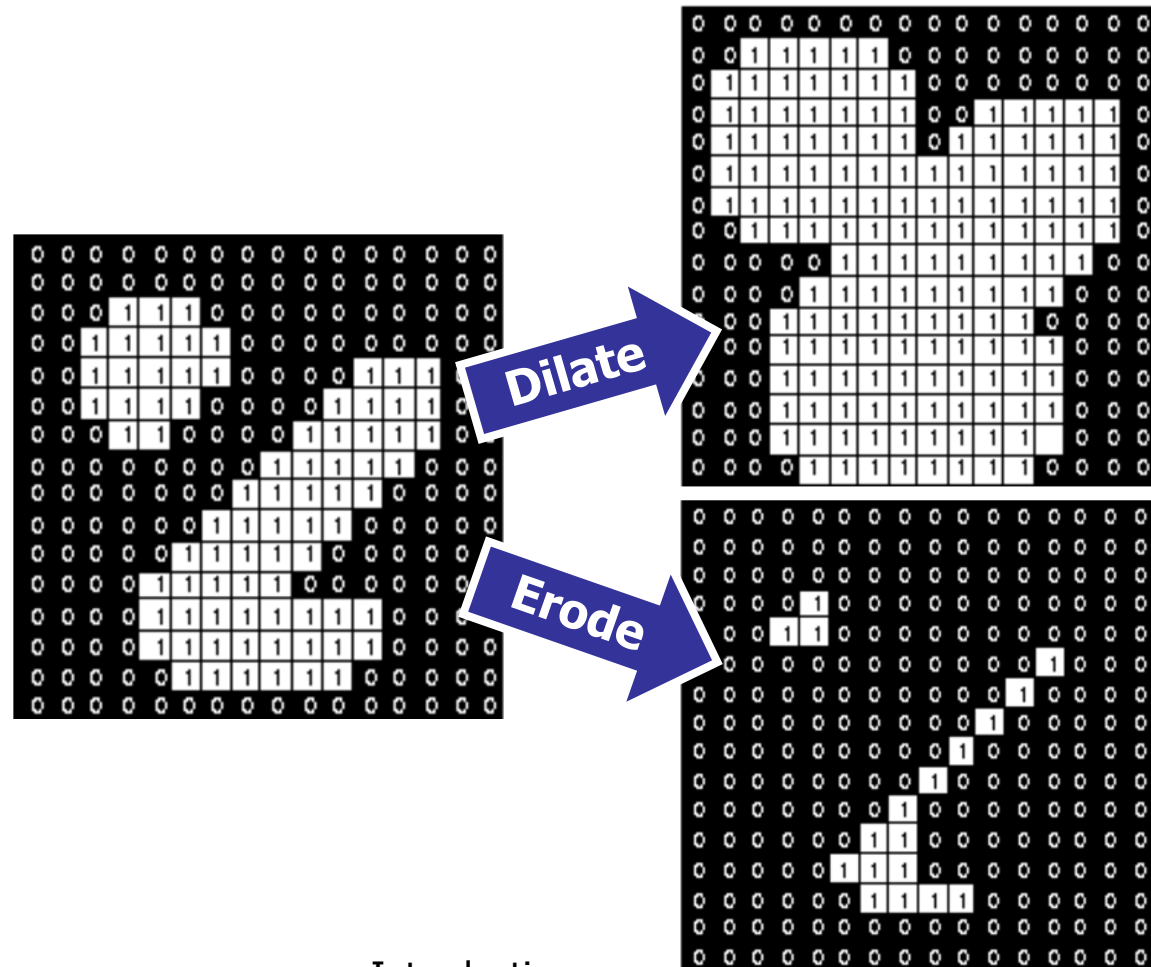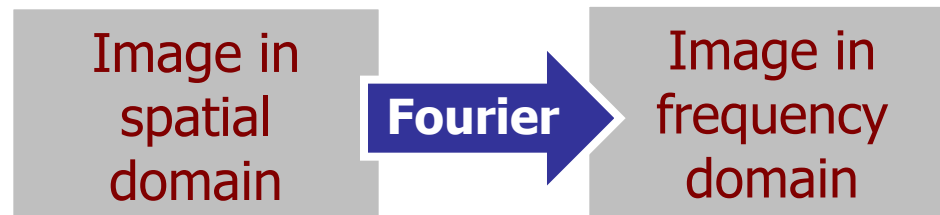# Topics Covered: Morphology

- Dilation
- Erosion
- Opening
- Closing
- ...

Dilate

Erode

Topics Covered: Fourier Transform

- **Fourier transform** is used to transform the image from spatial domain to frequency domain.

