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BIOMETRICS – INTRODUCTION AND FUNDAMENTALS

Poznan University of Technology [PUT]

<table>
<tr><th colspan="2">1. IDENTIFYING DATA.</th></tr>
<tr><td>· Course Name.</td><td>Biometrics – introduction and fundamentals.</td></tr>
<tr><td>· Coordinating University.</td><td>Poznan University of Technology</td></tr>
<tr><td>· Partner Universities Involved.</td><td>Not applicable.</td></tr>
<tr><td>· Course Field(s).</td><td>Biomedical Engineering, Computer science.</td></tr>
<tr><td>· Related Study Programme.</td><td>B.Sc. & M.Sc. Biomedical Engineering, M.Sc. Environmental and Resource Management, B.Sc. & M.Sc. Mechanical Engineering, B.Sc. & M.Sc. Artificial Intelligence</td></tr>
<tr><td>· ISCED Code.</td><td>0611 Computer use</td></tr>
<tr><td>· SDG.</td><td>Industry, innovation and infrastructure</td></tr>
<tr><td>· Study Level.</td><td>Bachelor [B], Masters [M]</td></tr>
<tr><td>· EUNICE Key Competencies</td><td>[Indicate the Key Competencies required for the course.]
• Green – strongly
• Orange- moderately
• Red – partially
• Blank cell - not at all
<table><tr><td>Problem solving</td><td>Orange- moderately</td></tr><tr><td>Teamworking</td><td>not at all</td></tr><tr><td>Communication</td><td>not at all</td></tr><tr><td>Self-management</td><td>Green – strongly</td></tr><tr><td>Cognitive flexibility</td><td>Red – partially</td></tr><tr><td>Digital competence</td><td>Green – strongly</td></tr></table></td></tr>
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	Technical competence	Green – strongly
	Global intercultural competence	not at all

· Number of ECTS credits allocated.	2
· Mode of Delivery.	Online self-study
· Language of Instruction.	English
· Course Dates.	*Start: 5th March, last lecture: 30th April, Final test 15th May*
· Precise Schedule of the Lectures.	Each week a new topic will be available for students on the course website.
· Key Words.	Biometrics, biometric features, face recognition, human recognition/identification
· Catchy Phrase.	"Discover your biometric features"

· Prerequisites and co-requisites.	Basics knowledge in human anatomy. Basics knowledge in computer science. EUNICE student: enrolled as a student in one of the 10 universities of EUNICE European University alliance. English level B2
· Number of EUNICE students that can attend the Course.	20 students + (1 x 10 partners university) = 30 students (total)
· Course inscription procedure(s).	Registration for the course on the EUNICE eLearning platform (moodle)

2. CONTACT DETAILS.	
· Department.	Institute of Applied Mechanics
· Name of Lecturer.	dr hab. inż. Michal Rychlik, dr inż. Jakub Grabski, dr hab. inż. Witold Stankiewicz

· E-mail.	michal.rychlik@put.poznan.pl , jakub.grabski@put.poznan.pl , witold.stankiewicz@put.poznan.pl
· Other Lecturers.	-

3. COURSE CONTENT.

Introduce to the latest biometric technology and its applications.
- Basic and fundamental theories and algorithms for different types of biometrics.
- How to develop a biometric system.
- Digital image processing and 3D data processing
- Machine learning in biometrics

4. LEARNING OUTCOMES.

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, internet software and tools, systems of computer aided engineering in biomedical engineering and technology. Student knows basic methods and techniques of describing the biometrics features and numerical tools (such Principal Component Analysis) for data processing, digital image processing, obtaining the 3D data of human face, hand for biometrics purpose, binary images and methods for creation of full colour images, devices used for acquisition of real images, methods of quality correction of digital images, methods for human identification based on machine learning.

5. OBJECTIVES.

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

6. COURSE ORGANISATION.

UNITS	
1.	Biometrics - general characteristics, a brief history of biometrics.
2.	The use of biometrics in security systems and limitations of biometrics.
3.	Selected image processing algorithms useful in various types of biometrics: fingerprints and iris images.
4.	Obtaining 3D data for biometrics: human face, hand and others.
5.	Introduction of use of Principal component analysis for 3D data processing.
6.	Identification of people based on 3D biometrics features: face, hand and femur bones.

7.	Methods and algorithms for model reduction in biometrics.
8.	Introduction to machine learning.
9.	Application of machine learning in biometrics – selected issues.

LEARNING RESOURCES AND TOOLS.
eLearning platform (moodle)
PLANNED LEARNING ACTIVITIES AND TEACHING METHODS.
Lecture: multimedia presentation supported by examples on the blackboard, additional materials (PDF files)

7. ASSESSMENT METHODS, CRITERIA AND PERIOD.
Final Module Test.
OBSERVATIONS.
Written examination in form of a test.

8. BIBLIOGRAPHY AND TEACHING MATERIALS.

1. R.M. Bolle, J.H. Connell, S. Pankanti, N.K. Ratha, A.W. Senior, Guide to Biometrics, Springer Professional Computing, Springer New York, 2004, ISBN: 978-0-387-40089-1. 2. D. Maltoni, D. Maio, A.K. Jain, S. Prabhakar, Handbook of fingerprint recognition, Springer, 2003. 3. S.Z. Li, A.K. Jain, Handbook of face recognition, Springer, 2005. 4. Ganesh R. Naik, Applied Biological Engineering – Principles and Practice, InTech Croatia; ISBN 978- 953-51-0412-4. 5. Andreas C. Muller, Sarah Guido Introduction to Machine Learning with Python. A Guide for Data Scientists O'Reilly, 2016