

# 046200 – Image Processing And Analysis

The course is given by Professor Israel Cohen from the Electrical Engineering faculty.

## Course Objectives and Targets:

This course is a fundamental course in digital image processing theory. During the course we explore the basic tools for processing and restoring of gray-level images. We discuss the basic aspects of lossless/lossy image compression and the use of neural networks and deep learning in image pattern classification.

## Lecture Topics:

1. Introduction to vision and image processing.
2. Two-Dimensional Discrete Fourier Transform.
3. Image Sampling, Interpolation, Aliasing, Uniform Quantization, False Contouring, Dithering.
4. Basic Tools in Digital Image Processing.
5. Intensity Transformations and Histogram Processing.
6. Spatial Filtering, Smoothing, Sharpening, Filtering in the Fourier Domain.
7. Image Restoration and Reconstruction, Noise Models, Linear Position Invariant Degradations, Inverse Filtering, Minimum Mean Square Error (Wiener) Filtering, Constrained Least Squares Filtering, ML estimation, MAP estimation, Iterative Reconstruction.
8. Image Compression, Lossless Compression, Lossy Compression, Huffman Coding, Predictive Coding, Transform Coding, Optimal Quantization (Max-Lloyd).
9. Neural Networks and Deep Learning, Deep Convolutional Neural Networks, Image Pattern Classification.

Prerequisites:

1. Sufficient background in Digital Signal Processing. In particular, we assume knowledge of the following topics:

Linear systems. Fourier transforms of continuous and discrete signals.

Frequency responses of continuous and discrete systems. Sampling theorem and perfect reconstruction. Discrete Fourier Transform (DFT) and its properties.

Cyclic convolution and its relation to DFT.

2. Sufficient background in Probability. In particular, we assume knowledge of the following topics:

Conditional probability. Random variables. Transformation of random variables. Expectations and moments. Discrete and continuous distributions.

Vector of random variables and their joint distributions. Conditional distributions and expectations.