Image in spatial domain	**Fourier** →	Image in frequency domain

Topics Covered: Low Pass Filters

- **Low** pass filter

  - **passes** signals with a frequency **lower** than a cutoff frequency and

  - **attenuates** signals with a frequency **higher** than the cutoff frequency
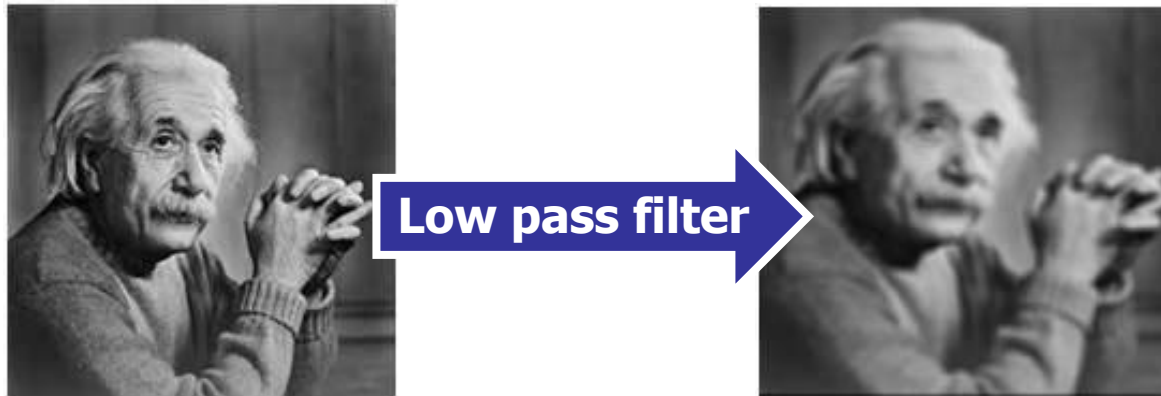
Low pass filter

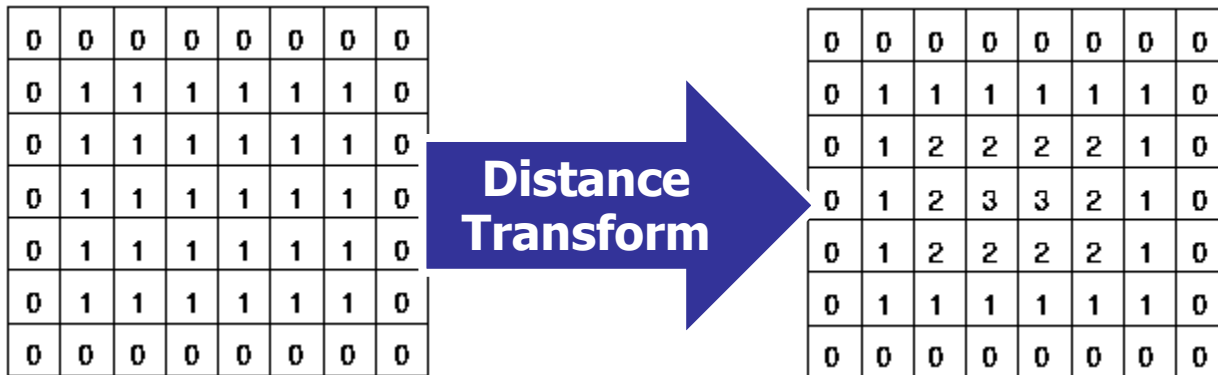# Topics Covered: High Pass Filters

- **High** pass filter
  - **passes** signals with a frequency **higher** than a cutoff frequency and
  - **attenuates** signals with a frequency **lower** than the cutoff frequency
- Such a filter highlights regions with step intensity variations as edges

High pass filter

Topics Covered:
Distance Transform

- Applied to binary images.

- Outputs a gray-scale image similar to the input image.

- The gray-scale intensities of points inside foreground regions show the distance to the closest boundary from each point

0	0	0	0	0	0	0	0
0	1	1	1	1	1	1	0
0	1	1	1	1	1	1	0
0	1	1	1	1	1	1	0
0	1	1	1	1	1	1	0
0	1	1	1	1	1	1	0
0	0	0	0	0	0	0	0

Distance Transform →

0	0	0	0	0	0	0	0
0	1	1	1	1	1	1	0
0	1	2	2	2	2	1	0
0	1	2	3	3	2	1	0
0	1	2	2	2	2	1	0
0	1	1	1	1	1	1	0
0	0	0	0	0	0	0	0

Topics Covered: Compression Types

- Two types of compression:
    - **Lossless compression**
        - Minimize the bit rate without causing distortion. The same quality is maintained.
    - **Lossy compression**
        - Get **best fidelity** for a **given bit rate**
        - Get **minimum bit rate** for a **given fidelity**

