



Subject card

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|---|---|--|----------|-------------------------------------|--|------------|-----|
| Subject name and code | Deep learning, PG_00054374 | | | | | | |
| Field of study | Informatics | | | | | | |
| Date of commencement of studies | February 2023 | Academic year of realisation of subject | | | 2023/2024 | | |
| 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 | 1 | Language of instruction | | | Polish | | |
| Semester of study | 2 | ECTS credits | | | 4.0 | | |
| Learning profile | general academic profile | Assessment form | | | exam | | |
| Conducting unit | Department of Biomedical Engineering -> Faculty of Electronics, Telecommunications and Informatics | | | | | | |
| Name and surname of lecturer (lecturers) | Subject supervisor | prof. dr hab. inż. Jacek Rumiński | | | | | |
| | Teachers | mgr inż. Natalia Szarwińska prof. dr hab. inż. Jacek Rumiński dr inż. Tomasz Kocejko | | | | | |
| Lesson types and methods of instruction | Lesson type | Lecture | Tutorial | Laboratory | Project | Seminar | SUM |
| | Number of study hours | 30.0 | 0.0 | 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 | | 4.0 | | 51.0 | 100 |
| Subject objectives | The aim of the course is to provide students with knowledge in the field of deep, artificial neural networks and to develop practical skills in this field. | | | | | | |

| Learning outcomes | Course outcome | Subject outcome | Method of verification |
|-------------------|--|--|---------------------------------------|
| | [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 | The effect of the learning process is the student acquiring the ability to apply deep learning algorithms in practice, in particular convolutional and recursive networks, in particular through the implementation of DNN models, their training, testing and interpreting the results. | [SU1] Assessment of task fulfilment |
| | [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. | The effect of the learning process is the acquisition of knowledge by the student in the field of deep learning methods, in particular in the field of data classification tasks, object detection and other tasks related to the field of study. | [SW1] Assessment of factual knowledge |
| | [K7_U05] can plan and conduct experiments related to the field of study, including computer simulations and measurements; interpret obtained results and draw conclusions | The effect of the learning process is the student acquiring the ability to use deep learning algorithms in practice, in particular convolutional and recursive networks, in particular by designing DNN models and planning experiments related to training and validation of models. | [SU1] Assessment of task fulfilment |
| | [K7_W01] Knows and understands, to an increased extent, mathematics to the extent necessary to formulate and solve complex issues related to the field of study. | The effect of the learning process is the student gaining knowledge in the field of understanding the definition of deep learning algorithms, in particular convolutional and recursive networks related patterns and problems related to the deep network learning process. | [SW1] Assessment of factual knowledge |

| Subject contents | <p>Introduction to deep learning</p> <p>Convolution operation and its importance</p> <p>CNN layers and their versions</p> <p>Convolutional neural networks (types of layers, learning)</p> <p>Classification with the use of convolutional networks</p> <p>Problems with learning deep networks (overfitting, fading gradient, etc.)</p> <p>Methods of counteracting problems related to learning deep networks (regularization, augmentation, dropout, early stopping, etc.)</p> <p>Transfer learning</p> <p>RNN models</p> <p>Development of RNN models (including LSTM etc.)</p> <p>The use of RNN models in NLP</p> <p>Generational models</p> <p>Autoencoders</p> <p>Application of generation models</p> <p>Reinforcement learning</p> <p>Reinforcement learning with the use of deep models part 1</p> <p>Reinforcement learning with the use of deep models part 2</p> | | | | | | | | | | | | | | |
|--|--|---|--|--------------------------|-------------------|-------------------------------|-----|-------|-------|-------------|------|-------|------|-------|-------|
| Prerequisites and co-requisites | Implementation of the subjects from the first semester. | | | | | | | | | | | | | | |
| Assessment methods and criteria | <table border="1"> <thead> <tr> <th data-bbox="456 1536 794 1565">Subject passing criteria</th> <th data-bbox="799 1536 1137 1565">Passing threshold</th> <th data-bbox="1142 1536 1469 1565">Percentage of the final grade</th> </tr> </thead> <tbody> <tr> <td data-bbox="456 1572 794 1601">Lab</td> <td data-bbox="799 1572 1137 1601">50.0%</td> <td data-bbox="1142 1572 1469 1601">50.0%</td> </tr> <tr> <td data-bbox="456 1608 794 1637">Assignments</td> <td data-bbox="799 1608 1137 1637">0.0%</td> <td data-bbox="1142 1608 1469 1637">10.0%</td> </tr> <tr> <td data-bbox="456 1644 794 1673">Exam</td> <td data-bbox="799 1644 1137 1673">50.0%</td> <td data-bbox="1142 1644 1469 1673">40.0%</td> </tr> </tbody> </table> | | | Subject passing criteria | Passing threshold | Percentage of the final grade | Lab | 50.0% | 50.0% | Assignments | 0.0% | 10.0% | Exam | 50.0% | 40.0% |
| Subject passing criteria | Passing threshold | Percentage of the final grade | | | | | | | | | | | | | |
| Lab | 50.0% | 50.0% | | | | | | | | | | | | | |
| Assignments | 0.0% | 10.0% | | | | | | | | | | | | | |
| Exam | 50.0% | 40.0% | | | | | | | | | | | | | |
| Recommended reading | Basic literature | <p>Bengio Yoshua, Courville Aaron, Goodfellow Ian, Deep Learning, Systemy uczące się, PWN 2018</p> <p>Andrew W. Trask, Zrozumieć głębokie uczenie, PWN, 2019</p> | | | | | | | | | | | | | |
| | Supplementary literature | brak | | | | | | | | | | | | | |
| | eResources addresses | <p>Adresy na platformie eNauczanie:</p> <p>Z_23_24 Uczenie głębokie - Moodle ID: 32677</p> <p>https://enauczanie.pg.edu.pl/moodle/course/view.php?id=32677</p> | | | | | | | | | | | | | |
| Example issues/ example questions/ tasks being completed | | | | | | | | | | | | | | | |

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| Work placement | Not applicable |
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