University of Gdańsk

Subject card

Subject name and code	Foundations of AI, PG_00136760						
Field of study	Informatics and Econometrics						
Date of commencement of studies	October 2024		Academic year of realisation of subject		2026/2027		
Education level	Bachelor's studies		Subject group		Obligatory subject group in the field of study Subject group related to scientific research in the field of study		
Mode of study	full-time studies		Mode of delivery		at the university		
Year of study	3		Language of instruction		Polish		
Semester of study	6		ECTS credits		7.0		
Learning profile	academic		Assessment form		exam		
Conducting unit	Department of Statistics -> Faculty of Management -> Rector						
Name and surname of lecturer (lecturers)	Subject supervisor		dr hab. Krzysztof Najman				
	Teachers						
Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	30.0	15.0	0.0	0.0	75
	E-learning hours included: 0.0						
Learning activity and number of study hours	Learning activity	Participation in didactic classes included in study plan		Participation in consultation hours		Self-study	SUM
	Number of study hours	75		20.0		80.0	175
Subject objectives	The aim of the course is to familiarize students with the essence of artificial intelligence, the history and directions of AI development, basic AI models, methods of data preparation, construction, verification, and visualization of selected AI models.						

Learning outcomes

Course outcome	Subject outcome	Method of verification
[IiEL3_W04] The student has advanced knowledge of mathematical, statistical, econometric and computer methods of obtaining, processing and analysing data depicting the functioning and development of the national economy and its elements, as well as the phenomena and processes occurring in their environment.	Has in-depth knowledge of advanced data analysis methods using selected artificial neural network models.	[SW4] test/exam - oral or written [SW1] oral statement/ conversation/discussion [SW2] presentation/project/paper/ report
[IiEL3_K02] The student can communicate with the public on computer science and econometrics topics in and outside the workplace, communicate his knowledge and share his skills through various media.	Is able to discuss, communicate and share knowledge in the theory and practice of using artificial intelligence models.	[SK1] oral statement/conversation/ discussion [SK2] presentation/project/paper/ report
[IiEL3_K01] The student understands the need to constantly supplement and deepen acquired knowledge; is open to new ideas and teaching methods.	Understands the need to constantly update knowledge in the field of artificial intelligence.	[SK1] oral statement/conversation/ discussion [SK2] presentation/project/paper/ report
[IiEL3_U02] The student is able to acquire basic information about economic processes and phenomena by direct observation, planned experiment or database queries, and collect and process it using modern information technology tools.	The student is able to collect statistical data from primary and secondary sources for the purposes of implementing social research using artificial intelligence models.	[SU1] oral statement/conversation/ discussion [SU2] presentation/project/paper/ report
[IiEL3_U05] The student can make a statistical description of advanced economic categories, formulate and verify simple hypotheses on their formation.	The student is able to independently conduct an analysis of selected social phenomena using selected models of artificial neural networks.	[SU2] presentation/project/paper/ report [SU4] test/exam - oral or written
[IiEL3_W05] The student has advanced knowledge of the sources of socio-economic data, their databases and ways of creating them.	The student knows the sources and methods of searching for secondary data used in social research using artificial intelligence methods.	[SW4] test/exam - oral or written [SW1] oral statement/ conversation/discussion [SW2] presentation/project/paper/ report

Subject contents

1. History and directions of artificial intelligence research, application areas.
2. Biological prototype of neural computations. Construction of a mathematical neuron. Perceptron. Types and properties of basic transformation functions.
3. Basic methods of learning a mathematical neuron. (Perceptron Learning Rule)
4. Selected architectures of artificial neural networks: layered, unidirectional and recurrent networks, networks with variable structure, self-learning networks.
5. Methods of learning artificial neural networks: learning rules, state and weight space, minimization of the value of the network error function.
6. Methods of preparing data for analyses based on artificial neural networks: training sets, test sets, control sets, data transformations, preprocessing and postprocessing.
7. Construction and methods of learning layered artificial neural networks. Error backpropagation algorithm and its variants.
8. Construction and methods of learning recurrent artificial neural networks. Elman, Hopfield network, LSTM (Long short-term memory).
9. Evaluation of the quality of neural models, evaluation of network stability, the problem of loss of generalization ability (underfitting, overfitting), network regularization.
10. Selected applications of artificial neural networks - approximation problem, regression problem, classification problem, time series forecasting.
11. Practical remarks on the process of building artificial intelligence models.
12. Advantages and disadvantages of using artificial neural networks.

Prerequisites and co-requisites

Basic knowledge of matrix and differential calculus.Basic programming skills in Python and R.

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
semester project	51.0%	40.0%
final exam	51.0%	60.0%

Recommended reading	Basic literature	Migdał-Najman K, Najman K, Samouczące się sztuczne sieci neuronowe w grupowaniu i klasyfikacji danych. Teoria i zastosowania w ekonomii, 2013. M. Hagan,H. Demuth, M. Beale, O. de Jesus, Neural Network Design (2nd Edition), 2014 F. Chollet, Deep Learning. Praca z językiem Python i biblioteką Keras, Helion, Gliwice 2019 (str. 19 - 129)
	Supplementary literature	M. Szeliga, Praktyczne uczenie maszynowe. PWN, Warszawa 2019 Sepp Hochreiter, Jürgen Schmidhuber, Long Short-Term Memory. Neural Comput 1997; 9 (8): 17351780 R. Tadeusiewicz, Sieci neuronowe, Akademicka Oficyna Wydawnicza, Warszawa 1993
	eResources addresses	
Example issues/ example questions/ tasks being completed		
Work placement	Not applicable	

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