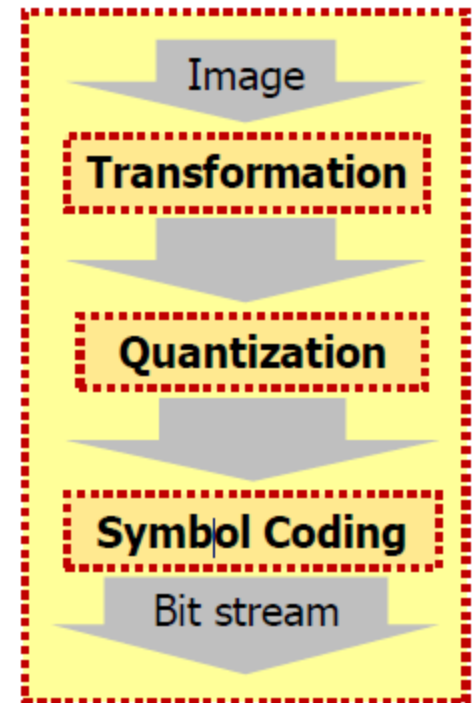# Topics Covered: Compression Steps

- **Transformation:**
  - Transform data to be ready for compression.
- **Quantization:**
  - Limit the number of symbols to represent the data.
  - This step is not used for lossless compression.
- **Symbol coding:**
  - Minimize the average codeword length used to represent the symbols.
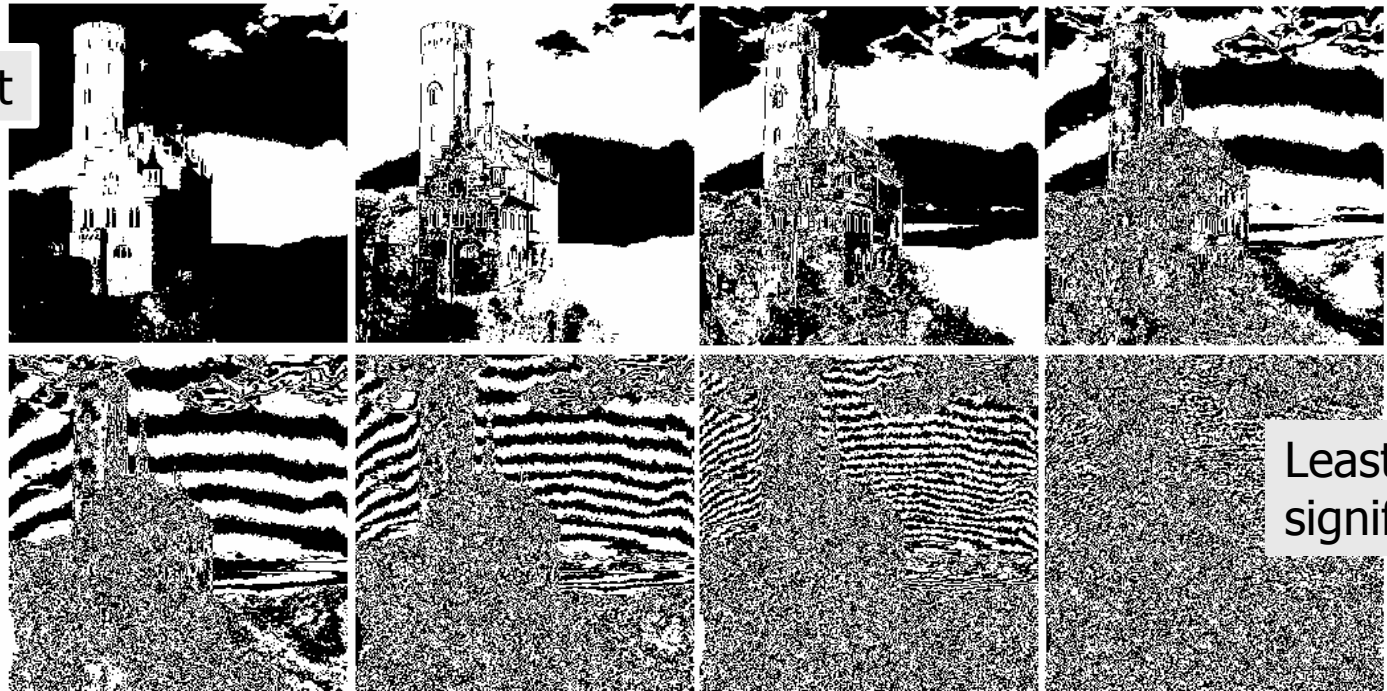
Topics Covered: Compression Techniques

- Lossless predictive coding
- Bit-plane coding (example below)
- LZW coding

Most significant

Least significant