

SYLLABUS OF A MODULE

Polish name of a module	SIECI NEURONOWE
English name of a module	NEURAL NETWORKS
ISCED classification - Code	0613
ISCED classification - Field of study	Software and applications development and analysis
Languages of instruction	English
Level of qualification: <i>1 – BSc (EQF 6)</i> <i>2 – MSc (EQF 7)</i> <i>3 – PhD (EQF 8)</i>	1
Number of ECTS credit points	4
Examination: <i>EO – exam oral</i> <i>EW – exam written</i> <i>A - assignment</i>	EW
Available in semester: <i>S – Spring only</i> <i>A – autumn only</i> <i>Y - booth</i>	S

Number of hours per semester:

Lecture	Exercises	Laboratory	Seminar	E-learning	Project
30E		30			

MODULE DESCRIPTION

MODULE OBJECTIVES

- O1. Familiarizing students with the operating principles of basic artificial neural network models
- O2. Learning about artificial neural network training algorithms
- O3. Learning about available external tools for creating artificial neural networks

PRELIMINARY REQUIREMENTS FOR KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Knowledge of mathematical analysis and linear algebra
2. Knowledge of classical machine learning methods
3. Knowledge of basic machine learning techniques
4. Ability to program in a high-level language
5. Ability to work independently and in a team
6. Knowledge of English

LEARNING OUTCOMES

- LO 1 – The student possesses knowledge of contemporary methods for creating artificial neural

networks and deep learning.

LO 2 – Can create models of artificial neural networks, including deep and convolutional ones.

LO 3 – Can think and act creatively and entrepreneurially.

MODULE CONTENT

Type of classes – lecture	Number of hours
Lec 1 - Introduction, history	2
Lec 2,3 - Introduction to the programming environment	4
Lec 4,7 - Linear models, self-organizing models. Perceptrons and Multilayer Perceptrons, Activation functions. Training Neural Networks: Gradient Descent and Backpropagation	8
Lec 8 - Overfitting, Underfitting, and Regularization Techniques	4
Lec 9,11 - Convolutional Neural Networks (CNNs). Recurrent Neural Networks (RNNs)	6
Lec 12,13- Popular neural network models	4
Lec 14 - Autoencoders	2
Lec 15 - Transfer Learning and Pre-trained Models	2
Sum	30
Type of classes– laboratory	Number of hours
Lab 1, 2 - Introduction to the programming environment	4
Lab 3 - Data generators	2
Lab 4, 5 - Perceptron and sigmoidal neuron	4
Lab 6, 7 - Backpropagation algorithm	4
Lab 8, 9 - Aspects of multilayer neural networks training	4
Lab 10, 11 - Text representations	4
Lab 12, 13 - Recurrent neural networks	4
Lab 14, 15 - Autoencoders	4
Sum	30

TEACHING TOOLS

1. Lecture using multimedia presentations
2. Preparation of reports on the implementation of the exercises
3. Instructions for completing the laboratory exercises
4. Laboratory equipped with PCs

WAYS OF ASSESSMENT (F – FORMATIVE, S – SUMMATIVE

F1. - assessment of preparation for laboratory exercises
F2. - assessment of the ability to apply the acquired knowledge while doing the exercises
F3. - evaluation of reports on the implementation of exercises covered by the curriculum
F4. - assessment of activity during classes
S1. - assessment of the ability to solve the problems posed and the manner of presentation obtained results - pass mark *

S2. - assessment of mastery of the teaching material being the subject of the lecture - exam

STUDENT'S WORKLOAD

L.p.	Forms of activity	Average number of hours required for realization of activity
1. Contact hours with teacher		
1.1	Lectures	30
1.2	Tutorials	
1.3	Laboratory	30
1.4	Seminar	
1.5	Project	
1.6	Examination	2
Total number of contact hours with teacher:		62
2. Student's individual work		
2.1	Preparation for tutorials and tests	
2.2	Preparation for laboratory exercises, writing reports on laboratories	20
2.3	Preparation of project	
2.4	Preparation for final lecture assessment	
2.5	Preparation for examination	18
2.6	Individual study of literature	
Total number of hours of student's individual work:		38
Overall student's workload:		100
Overall number of ECTS credits for the module		4
Number of ECTS points that student receives in classes requiring teacher's supervision:		2.5
Number of ECTS credits acquired during practical classes including laboratory exercises and projects:		2.0

BASIC AND SUPPLEMENTARY RESOURCE MATERIALS

1. Ian Goodfellow and Yoshua Bengio and Aaron Courville, Deep Learning, MIT Press
2. http://www.deeplearningbook.org , 2016
3. Charu C. Aggarwal, Neural Networks and Deep Learning. A Textbook, Springer, 2018
4. James P. Coughlin, Robert H. Baran: Neural Computation in Hopfield Networks and Boltzmann

MODULE COORDINATOR (NAME, SURNAME, E-MAIL ADDRESS)

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