

## Subject card

|                                             |                                                                                                                                                                                                                                                                                 |                                                          |                                         |                                     |         |                                                                                                                      |     |
|---------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------|-----------------------------------------|-------------------------------------|---------|----------------------------------------------------------------------------------------------------------------------|-----|
| Subject name and code                       | Introduction to Machine Learning, PG_00198515                                                                                                                                                                                                                                   |                                                          |                                         |                                     |         |                                                                                                                      |     |
| Field of study                              | Informatics                                                                                                                                                                                                                                                                     |                                                          |                                         |                                     |         |                                                                                                                      |     |
| Date of commencement of studies             | October 2026                                                                                                                                                                                                                                                                    |                                                          | Academic year of realisation of subject |                                     |         | 2027/2028                                                                                                            |     |
| Education level                             | Bachelor's studies                                                                                                                                                                                                                                                              |                                                          | Subject group                           |                                     |         | Obligatory subject group in the field of study<br>Subject group related to scientific research in the field of study |     |
| Mode of study                               | part-time studies                                                                                                                                                                                                                                                               |                                                          | Mode of delivery                        |                                     |         | at the university                                                                                                    |     |
| Year of study                               | 2                                                                                                                                                                                                                                                                               |                                                          | Language of instruction                 |                                     |         | Polish                                                                                                               |     |
| Semester of study                           | 4                                                                                                                                                                                                                                                                               |                                                          | ECTS credits                            |                                     |         | 5.0                                                                                                                  |     |
| Learning profile                            | academic                                                                                                                                                                                                                                                                        |                                                          | Assessment form                         |                                     |         | credit                                                                                                               |     |
| Conducting unit                             |                                                                                                                                                                                                                                                                                 |                                                          |                                         |                                     |         |                                                                                                                      |     |
| Name and surname of lecturer (lecturers)    | Subject supervisor                                                                                                                                                                                                                                                              |                                                          | mgr Grzegorz Madejski                   |                                     |         |                                                                                                                      |     |
|                                             | Teachers                                                                                                                                                                                                                                                                        |                                                          |                                         |                                     |         |                                                                                                                      |     |
| Lesson types                                | Lesson type                                                                                                                                                                                                                                                                     | Lecture                                                  | Tutorial                                | Laboratory                          | Project | Seminar                                                                                                              | SUM |
|                                             | Number of study hours                                                                                                                                                                                                                                                           | 10.0                                                     | 0.0                                     | 20.0                                | 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                                                       |                                         | 0.0                                 |         | 95.0                                                                                                                 | 125 |
| Subject objectives                          | 1. Obtaining the basic methods of machine learning<br>2. Acquiring the ability to use basic machine learning algorithms - working in the Python environment<br>3. Mastering mathematical methods of modeling problems and machine learning tools and assessing their usefulness |                                                          |                                         |                                     |         |                                                                                                                      |     |

