Eötvös Loránd University, Budapest, Hungary, 2005 – 2007 Fall, Spring
Instructor: Barnabás Póczos

This is a graduate-level introductory course to image processing. We cover basic methods such as filtering, compressing, denoising, Fourier transformation, and discuss applications in AI, computer vision, and pattern recognition. The course project assignments require programming in Matlab, C++, or Java.

Frequency domain
- Discrete cosine transformation.

Compression and Denoising

Filtering
- Edge detection: Sobel, Prewitt, Roberts, Laplacian, Canny, zero-cross methods.
- Corner detection.

Active contour models
- Parameter learning of AR dynamics. The Condensation algorithm.

Mutual information and dependence estimation
- Euclidean graph optimization. Image registration with mutual information.
- Independent component analysis. Edge detection using ICA.

Matrix Factorization
- NMF components on face datasets. NMF, PCA, and ICA components on natural images.

Boosting

Support Vector Machines
- Introduction to kernel machines and SVMs.
- Image classification.

Hidden Markov Models
- Parameter estimation of hidden Markov models (HMM).
- Facial expression recognition using HMM and PCA/ICA.

Texture synthesis
- Markov Random Fields.
- Image quilting.
- Wavelet based methods.