University of Gdańsk

Subject card

Subject name and code	Fundamentals and Applications of Deep Learning, PG_00177497						
Field of study	Informatics and Econometrics						
Date of commencement of studies	October 2025		Academic year of realisation of subject		2026/2027		
Education level	Master's studies		Subject group		Obligatory subject group in the field of study Optional subject group 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	2		Language of instruction		Polish		
Semester of study	4		ECTS credits		4.0		
Learning profile	academic		Assessment form		credit		
Conducting unit	Department of Econometrics -> Faculty of Management -> Rector						
Name and surname of lecturer (lecturers)	Subject supervisor		dr Sabina Nowak				
	Teachers						
Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	15.0	15.0	15.0	0.0	0.0	45
	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	45		3.0		52.0	100
Subject objectives	The course aims to provide basic knowledge about deep learning methods and artificial neural networks. Students will learn the theoretical foundations and practical applications of deep learning methods.						

Learning outcomes

Course outcome	Subject outcome	Method of verification
[IiEMU2_W08] The student possesses a comprehensive understanding of the methods, conditions, directions, and dilemmas involved in applying advanced econometrics, informatics or statistics tools in response to dynamic environmental changes.	The student learns the theoretical foundations of deep learning and the basic tools for creating deep learning models.	[SW2] presentation/project/paper/ report
[IiEMU2_W10] Student possesses a deeper understanding of the essential dilemmas of modern civilization, particularly concerning the IT development.	The student understands the dilemmas associated with applying deep learning methods in business.	[SW2] presentation/project/paper/ report
[IiEMU2_W03] The student possesses a thorough understanding of how organizations operate, including the complex phenomena, processes, and relationships that exist in their environments and how these impact their functioning.	The student learns the practical applications of the deep learning methods.	[SW2] presentation/project/paper/ report
[IiEMU2_U06] Students can utilize structured and detailed knowledge of management, quality sciences, economics, and finance to address dilemmas and develop innovative solutions for complex or unusual problems that arise in professional settings.	The student is able to build, verify and evaluate deep neural networks and their practical applications.	[SU2] presentation/project/paper/ report
[IiEMU2_U03] The student is able to obtain and verify data from properly selected sources and to collect, process, and visualize it using modern econometrics, informatics or statistics tools.	The student is able to collect and prepare data for the application of Deep Learning methods, create an appropriate environment and work process for Deep Learning models.	[SU2] presentation/project/paper/ report [SU5] implementation of a problem task

Subject contents

1. Machine Learning vs. Deep Learning.
2. Overview of the structure and functioning of artificial neural networks.
3. Training algorithms used for neural networks.
4. Experiments with artificial neural networks.
5. Visualization and interpretation of how artificial neural networks operate.
6. Special types of neural networks, including: Convolutional Neural Networks (CNNs), Recurrent Neural Networks (RNNs), Autoencoders and Variational Autoencoders (VAEs), Generative Adversarial Networks (GANs), Diffusion Models, Transformer Models.
7. Applications of Deep Learning economics, finance, and management.

Prerequisites and co-requisites

Students should know basics of multivariate calculus, linear algebra, probability and statistics.

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Project with presentation	51.0%	100.0%

Recommended reading

Basic literature

1. F. Chollet, Deep Learning. Praca z językiem Python i biblioteką Keras, Wydawnictwo Helion, 2019.
2. I. Goldfellow, Y. Bengio, A. Courville, Deep Learning. Systemy uczące się, Wydawnictwo Naukowe PWN, 2018.
3. K. Migdał-Najman, K. Najman, Samouczące się sztuczne sieci neuronowe w grupowaniu i klasyfikacji danych. Teoria i zastosowania w ekonomii, Wydawnictwo Uniwersytetu Gdańskiego, 2013.
4. M. Szeliga, Praktyczne uczenie maszynowe, Wydawnictwo PWN, 2019.
5. J. Tabor, M. Śmieja, Ł. Struski, P. Spurek, M. Wołczyk, Głębokie uczenie. Wprowadzenie, Wydawnictwo Helion, 2022.
6. V. Zocca, G. Spacagna, D. Slater, Deep Learning. Uczenie głębokie z językiem Python. Sztuczna inteligencja i sieci neuronowe, Wydawnictwo Helion, 2021.

Supplementary literature

1. J.T. Seynowski, Deep Learning. Głęboka rewolucja. Kiedy sztuczna inteligencja spotyka się z ludzką, Poltext 2019.
2. J. Schmidhuber, Deep learning in neural networks: An overview, Neural Networks, Vol. 61, pp. 85-117, 2015. https://doi.org/10.1016/j.neunet.2014.09.003.

eResources addresses

Basic

https://www.deeplearningbook.org/ - Ian Goodfellow and Yoshua Bengio and Aaron Courville, Deep Learning, MIT Press

Supplementary

https://www.youtube.com/watch?v=alfdI7S6wCY&list=PLtBw6njQRU-rwp5__7C0oIVt26ZgjG9NI - MIT Introduction to Deep Learning

Example issues/ example questions/ tasks being completed	
Work placement	Not applicable

Document generated electronically. Does not require a seal or signature.