Wrocław University of Science and Technology
Doctoral School

COURSE CARD

1. Basic information

Course name in English:	Introduction to Artificial intelligence
Course name in Polish:	Wprowadzenie do sztucznej inteligencji
Number of hours:	30
Type of course:	Elective course
Form of course:	lecture
Code of course:	W04ITT-SD0116W / ITQ100431W
Course leader:	Prof. Dariusz Król
Faculty of the course leader:	W4 Faculty of Information and Communication Technology
Email address of the course leader:	dariusz.krol@pwr.edu.pl

Scientific discipline(s) assigned to the course (doctoral students representing the marked disciplines can participate in the course):	Architecture and urban planning	☒
	Automation, electronic, and electrical engineering	☒
	Information and communication technology	☒
	Biomedical engineering	☒
	Chemical engineering	☒
	Civil engineering and transport	☒
	Mechanical engineering	☒
	Environmental engineering, mining, and energy	☒
	Mathematics	☒
	Chemical sciences	☒
	Physical sciences	☒
	Management and quality studies	☒

2. Objectives

The course has four main objectives:
1. familiarizes doctoral candidates with a wide range of qualitative research methods and provides examples of their practical application in the field of AI,
2. better understand a range of artificial intelligence techniques, their strengths and limitations,
3. with several sample applications and projects, prepare students to Industry 4.0 / 5.0,
4. helps the candidates to identify appropriate qualitative methods for their dissertation project.

3. Content

Detailed information about the course content, including topics and form of classes.

No.	Topic	Number of hours	Form of classes
1	Introduction to Artificial Intelligence (Prof. D. Król)	2	lecture
2	Machine learning I (Prof. M. Zięba)	2	lecture
3	Machine learning II (Prof. M. Zięba)	2	lecture

4	Reinforcement and Deep Learning I (Prof. O. Unold)	2	lecture
5	Reinforcement and Deep Learning II (Prof. O. Unold)	2	lecture
6	Reinforcement and Deep Learning III (Prof. O. Unold)	2	lecture
7	Artificial Intelligence for Signal Processing I (Prof. K. Brzostowski)	2	lecture
8	Artificial Intelligence for Signal Processing II (Prof. K. Brzostowski)	2	lecture
9	Artificial Intelligence for Natural Language Processing I (Prof. M. Piasecki)	2	lecture
10	Artificial Intelligence for Natural Language Processing II (Prof. M. Piasecki)	2	lecture
11	Artificial Intelligence for Natural Language Processing III (Prof. M. Piasecki)	2	lecture
12	Collective Intelligence (Prof. Ngoc Thanh Nguyen, Dr. M. Maleszka)	2	lecture
13	Artificial Intelligence for Big Data (Prof. D. Król)	2	lecture
14	Ethics in Artificial Intelligence (Prof. D. Król)	2	lecture
15	The Future of Artificial Intelligence (Prof. D. Król)	2	lecture

4. Prerequisites
List of prerequisites relating to knowledge, skills and other competences for course participants.

No obligatory prerequisites beyond the minimum requirements for entrance to the Doctoral School. The course is primarily open to all PhD students at WUST. It is particularly suitable for doctoral candidates at the early stage of their doctoral training.

However, in such interdisciplinary student group, a prior knowledge and expectation assessment (survey), before the first lecture, is required. This assessment can help us diagnose students' understanding of and proficiency with the material we expect them to have, so that we can adapt our subsequent lectures accordingly. In some cases, if a student has significant gaps in knowledge and skills, we can mention the options of dropping or postponing our course (if possible), so that the student can do what it takes to fill those gaps.

5. Learning outcomes
List of learning outcomes at level 8 of the Polish Qualifications Framework assigned to the course (mark the learning outcomes in the last column).

