Course name: **Computer vision, pattern recognition and image retrieval**		
Field of study: **Computer science**	Type of study: **Full time**	Course code: **CIDM3_01**
Course characteristics: **Mandatory within the speciality of Computational Intelligence and Data Mining**	Level: **Second (MSc.)**	Year: **II** Semester: **III**
Type of classes: **lectures, laboratories, exercises**	Hours per week: **2 lect exam, 2 lab, 1 ex**	ECTS points: **5 ECTS**

COURSE GUIDE

Aims

C1. familiarize students with the problems of computer vision, pattern recognition and image retrieval

C2. acquisition by students practical skills in the use of methods and techniques of computer vision, pattern recognition and image retrieval

Prerequisites

1. This course requires programming experience as well as linear algebra, basic calculus, and basic probability.
2. Previous knowledge of neural networks or machine learning will be important.
3. Previous knowledge of evolutionary or genetic algorithms will be helpful.

Learning outcomes

EE 1 – the student has a broad knowlegde of computer vision,

EE 2 – the student has a broad knowlegde of pattern recognition,

EE3 – the student has a broad knowlegde of image retrieval,

EE 4 – the student is able to put into practice the methods of computer vision,

EE 5 – the student is able to put into practice the methods of pattern recognition,

EE 6 – the student is able to put into practice the methods of image retrieval,

EE 7 – the student has wide powers of selection techniques and algorithms for computer vision, pattern recognition and image retrieval.

Content

LECTURES		**hours**
Lect 1	Introduction to computer vision: optics, geometric transformations and cameras	**2**
Lect 2	Mathematical foundamentals and types of data in image processing	**2**
Lect 3	Image processing techniques: filtering, fourier transforms, wavelets	**2**
Lect 4	Feature detection techniques: points, patches, edges	**2**
Lect 5	Segmentation methods	**2**
Lect 6	Stereovision, multiple views and motion	**2**
Lect 7	3D Reconstruction	**2**
Lect 8	Artificial intelligence for clustering and classification	**2**
Lect 9	Dimensionality reduction: feature extraction methods (PCA, LDA..., Haar)	**2**

Lect 10	Recognition: object detection, category recognition, scene understanding	**2**
Lect 11	2D and 3D Face recognition	**2**
Lect 12	Content-based Image Retrieval using low-level features	**2**
Lect 13	Points detectors and descriptors: Speed Up Robust Feature, Scale Invariant Feature Transform	**2**
Lect 14	Features comparing techniques	**2**
Lect 15	Understanding images	**2**

LABORATORY		**hours**
Lab 1	Introduction to computer vision: optics, geometric transformations and cameras	**2**
Lab 2	Mathematical foundamentals and types of data in image processing	**2**
Lab 3	Image processing techniques: filtering, Fourier transforms, wavelets	**2**
Lab 4	Feature detection techniques: points, patches, edges	**2**
Lab 5	Segmentation methods	**2**
Lab 6	Stereovision, multiple views and motion	**2**
Lab 7	3D Reconstruction	**2**
Lab 8	Artificial intelligence for clustering and classification	**2**
Lab 9	Dimensionality reduction: feature extraction methods (PCA, LDA..., Haar)	**2**
Lab 10	Recognition: object detection, category recognition, scene understanding	**2**
Lab 11	2D and 3D Face recognition	**2**
Lab 12	Content-based Image Retrieval using low-level features	**2**
Lab 13	Points detectors and descriptors: Speed Up Robust Feature, Scale Invariant Feature Transform	**2**
Lab 14	Features comparing techniques	**2**
Lab 15	Understanding images	**2**

Exercises		**hours**
Ex 1	Introduction to computer vision: optics, geometric transformations and cameras	**1**
Ex 2	Mathematical foundamentals and types of data in image processing	**1**
Ex 3	Image processing techniques: filtering, Fourier transforms, wavelets	**1**
Ex 4	Feature detection techniques: points, patches, edges	**1**
Ex 5	Segmentation methods	**1**
Ex 6	Stereovision, multiple views and motion	**1**
Ex 7	3D Reconstruction	**1**
Ex 8	Artificial intelligence for clustering and classification	**1**
Ex 9	Dimensionality reduction: feature extraction methods (PCA, LDA..., Haar)	**1**
Ex 10	Recognition: object detection, category recognition, scene understanding	**1**
Ex 11	2D and 3D Face recognition	**1**
Ex 12	Content-based Image Retrieval using low-level features	**1**
Ex 13	Points detectors and descriptors: Speed Up Robust Feature, Scale Invariant Feature Transform	**1**
Ex 14	Features comparing techniques	**1**
Ex 15	Understanding images	**1**

Teaching tools

1. lecture with the use of multimedia presentations
2. materials, literature and the website of the subject
3. instructions for the laboratory and excersizes

Literature

G.X. Ritter, J.N. Wilson, Handbook of Computer Vision Algorithms in Image Algebra, CRC Press, 2001
D.A. Forsyth, J. Ponce, Computer Vision: A Modern Approach (2nd Edition), Prentice Hall, 2011
B. Jahne (Eds.), Handbook of Computer Vision and Applicaations, Parts 1,2,3, Academic Press, 1999
R. Szeliski, Computer Vision: Algorithms and Applications, Springer; 2011 edition

Li Zhaoping, Understanding Vision: Theory, Models, and Data, Oxford University Press, 2014
C.M. Bishop, Pattern Recognition and Machine Learning, Springer, 2007
SK. Vasudevan, PLK. Priyadarsini, S. Vasudevan, Content Based Image Retrieval, LAP 2012

Teacher

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Additional notes

1. All information for students is available on the website of the Institute of Computational Intelligence
2. Information on the consultation is placed on the personal website of the lecturer of the Institute of Computational Intelligence in the first week of classes.