załącznik do Regulaminu programu „visiting profesor”

Code of the course	4606-VP-ES-00022	Name of the course	Polish	**Nowoczesne metody sztucznej inteligencji w obliczeniach wizualnych**	
			English	**Modern AI in Visual Computing**	
Type of the course	Specialty subject				
Course coordinator	Przemyslaw Musialski		Course teacher	Przemyslaw Musialski	
Implementing unit	Faculty of Mathematics and Information Science	Scientific discipline / disciplines*	Information and Communication Technology, Mathematics		
Level of education	Doctoral studies	Semester	spring		
Language of the course	English				
Type of assessment	Graded credit	Number of hours in a semester	30	ECTS credits	2
Minimum number of participants	10	Maximum number of participants	15	Available for students (BSc, MSc)	Yes/No MSc - Yes

Type of classes		Lecture	Auditory classes	Project classes	Laboratory	Seminar
Number of hours	in a week					
	in a semester	27		3		

* does not apply to the Researcher’s Workshop

1. Prerequisites

Knowledge in linear algebra, analytical geometry, and optimization is required, however, depending on the background of the students, a recap on these topics will be provided.

2. Course objectives

The course provides the mathematical background of differential geometry and its application for representation of geometric objects in computer science with respect to modern machine learning techniques called implicit neural representations (INRs). These representations have a lot of applications in computer graphics, computer vision, CAD-engineering, and related disciplines.

3. Course content (separate for each type of classes)

Lecture

The course covers parameterizations of 3D shapes, represented as meshes, 3D point clouds, and parameterized 3D surfaces as neural networks. It will cover the neural network design, its properties, as well as the processing, optimization, deformation, and conversion to classic CAD representations to such neural forms.

Project

Practical exercises where the concepts will be applied to real examples and will be programmed in Python in form of projects in groups of 2-3 students.

4. Learning outcomes

Type of learning outcomes	Learning outcomes description	Reference to the learning outcomes of the WUT DS	Learning outcomes verification methods*
Knowledge			
K01	The student knows modern methods of artificial intelligence in computer graphics.	SD_W2	homework
K02	The student knows and understands the main development trends in computer graphics.	SD_W3	homework
Skills			
S01	The student is able to critically analyze and evaluate the results of scientific research in the field of machine learning and computer graphics, in particular assess the usefulness and possibility of using the results of theoretical work in practice.	SD_U2	homework
S02	The student is able to communicate on specialist topics related to AI in computer graphics to a degree that allows active participation in the national and international scientific community.	SD_U4	homework
Social competences			
SC01	The student recognizes the importance of knowledge and scientific achievements in solving cognitive and practical problems.	SD_K2	homework

*Allowed learning outcomes verification methods: exam; oral exam; oral test; project evaluation; report evaluation; presentation evaluation; active participation during classes; homework; tests

5. Assessment criteria

Assessment is based on projects prepared in groups of 2-3 students. Detailed information will be available at the beginning of the semester.

6. Literature

Primary references:

[1] Gilbert Strang, Linear Algebra and Learning from Data (2019), MIT Press

[2] Ian Goodfellow, Yoshua Bengio and Aaron Courville, Deep Leaming, MIT Press. (this is easy to read)

[3] Christopher Bishop, Pattern Recognition and Machine Leaming. Springer 2007.

Secondary references:

[1] Curves and Surfaces for CAGD, A Practical Guide, 5th edition, by Gerald Farin, Published by Morgan-Kaufmann, Published 2002, 499 pages, ISBN 1-55860-737-4

[2] H. Pottmann, A. Asperl, M. Hofer and A. Kilian: Architekturgeometrie. Springer & Bentley Institute Press (2010), 1st Edition., 474 S. 650 Abb. in Farbe., Geb. ISBN: 978-3-211-99765-9

7. PhD student's workload necessary to achieve the learning outcomes**

No.	Description	Number of hours
1	Hours of scheduled instruction given by the academic teacher in the classroom	30
2	Hours of consultations with the academic teacher, exams, tests, etc.	5

3	Amount of time devoted to the preparation for classes, preparation of presentations, reports, projects, homework	20
4	Amount of time devoted to the preparation for exams, test, assessments	5
	Total number of hours	**60**
	ECTS credits	**2**

** 1 ECTS = 25-30 hours of the PhD students work (2 ECTS = 60 hours; 4 ECTS = 110 hours, etc.)

8. Additional information	
Number of ECTS credits for classes requiring direct participation of academic teachers	1
Number of ECTS credits earned by a student in a practical course	1