

BASIC IMAGE PROCESSING ALGORITHMS

1. SYLLABUS INFORMATION

1.1. Course title

Basic Image Processing Algorithms

1.2. University

Pázmány Péter Catholic University

1.3. Semester

1st year, 1st semester

2. COURSE DETAILS

2.1. Course nature

Compulsory

2.2. ECTS Credit allotment

5

2.3. Faculty data

Dr. Benedek Csaba

3. COMPETENCES AND LEARNING OUTCOMES

3.1. Course objectives

The aim of the course is to give an introduction to the basic algorithms used in digital image processing and computer vision. The lectures in the first part of the semester cover various topics from the classical image processing era, such as image representation, 2D convolutions, image enhancement and recovery, texture analysis and Fourier space based image filtering. The second part of the course is dedicated to more recent tools, including Meanshift and Markov Random Field segmentation models, extraction and utilization of SIFT, HOG and BLP descriptors, and the basics of using machine learning approaches for image recognition problems. For attending this course, no prior knowledge of image processing or computer vision is assumed. However, the participating students need to have a good programming background, and experience with different data structures, linear algebra, vector calculus, and the basics of signal processing.

3.2. Course contents

1. Introduction: History and Applications, Digital representation of an image, Color Spaces
2. 2D convolution and its applications
3. Canny edge detector, Hough transformation & Image Enhancement (part 1)
4. Enhancement (part 2), Fourier analysis
5. Texture analysis
6. Image recovery
7. Image segmentation: Intro, K-means and Morphology
8. Markov Random Fields

9. Watershed and Mean shift
10. Descriptors (Harris, SIFT)
11. Descriptors II (HOG, LBP, binary descriptors)
12. Machine Learning - supervised algorithms
13. Introduction to Deep Learning

3.3. Course bibliography

W. K. Pratt: Digital Image Processing, Wiley, 2001

Richard Szeliski, "Computer Vision. Algorithms and Applications." Springer, London, 2011

MSeul, L. O’Gorman and M. J. Sammon, "Practical Algorithms for Image Analysis", Cambridge University Press, Cambridge, 2012

4. EVALUATION PROCEDURES AND WEIGHT OF COMPONENTS IN THE FINAL GRADE

Exam