COURSE DESCRIPTION CARD - SYLLABUS

Course name

Modal analysis and machine learning

Course

Field of study

Biomedical Engineering

Year/Semester

3/6

Area of study (specialization)

-

Profile of study

general academic

Level of study

First-cycle studies

Course offered in

Polish

Form of study

full-time

Requirements

elective

Number of hours

Lecture

15

Laboratory classes

15

Other (e.g. online)

0

Tutorials

0

Projects/seminars

0

Number of credit points

2

Lecturers

Responsible for the course/lecturer:

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Wydział Inżynierii Mechanicznej

ul. Jana Pawła II 24, 60-965 Poznań

Responsible for the course/lecturer:

Prerequisites

KNOWLEDGE: the student has basic knowledge of information technology and biomedical engineering

SKILLS: the student is able to integrate the obtained information and interpret it

SOCIAL COMPETENCES: the student is able to cooperate in a project team, is aware of the responsibility for the tasks performed, understands the need to acquire new knowledge

Course objective

Students gain knowledge about the techniques of analysis and processing of medical data. They will learn selected data analysis techniques, such as principal component analysis (PCA), LLE (locally linear embedding), support vector machines (SVM) and others in the field of machine learning and artificial

intelligence, in order to further interpret medical data and create 3D tissue-specific models for the patient.

Course-related learning outcomes

Knowledge

Has a basic knowledge of computer science that allows to use the basics of algorithmics, compilers and programming languages, multimedia techniques, software and Internet tools, computer-aided engineering systems in biomedical engineering and technology.

He knows the basic methods of techniques and tools in the area of computer graphics, thanks to which he can understand and describe: processing real images into digital form, digital image processing, methods of improving the quality of digital images.

He has detailed knowledge of digital image processing, thanks to which he can describe: images and signals, observations and measurements, digital image processing, image analysis methods, reduction of feature space dimensionality - cluster analysis, classification and recognition; can recognize images; present selected classification problems, IT tools for image processing, analysis and recognition..

Skills

Can use the methods of image analysis and processing to carry out tasks in the field of biomedical engineering.

Can plan computer simulations, interpret the obtained results and draw conclusions. He can use computer aids to solve technical tasks, in particular in the field of visualization and analysis of data from medical imaging, segmentation, registration and detection of shapes and their contours.

Has the ability to self-educate. s.

Social competences

Understands the need for lifelong learning; can inspire and organize the learning process of other people.

Can properly define priorities for the implementation of a task set by himself or others.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Test / colloquium and evaluation of tasks performed during the laboratory classes. Points are awarded for both items. The condition for receiving a positive evaluation is obtaining at least 50% of the possible points.

Programme content

Data sources in medical diagnostics.

Basics of working in the Python + OpenCV environment. Image transformations.

Detection of objects and contours. Segmentation and registration. Creation of 3D models based on DICOM data.

Low-dimensional (modal) analysis of medical data. Principal component analysis of PCA and derivative methods. Locally linear embedding (LLE).

Machine learning and artificial intelligence in biomedical engineering. Support vector machines (SVM) in regression and classification applications, logistic and linear regression. Neural networks.

Teaching methods

Information / problem lecture, case study, multimedia presentation, computer lab.

Bibliography

Basic

A. Geron. Uczenie maszynowe z użyciem Scikit-Learn i TensorFlow. Helion, 2020. ISBN: 978-83-283-6002-0

A. Kaehler, G. Bradski. OpenCV 3. Komputerowe rozpoznawanie obrazu w C++ przy użyciu biblioteki OpenCV. Helion, 2017. ISBN: 978-83-283-1656-0

M. Gągolewski, M. Bartoszuk, A. Cena. Przetwarzanie i analiza danych w języku Python. PWN, Warszawa, 2016. ISBN: 9788301189402

Additional

M. Dawson: Python dla każdego. Podstawy programowania. Helion, 2014. ISBN: 978-83-246-9358-0

B. Menze, G. Langs, Z. Tu, A. Criminisi. Medical Computer Vision. Recognition Techniques and Applications in Medical Imaging. Springer, 2011.

J. Howse. OpenCV Computer Vision with Python. Packt Publishing Limited, 2013. ISBN: 9781782163923

Breakdown of average student's workload

	Hours	ECTS
Total workload	50	2,0
Classes requiring direct contact with the teacher	30	1,0
Student's own work (literature studies, preparation for laboratory classes, preparation for tests, project preparation) [1]	20	1,0

[1] delete or add other activities as appropriate