



Subject card

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| Subject name and code | Deep Learning with Reinforcement, PG_00048248 | | | | | | |
| Field of study | Informatics | | | | | | |
| Date of commencement of studies | February 2025 | | Academic year of realisation of subject | | 2025/2026 | | |
| Education level | second-cycle studies | | Subject group | | Optional subject group Specialty 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 | 1 | | Language of instruction | | Polish | | |
| Semester of study | 2 | | ECTS credits | | 2.0 | | |
| Learning profile | general academic profile | | Assessment form | | assessment | | |
| Conducting unit | Department of Algorithms and Systems Modelling -> Faculty of Electronics, Telecommunications and Informatics | | | | | | |
| Name and surname of lecturer (lecturers) | Subject supervisor | | dr inż. Paweł Kowalski | | | | |
| | Teachers | | dr inż. Paweł Kowalski | | | | |
| Lesson types and methods of instruction | Lesson type | Lecture | Tutorial | Laboratory | Project | Seminar | SUM |
| | Number of study hours | 15.0 | 0.0 | 0.0 | 15.0 | 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 | | 4.0 | | 16.0 | 50 |
| Subject objectives | Introduces Machine Learning methods for optimal behavior using Reinforcement Learning. Shows how to scale Reinforcement Learning to complex problems using Deep Neural Networks. Show most successful Deep Reinforcement Learning methods using Value Function approximation and Policy Gradient. | | | | | | |

| Learning outcomes | Course outcome | Subject outcome | Method of verification |
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| | [K7_U12] is able, to an increased extent, to analyze the operation of components and systems related to the field of study, as well as to measure their parameters and study their technical characteristics, and to plan and carry out experiments related to the field of study, including computer simulations, interpret the obtained results and draw conclusions | Is able to plan and conduct neural network training using a selected reinforcement learning algorithm. | [SU1] Assessment of task fulfilment [SU3] Assessment of ability to use knowledge gained from the subject [SU5] Assessment of ability to present the results of task |
| | [K7_W10] knows and understands, to an increased extent, the basic processes occurring in the life cycle of equipment, objects and technical systems, as well as methods of supporting processes and functions, specific to the field of study | The student knows and understands reinforcement learning algorithms and their application in the life cycle of technical systems, including the processes of implementation, monitoring, and adaptation under changing operational conditions. | [SW3] Assessment of knowledge contained in written work and projects [SW2] Assessment of knowledge contained in presentation |
| | [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 | Knows theoretical model for reinforcement learning: Markov's process Knows algorithms used for reinforced learning | [SW3] Assessment of knowledge contained in written work and projects [SW1] Assessment of factual knowledge |
| | [K7_U04] can apply knowledge of programming methods and techniques as well as select and apply appropriate programming methods and tools in computer software development or programming devices or controllers using microprocessors or programmable elements or systems specific to the field of study, making assessment and critical analysis of the prepared software as well as a synthesis and creative interpretation of information presented with it | Is able to reproduce reinforcement learning algorithm | [SU4] Assessment of ability to use methods and tools [SU2] Assessment of ability to analyse information |
| Subject contents | Imitation learning Reinforcement Learning Introduction Markov Decision Process Dynamic Programming Methods Model Free Learning Deep Learning using value function approximation Deep Learning using policy gradient methods Practical aspects of Deep Reinforcement Learning | | |

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|----------------------------------------------------------|-----------------------------------------------------------------------------|---------------------------------------------------------------|-------------------------------|
| Prerequisites and co-requisites | Knowledge of Python programming language | | |
| | Basic calculus, linear algebra and probabilistic theory | | |
| | Machine Learning and Deep Learning fundamentals | | |
| Assessment methods and criteria | Subject passing criteria | Passing threshold | Percentage of the final grade |
| | Project | 50.0% | 60.0% |
| | Lecture tasks | 50.0% | 40.0% |
| Recommended reading | Basic literature | Reinforcement Learning, Richard S. Sutton and Andrew G. Barto | |
| | | "Neural Networks and Deep Learning",Michael A. Nielsen | |
| | Supplementary literature | "Deep Reinforcement Learning Hands-On", Maxim Lapan | |
| | eResources addresses | Adresy na platformie eNauczanie: | |
| Example issues/ example questions/ tasks being completed | Design and conduct the training of an agent playing a selected video game. | | |
| | Design and conduct training for a control network of an autonomous vehicle. | | |
| Work placement | Not applicable | | |

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