COURSE DESCRIPTION CARD - SYLLABUS

Course name
Biometrics [S1IBio1E>PB]

Course

Field of study
Biomedical Engineering

Year/Semester
4/7

Area of study (specialization)
–

Profile of study
general academic

Level of study
first-cycle

Course offered in
english

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

2,00

Coordinators

Lecturers

Prerequisites

1. Basics knowledge in computer science and general programming. 2. Skills of logical thinking, general programming, use of information obtained from literature, the Internet and other sources. 3. Understanding the need for learning and acquiring new knowledge.

Course objective

To familiarize students with biometric methods of person recognition and identity verification based on such individual features as fingerprints, iris, voice, etc.

Course-related learning outcomes

Knowledge:
1. student has basic knowledge in computer science that allows him/her to describe the architecture of computer systems; to use basics of algorithmics, databases and relational databases, compilers and programming languages, procedural and object-oriented programming, multimedia techniques, internet software and tools, systems of computer aided engineering in biomedical engineering and technology [k_w04].
2. student has detailed knowledge about digital signal processing, which allows him/her to describe: systems and signals, observations and measurements, signal sources, methods of signal acquisition, analogue and discrete signals, digital signal processing, methods of signal analysis, non-parametric and

parametric methods for determination of signal features, reduction of dimension of characteristic space –data clustering, classification and identification; he/she knows how to identify images; present: selected classification issues, elements of system diagnostics, it processing, analytical and signal identification tools [k_w18].
3. student knows basic methods, techniques and tools of computer graphics that let him/her understand and describe: processing real images into digital form, digital image processing, binary images, methods for creation of full colour images, devices used for acquisition of real images, methods of quality correction of digital images [k_w24].

Skills:
1. student knows how to retrieve information from literature, databases and other properly selected sources (also in english) in the area of biomedical engineering; in particular he/she knows how to combine this information with technical aspects and engineering design, how to interpret it and how to draw conclusions and formulate and justify opinions [k_u01].
2. student has the skill of self-learning.się [k_u05].
3. student knows how to use computer aided design to solve technical problems [k_u08].
4. student knows how to formulate problems and how to use mathematical methods to analyze technical issues; in particular for digital image processing [k_u10].
5. student knows how to apply methods of image analysis and processing to carry out tasks in biomedical engineering [k_u11].

Social competences:
1. student is well aware of the necessity for continuous learning [k_k01].
2. student knows how to prioritize in order to carry out a task either defined by him/herself or by others [k_k04].
3. student is well aware of the social role of a graduate of a technical university, understands the need to formulate and inform the public through mass media about technical achievements and of other aspects of engineering activity and makes sure that such information and opinions are conveyed in a way that is generally understood [k_k07].

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Learning outcomes presented above are verified as follows:
Lecture – final test.
Depending on the percentage of the student"s performance on the tests, the following scores are awarded:
2 (not enough) <0 points; 50 points>
3 (sufficient) (50 points; 60 points>
3+ (positive plus) (60 points; 70 points>
4 (good) (70 points; 80 points>
4+ (good plus) (80 points; 90 points >
5 (very good) (90 points; 100 points>
Laboratory – credit based on:
- oral or written answer regarding the content of each laboratory exercise. To get credit, all exercises must be passed,
- final test - an individual task carried out by the student on his / her last class.
Depending on the obtained sum of points and resulting percentage, the following scores are awarded:
2 (not enough) <0%; 50%>
3 (sufficient) (50%; 60%>
3+ (positive plus) (60%; 70%>
4 (good) (70%; 80%>
4+ (good plus) (80%; 90%>
5 (very good) (90%; 100%>

Programme content

Lecture:
1. Biometrics - general characteristics, a brief history of biometrics.
2. The use of biometrics in security systems.

3. Limitations of biometrics.
4. Selected image processing algorithms useful in various types of biometrics.
5. Identification of persons based on fingerprints.
6. Identification of people based on facial photos.
7. Identification of persons on the basis of voice recording.
8. Identification of people based on iris pictures.
9. Identification of people based on body posture and movement (gait).
10. Identification of people using other types of biometrics (recognition of hand shapes, based on thermographic images, DNA, handwriting and others).
Laboratory:
1. Basics of image processing in MATLAB.
2. Fingerprint recognition - practical issues.

Teaching methods

1. Lecture: multimedia presentation supported by examples on the blackboard.
2. Laboratory: programming in MATLAB, performing tasks, discussion.

Bibliography

Basic
1. R.M. Bolle, J.H. Connell, S. Pankanti, N.K. Ratha, A.W. Senior, Biometria, Wydawnictwa Naukowo-Techniczne, Warszawa 2008 [in Polish].
2. Z. Wróbel, R. Koprowski, Praktyka przetwarzania obrazów z zadaniami w programie Matlab, Akademicka Oficyna Wydawnicza EXIT, Warszawa 2012 [in Polish].
3. D. Maltoni, D. Maio, A.K. Jain, S. Prabhakar, Handbook of fingerprint recognition, Springer, 2003.
4. S.Z. Li, A.K. Jain, Handbook of face recognition, Springer, 2005.
Additional
1. K. Ślot, Wybrane zagadnienia biometrii, Wydawnictwa Komunikacji i Łączności, Warszawa 2008 [in Polish].
2. K. Ślot, Rozpoznawanie biometryczne. Nowe metody ilościowej reprezentacji obiektów, Wydawnictwa Komunikacji i Łączności, Warszawa 2010 [in Polish].

Breakdown of average student's workload

	Hours	ECTS
Total workload	75	3,00
Classes requiring direct contact with the teacher	40	1,50
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	35	1,50