|                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                          |                                                                              |
|---------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------|
| Learning outcomes               | Course outcome                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Subject outcome                                                                                                                                                                                                                                                                                                                          | Method of verification                                                       |
|                                 | [INFOL3_U06] is able to select and apply appropriate IT methods and tools to solve complex problems, is able to use acquired knowledge by appropriately selecting sources and information derived from them, and perform evaluation, critical analysis, and synthesis of this information                                                                                                                                                                                                                                                                                    | The student is able to select appropriate machine learning methods, such as regression, classification, clustering, decision trees, support vector machines (SVM), and neural networks, and apply appropriate software tools, including Python, the scikit-learn, pandas, and NumPy libraries, as well as Jupyter Notebook environments. | [SU2] presentation/project/paper/report<br>[SU4] test/exam - oral or written |
|                                 | [INFOL3_W06] knows and understands advanced models of database systems, with particular emphasis on the relational model                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 1. The student is able to use the Python environment for machine learning.<br>2. The student knows data analysis methods.<br>3. The student is able to use the TensorFlow library tools to train neural networks.                                                                                                                        | [SW4] test/exam - oral or written<br>[SW2] presentation/project/paper/report |
|                                 | [INFOL3_U02] is able to use his/her knowledge of higher mathematics to model and solve complex problems                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | The student is able to apply knowledge of higher mathematics, in particular linear algebra, calculus, probability theory, and statistics, to data modeling, the analysis and implementation of machine learning algorithms, and the solution of complex prediction and classification problems.                                          | [SU2] presentation/project/paper/report<br>[SU4] test/exam - oral or written |
|                                 | [INFOL3_W03] knows and understands advanced concepts in the field of algorithms and data structures, formal languages, automata theory and computational complexity, and artificial intelligence                                                                                                                                                                                                                                                                                                                                                                             | The student understands the role of relational databases in the machine learning process. The student is able to retrieve data from relational databases, understands their structure, and uses data stored in the relational model to prepare training datasets, as well as for data processing and analysis.                           | [SW4] test/exam - oral or written<br>[SW2] presentation/project/paper/report |
| Subject contents                | <p>1.Introduction to basic terminology and notation. System creation strategy in machine learning2. Python in machine learning. Using the Python environment for machine learning: Anaconda, Jupyter, NumPy, Pandas, Matplotlib, SciPy.3.Data pre-processing. Best model evaluation methods and parametric tuning.4. Data analysis using regression analysis, cluster analysis5.Training neural networks using the TensorFlow library6. Application examples:(i) Modeling sequential data using recurrent neural networks(ii) Working with text(iii) Working with images</p> |                                                                                                                                                                                                                                                                                                                                          |                                                                              |
| Prerequisites and co-requisites | Knowledge of the basics of programming, algorithms and complexity, languages and paradigms of object-oriented programming in the languages chosen by the student.                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                          |                                                                              |
| Assessment methods and criteria | Subject passing criteria                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Passing threshold                                                                                                                                                                                                                                                                                                                        | Percentage of the final grade                                                |
|                                 | a test exam of lecture content                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 51.0%                                                                                                                                                                                                                                                                                                                                    | 50.0%                                                                        |
|                                 | graded project                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 51.0%                                                                                                                                                                                                                                                                                                                                    | 50.0%                                                                        |
| Recommended reading             | Basic literature                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | <p>1. M. Szeliga, Data science i uczenie maszynowe, Wydawnictwo naukowe PWN, Warszawa, 2017.<br/>2. T. Morzy, Eksploracja danych metody i algorytmy, Wydawnictwo naukowe PWN, Warszawa, 2013.<br/>3. Christopher M. Bishop Pattern Recognition and Machine Learning, Springer, 2007</p>                                                  |                                                                              |

|                                                                |                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|----------------------------------------------------------------|--------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                | Supplementary literature | 1. J. Koronacki, J. Ćwik: Statystyczne systemy uczące się. Wydanie drugie, EXIT, Warszawa, 20072. K. Krawiec, J. Stefanowski, Uczenie maszynowe i sieci neuronowe. Wydawnictwo Politechniki Poznańskiej, Poznań, 2004,3. P. Cichosz, Systemy uczące się, WNT, Warszawa, 2000.4. W. Duch, J. Korbicz, L. Rutkowski, R. Tadeusiewicz, Sieci neuronowe, Exit, Warszawa, 20005. M. Gągolewski, M. Bartoszek, A. Cena, Przetwarzanie i analiza danych w języku Python, PWN, 20166. W. McKinney, Python for Data Analysis. Data Wrangling with Pandas, NumPy, and IPython, O'Reilly Media, 20127. W. Richert, L.P. Coelho, Building Machine Learning Systems with Python, Packt Publishing, 20138. M. Lutz, Learning Python, O'Reilly Media, 20139.. E. Bressert, SciPy and NumPy, O'Reilly Media, 2012 |
|                                                                | eResources addresses     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Example issues/<br>example questions/<br>tasks being completed |                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Work placement                                                 | Not applicable           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |

Document generated electronically. Does not require a seal or signature.