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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. Recommendations

2.4. Faculty data
Prof. Csaba Benedek

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 Mean shift 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
Introduction: History and Applications, Digital representation of an image, Color Spaces
2D convolution and its applications (Canny edge detector, Hough transformation)
Image Enhancement
Image analysis in the Fourier domain
Texture analysis

Image recovery
Image segmentation: Intro, K-means and Morphology
Markov Random Fields
Watershed and Mean shift
Descriptors I (Harris, SIFT)
Descriptors II (HOG, LBP, binary descriptors)
Machine Learning – supervised algorithms
Introduction to Deep Learning

3.3. Course bibliography

[1] W. K. Pratt, "Digital Image Processing," Wiley, 2001
[2] R. Szeliski, "Computer Vision. Algorithms and Applications," Springer, London, 2011
[3] M. Seul, L. O'Gorman and M. J. Sammon, "Practical Algorithms for Image Analysis," Cambridge University Press, Cambridge, 2012

4. TEACHING-AND-LEARNING METHODOLOGIES AND STUDENT WORKLOAD

4.1. Contact hours

	Hours
Classroom instruction (minimum 33%)	48
Independent study time	48

4.2. List of training activities

Activity	Hours
Lectures	24
Practice	12
Computer lab	12
Assessment activities	4

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

5.1. Regular assessment

5.2. List of evaluation activities

Evaluatory activity	%
Final exam	50
Programming assignments/classroom activities	50