Deep Learning with Python

- ***COURSE SYLLABUS***

1.	**Course title:**	
	Deep Learning with Python	
2.	**Lecturer:**	
	dr inż. Piotr Klejment	
3.	**Field, type and level of studies, year of study:**	
	all years of study, IT tools for scientists	
4.	**Course character:**	
	monographic lecture	
5.	**Teaching method:**	
	traditional or traditional + on-line	
6.	**Language:**	*English*
7.	**Course type and number of hours:**	
	Lecture, 10 h	
8.	**Estimated load of student's independent work:**	*15 h*
9.	**Total workload and number of ECTS points:**	*25 h, 1 ECTS*
10.	**Short description and main focus of the course:**	
	GENERAL DESCRIPTION *Deep learning is one of the most powerful and advanced types of machine learning based on deep neural networks - networks with multiple levels of neurons. Designed for the most challenging problems, deep learning is capable of learning complex patterns from large datasets and excels at handling unstructured data. However, deep learning models are generally much more complex and computationally time-consuming, requiring significantly greater programming skills from the user, for example, compared to supervised machine learning algorithms.* *Deep learning is an excellent tool for scientists working with complex datasets, but it requires advanced and specialized programming knowledge. The goal of this course is to introduce deep learning models from scratch, with the goal of achieving, by the end of the course, the ability to apply this technique to selected scientific problems.* *COURSE OUTLINE* *1) Libraries. TensorFlow and PyTorch are two of the most common libraries for solving deep learning problems. Both serve similar purposes – designing and training machine learning models – but offer slightly different workflows and capabilities. A third popular library is Keras,*	

	a high-level API (Application Programming Interface) designed to facilitate the implementation of machine learning models, particularly neural networks. *2) Deep Learning from first principles. Neural Networks: Artificial Neural Networks - key components, optimization algorithms, activation functions, architecture and learning process in neural network.* *3) Types of Deep Learning Models. Feedforward Neural Networks, Convolutional Neural Networks, Recurrent Neural Networks, Long Short-Term Memory Networks, Radial Basis Function Networks, Deep Belief Networks, Generative Models in Deep Learning.* *4) Applications of Artificial Neural Networks in scientific problems.*	
11.	**References:**	
	books, on-line resources	
12.	**Prerequisites:**	
	computer literacy, at least intermediate knowledge of Python	
13.	**Educational outcomes:**	**PQF level 8 codes:**
	***Knowledge:** Student knows and understands:* *(P8S_WG) the world's achievements relating to:* *theoretical foundations, general and selected specific issues of the artificial intelligence problems at a level enabling the revision of existing paradigms;* *the main scientific developments in the academic or artistic disciplines essential to the study programme;* *the methodology of scientific research (with computer programming language Python, artificial intelligence and neural networks)* *rules for dissemination of scientific results (from artificial intelligence models)*	*P8S_WG*
	***Practical Skills:** Student is able to:* *(P8U_U) analyse and creatively synthesise scientific and creative achievements to identify and solve (artificial intelligence) research problems as well as those related to innovative and creative activities;* *contribute new elements to these achievements;* *independently plan one's own development as well as inspire the development of others;* *participate in the exchange of experiences and ideas, also in the international community* *(P8S_UW) take advantage of programming skills to creatively identify, formulate and innovatively solve complex problems or perform research activities, especially:* *to define the aim and subject of the research, formulate a research hypothesis, develop research methods, techniques and tools and use them creatively draw conclusions on the basis of research results;* *perform critical analysis and evaluation of the results of scientific research, expert activities and other works of a creative nature and their contribution to knowledge;*	*P8U_U, P8S_UW*

	transfer the results of research studies to the economic and social spheres	
	Social Skills: *Student is ready to:* *(P8U_K) conduct independent research (own neural networks) which contributes to existing scientific and creative achievements;* *assume professional and public challenges taking into consideration: their ethical dimension, responsibility for their results and develop models of good practice in such situations* *(P8S_KK) critically evaluate the achievements in scientific programming;* *critically evaluate one's contributions to the development of that field;* *recognize the value of knowledge in solving cognitive and practical problems*	*P8U_K, P8S_KK*
14.	**Evaluation of the educational outcomes:**	
	lecture activities + tests	
15.	**Criteria to complete the course:**	
	achieving the appropriate threshold of points from all tests and activities + attendance	
16.	**Contact with the lecturer:**	
	email (pklejment@igf.edu.pl), possible personal consultations	