Symbol	Learning outcome	
	KNOWLEDGE. Doctoral student knows and understands:	
SzD_W3	the main trends in the development of the scientific or artistic disciplines covered in the curricula;	☒
SzD_W4	research methodology;	☐
SzD_W5	the rules for the dissemination of scientific results, including in open access mode;	☐
SzD_W6	the fundamental dilemmas of modern civilization;	☒
SzD_W7	the legal and ethical conditions of scientific activity;	☐

SzD_W8	the economic and other relevant conditions of scientific activity;	☐
SzD_W9	basic principles of knowledge transfer to the economic and social spheres and commercialisation of results of scientific activity and know-how related to these results.	☐
	SKILLS. Doctoral student is able to:	
SzD_U2	use knowledge from different fields of science or art to creatively identify, formulate and innovatively solve complex problems or perform research tasks, in particular: - define the purpose and subject of scientific research, formulate a research hypothesis, - develop research methods, techniques and tools, and use them creatively, - draw conclusions on the basis of scientific research; critically analyse and evaluate the results of scientific research, expertise and other creative work and their contribution to knowledge development; transfer the results of scientific activities to the economic and social spheres;	☐
SzD_U3	communicate on specialised topics to the extent that they enable an active participation in the international scientific community;	☐
SzD_U4	disseminate research results, including in popular forms;	☐
SzD_U5	initiate debates and participate in a scientific discourse;	☐
SzD_U6	be able to speak a foreign language at B2 level of the Common European Framework of Reference for Languages to a level that enables them to participate in the international scientific and professional environment;	☐
SzD_U7	plan and implement an individual or collective research or creative activity, including in an international environment;	☐
SzD_U8	independently plan and act for one's own development and inspire and organize the development of others;	☐
SzD_U9	plan classes or groups of classes and implement them using modern methods and tools.	☐
	SOCIAL COMPETENCES. Doctoral student is ready to:	
SzD_K3	fulfilling the social obligations of researchers and creators, initiate public interest activities, thinking and acting in an entrepreneurial way;	☐
SzD_K4	maintaining and developing the ethos of research and creative environments, including: - carrying out scientific activities in an independent manner, - respecting the principle of public ownership of research results, taking into account the principles of intellectual property protection.	☐

6. Evaluation

Short description of the method(s) used to evaluate the learning outcomes assigned to the course, e.g., exam, test, report, presentation, etc.

Exam in the form of a test

7. Teaching methods

Short description of the teaching methods used during the course, e.g., multimedia presentation, discussion, literature studies, developing written documents, own work, etc.

Electronic handouts, presentations with multimedia elements, e.g. Google Slides, links to further reading on the Web, a large collection of online library resources, two invited experts from academia and industry for online short talks, interleaving - to improve students' recall of information, interleave old with the new in the form of quiz, problem-solving discussions, simulations

8. Literature
List of primary and secondary literature used to prepare the course and including additional knowledge for participants, e.g., books, textbooks, research papers, standards, web pages, etc.

[1] Auffarth, Ben (2020). Artificial Intelligence with Python Cookbook: Proven recipes for applying AI algorithms and deep learning techniques using TensorFlow 2.x and PyTorch 1.6 (1st ed.). Packt Publishing. ISBN 978-1-78913-396-7. Archived from the original on 8 January 2021. Retrieved 13 January 2021

[2] Boashash, Boualem. Time-frequency signal analysis and processing: a comprehensive reference. Academic press, 2015.

[3] Flandrin, Patrick. Explorations in time-frequency analysis. Cambridge University Press, 2018.

[4] Gonzalez, Rafael C., and Richard E. Woods. "Digital image processing." (2017).

[5] Dan Jurafsky and James H. Martin. Speech and Language Processing (3rd ed. draft). https://web.stanford.edu/~jurafsky/slp3/ed3book_dec302020.pdf

[6] Neapolitan, Richard; Jiang, Xia (2018). Artificial Intelligence: With an Introduction to Machine Learning. Chapman & Hall/CRC. ISBN 978-1-138-50238-3. Archived from the original on 22 August 2020. Retrieved 3 January 2018.

[7] Poole, David; Mackworth, Alan (2017). Artificial Intelligence: Foundations of Computational Agents (2nd ed.). Cambridge University Press. ISBN 978-1-107-19539-4. Archived from the original on 7 December 2017. Retrieved 6 December 2017.

[8] Richard S. Sutton and Andrew G. Barto. Reinforcement Learning: An Introduction (Second edition, in progress). https://web.stanford.edu/class/psych209/Readings/SuttonBartoIPRLBook2ndEd.pdf

9. Other remarks
Additional remarks, comments, (e.g., language of the course)

 The order of lectures could be rearranged. The lectures might be remotely operated. In such case, the lecturer will send you link for the meeting