COURSE DESCRIPTION CARD - SYLLABUS

Course name
Computer aided detection and diagnosis [S2IBio1-BiIW>WiDWK]

Course

Field of study
Biomedical Engineering

Year/Semester
2/3

Area of study (specialization)
Bionics and Virtual Engineering

Profile of study
general academic

Level of study
second-cycle

Course offered in
Polish

Form of study
full-time

Requirements
elective

Number of hours

Lecture
15

Laboratory classes
15

Other
0

Tutorials
0

Projects/seminars
0

Number of credit points

2,00

Coordinators

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Lecturers

Prerequisites

The student has basic knowledge and skills in the field of programming and medical image processing. The student is able to independently write a program in the selected programming language that allows for the opening of the image files and their initial digital processing. Student understands the need to learn and constantly acquire new knowledge.

Course objective

To give students the knowledge about the basic computer techniques enabling support of the physician"s work in the field of signal processing and medical images, their automatic analysis, detection of pathological changes and supporting the doctor"s diagnosis.

Course-related learning outcomes

Knowledge:
Student has basic knowledge of the use of artificial intelligence methods in the field of detecting pathological changes in medical images, indicating the possibility of disease occurrence or estimating a selected parameter.
He knows the basic examples of CADe (computer aided detection) and CADx (computer aided diagnosis)

applications in medicine.

Skills:
Student can use selected techniques of artificial intelligence and data mining in the processing of signals and medical images by writing a program in a selected programming language using publicly available databases and programming libraries.

Social competences:
Student understands the need for lifelong learning.
Student is able to set priorities for the implementation of a task set by himself or others.
Student is aware of the social role of a technical university graduate and understands the need to formulate and experience the society, in particular through the mass media, information and opinions on technological achievements and other aspects of engineering activities.
Student is aware of the importance of computer-aided detection and diagnosis in medicine and the modern world.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

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Lecture: final test.
Passing requires more than 50% of points:> 50% - dst,> 60% - dst plus,> 70% - db,> 80% - db plus,> 90% of points - very good
Project: ongoing consultations on the progress in the implementation of project tasks, evaluation of the final effect of the work - in the form of a written program and a prepared report.

Programme content

Techniques for detection of selected objects, e.g. anatomical elements in medical images, and classification of selected diseases - theoretical basis and examples of applications.

Course topics

Lecture:
Introduction to CADe (computer aided detection) and CADx (computer aided diagnosis).
Segmentation of medical images.
Artificial intelligence and data mining methods in computer aided detection and diagnosis.
Methods to enhance essential features and suppress background noise in medical images.
Methods for detecting important features of objects in medical images and biological signals.
Methods for detecting and classifying objects, e.g. pathological changes, in medical images.
Methods allowing to estimate selected parameters of the human body or particular tissues.
Design:
Project topics individually selected in the field of computer-aided detection and diagnosis.

Teaching methods

1. Lecture with multimedia presentation
2. Projects - solving individual project tasks

Bibliography

Basic
1. L. Rutkowski, Metody i techniki sztucznej inteligencji, Wydawnictwo Naukowe PWN, Warszawa 2012 [in Polish].
2. R. Tadeusiewicz, M. Szaleniec, Leksykon sieci neuronowych, Wydawnictwo Fundacji „Projekt Nauka”, Wrocław 2015 [in Polish].
3. Z. Wróbel, R. Koprowski, Praktyka przetwarzania obrazów z zadaniami w programie Matlab, Akademicka Oficyna Wydawnicza EXIT, Warszawa 2012 [in Polish].
4. G. Sarbicki, Python. Kurs dla nauczycieli i studentów, Wydawnictwo Helion, Gliwice 2019 [in Polish].
5. M. Kirk, Python w uczeniu maszynowym, APN Promise, Warszawa 2018 [in Polish].
Additional

1. Qiang Li, Robert M. Nishikawa (eds.), Computer-Aided Detection and Diagnosis in Medical Imaging, CRC Press 2015.
2. Paulo Mazzoncini de Azevedo-Marques, Arianna Mencattini, Marcello Salmeri, Rangaraj M. Rangayyan (eds.), Medical Image Analysis and Informatics: Computer-Aided Diagnosis and Therapy, CRC Press 2018.

Breakdown of average student's workload

	Hours	ECTS
Total workload	50	2,00
Classes requiring direct contact with the teacher	30	1,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	20	1,00