COURSE DESCRIPTION CARD - SYLLABUS

Course name
Advanced techniques in medical images processing

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 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:
dr hab. inż. Witold Stankiewicz

Zakład Inżynierii Wirtualnej

Instytut Mechaniki Stosowanej

Politechnika Poznańska

e-mail: witold.stankiewicz

Responsible for the course/lecturer:
dr inż. Jakub Grabski

Zakład Mechaniki Technicznej

Instytut Mechaniki Stosowanej

Politechnika Poznańska

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Prerequisites

- basic knowledge of computer science, programming basics and digital images processing,

- basic programming skills,

- understanding the need to learn and constantly acquire new knowledge.

Course objective

Getting familiarized students with advanced techniques in digital images processing based on selected medical images examples.

Course-related learning outcomes

Knowledge

1. Student has an extended and deepened knowledge of mathematics and computer science, useful for formulating and solving complex engineering tasks in the field of biomedical engineering.

2. Student has knowledge of engineering information systems.

3. Student knows the basic methods, techniques and tools used in solving complex engineering tasks.

Skills

1. Student is able to obtain information from literature, databases and other properly selected sources (also in English).

2. Student is able to use information and communication techniques appropriate to the implementation of tasks typical for engineering activities.

3. Student has the ability to implement selected algorithms, as well as to use publicly available functions and codes in order to carry out a specific engineering task in biomedical engineering and technology.

4. Student is able to assess the usefulness of methods and tools for solving an engineering task.

Social competences

1. Student is aware of the importance and understanding of non-technical aspects and effects of engineering activities

2. Student is able to set priorities for the implementation of the tasks set by himself or others

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Credit for the lecture on the basis of a written work. The student obtains a grade on the basis of the obtained result:

below 50% - insufficient

(50%; 60%> - sufficient

(60%; 70%> - a sufficient plus

(70%; 80%> - good

(80%; 90%> - a good plus

over 90% - very good

Assessment from the laboratory obtained on the basis of the current control of students' knowledge through tests.

Programme content

Lectures:

1. Image segmentation techniques.

2. Application of the region growing technique in the segmentation of medical images.

3. Application of the split and merge algorithm in the segmentation of medical images.

4. Application of the watershed segmentation algorithm (inspired by nature and geography - from the theory of river catchments) in the segmentation of medical images.

5. Advanced image filtering techniques.

6. Examples of the application of selected image filtration techniques in biomedical engineering.

7. Selected application of artificial intelligence methods in medical image processing.

During laboratory exercies, students will have the opportunity to independently test the algorithms learned during the lectures on selected examples of medical images in a selected programming environment (MATLAB / Python).

Teaching methods

1. Lecture: multimedia presentation supported by examples on the board and in advanced engineering software.

2. Laboratory: solving project tasks, discussion.

Bibliography

Basic

1. R. Koprowski, Z. Wróbel, Praktyka przetwarzania obrazów z zadaniami w programie Matlab, Akademicka Oficyna Wydawnicza EXIT, Warszawa 2012 [in Polish].

2. R. Tadeusiewicz, P. Korohoda, Komputerowa analiza i przetwarzanie obrazów, Wydawnictwo Fundacji Postępu Telekomunikacji, Kraków 1997 [in Polish].

Additional

1. R.C. Gonzalez, R.E. Woods, S.L. Eddins, Digital Image Processing using MATLAB, Gatesmark Publishing, 2009.

2. W. Birkfeller, Applied Medical Image Processing. A basic course, Taylor and Francis Group, LLC, 2011.

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/tutorials, preparation for tests/exam, project preparation) [1]	20	1,0

[1] delete or add other activities as appropriate