GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Deep Learning in Computer Vision, PG_00047488		
Field of study	Informatics		
Date of commencement of studies	February 2024	Academic year of realisation of subject	2024/2025
Education level	second-cycle studies	Subject group	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	English
Semester of study	3	ECTS credits	4.0
Learning profile	general academic profile	Assessment form	exam
Conducting unit	Department of Computer Architecture -> Faculty of Electronics, Telecommunications and Informatics		
Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. Adam Brzeski	
	Teachers	dr inż. Adam Brzeski	

Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	15.0	0.0	15.0	0.0	0.0	30
	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	30	8.0	62.0	100

Subject objectives	The aim of the course is to present modern, advanced architectures of neural networks and training methods applied in image processing and analysis.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K7_W03] Knows and understands, to an increased extent, the construction and operating principles of components and systems related to the field of study, including theories, methods and complex relationships between them and selected specific issues - appropriate for the curriculum.	Student knows and uses advanced, modern convolutional neural networks and recurrent networks as well as proper software libraries for applications in image processing and analysis	[SW1] Assessment of factual knowledge
[K7_U09] can carry out a critical analysis of the functioning of existing technical solutions and assess these solutions, as well as apply experience related to the maintenance of advanced technical systems, devices and facilities typical for the field of studies, gained in the professional engineering environment	Student knows quality criteria used in image analysis problems, quality metrics achieved by state-of-the-art methods for a set of common problems, advantages and disadvantages of base architectures applied in the field	[SU1] Assessment of task fulfilment
[K7_W41] Knows and understands, to an increased extent, the standards, production methods, life cycle and development trends of software as well as information systems and applications.	Student knows and understands deeply standards and principles of developing and deploying computer vision systems based on machine learning	[SW1] Assessment of factual knowledge
[K7_U03] can design, according to required specifications, and make a complex device, facility, system or carry out a process, specific to the field of study, using suitable methods, techniques, tools and materials, following engineering standards and norms, applying technologies specific to the field of study and experience gained in the professional engineering environment	Student is able to design deep neural network architectures appropriate for given problems by choosing proper base architectures and applying suitable training methods	[SU1] Assessment of task fulfilment
[K7_W42] Knows and understands, to an increased extent, the principles and trends in the analysis and design of local and distributed IT systems and the basics of computer modeling and computerization of complex cognitive and decision-making processes.	Student knows methods for modelling complex cognitive and decision processes in the field of vision and image analysis	[SW1] Assessment of factual knowledge

Subject contents

1. Overview of deep learning applications in computer vision
2. Advanced architectures of convolutional neural networks
3. Applications in object localisation and detection
4. Semantic segmentation, instance-aware segmentation
5. Model visualisation, activation and saliency maps
6. Weakly-supervised, semi-supervised and unsupervised training methods
7. Generative models
8. Image transforms
9. Prediction from video sequences
10. Predicting sequences from images, image captioning

Prerequisites and co-requisites

Basic knowledge of neural networks, deep learning techniques and machine learning, basic familiarity with Python programming language

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
exam	50.0%	50.0%
laboratory	50.0%	50.0%

Recommended reading

Basic literature	1. Ian Goodfellow, Yoshua Bengio and Aaron Courville, “Deep Learning”, http://www.deeplearningbook.org/ 2. Michael Nielsen, “Neural Networks and Deep Learning”, http://neuralnetworksanddeeplearning.com/ 3. Richard S. Sutton and Andrew G. Barto, “Reinforcement Learning: An introduction”, 2nd Edition, draft in progress https://webdocs.cs.ualberta.ca/~sutton/book/the-book.html 4. Andrew Ng, Jiquan Ngiam, Chuan Yu Foo, Yifan Mai, Caroline Suen, Adam Coates, Andrew Maas, Awni Hannun, Brody Huval, Tao Wang, Sameep Tandon, “Unsupervised Feature Learning and Deep Learning Tutorial”, http://deeplearning.stanford.edu/tutorial/
Supplementary literature	1. Andrew Ng, “Machine Learning Yearning”, http://www.mlyearning.org/
eResources addresses	Adresy na platformie eNauczanie:

Example issues/ example questions/ tasks being completed	- Implementation and training of chosen deep neural network architecture for analysis or processing of images - Choosing proper architectures for given data analysis problems - Naming techniques used in advanced convolutional neural networks
Work placement	Not applicable