#### card of course

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| Subject name | Python Programming - Scikit-learn Library |

1. The placement of the subject in the study system

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| 1.1. Field of study | Computer science |
| 1.2. Form and path of study | Full-time/Part-time |
| 1.3. Level of education | First-cycle studies |
| 1.4. Study profile | Practical |

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| 1. 5. Specialty | Artificial intelligence |
| 1.6. Subject Coordinator | Dr inż. Róża Dzierżak |

2. General characteristics of the subject

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| 2.1. Belonging to a subject group | Directional/Practical |
| 2.2. Number of ECTS | 5 |
| 2.3. Language of lectures | English |
| 2.4. Semesters in which the subject is taught | IV |
| 2.5.Criteria for selecting course participants | For specialization: Artificial Intelligence |

1. Learning outcomes and course delivery
	1. Subject Objectives

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| No. | Subject Objectives |
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| C1 | Getting to know the Scikit-learn library, learning the basic functions and tools of the Scikit-learn library for machine learning. |
| C2 | Create and train models with Scikit-learn, including classification, regression, and clustering. |
| C3 | Solve analytical problems and interpret results using Scikit-learn. |

* 1. Subject-specific learning outcomes, divided into knowledge , skills and competences , with reference to the directional learning outcomes

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| No. | Description of subject learning outcomes | Reference to directional effectslearning (symbols) | Method of implementation (mark "X") |
| ST | NST |
| Classes at the University | Activities on the platform | Classes at the University | Activities on the platform |
| After passing the course, the student knows and understands **the knowledge** |
| W1 | Knows the basic functions and tools of the Scikit-learn library. | INF\_W07INF\_W10 INF\_W19 |  | X |  | X |
| W2 | Understands machine learning processes such as classification, regression, and clustering. |  | X |  | X |
| W3 | Possesses knowledge of data preprocessing, including normalization, standardization and feature transformations. |  | X |  | X |
| W4 | Knows basic machine learning algorithms implemented in Scikit-learn, such as decision trees, SVM, KNN, linear and logistic regression. |  | X |  | X |
| W5 | Understands model evaluation methods, including cross-validation and hyperparameter selection. |  | X |  | X |
| After passing the course, the student is **able** to: |
| U1 | Is able to prepare data for analysis, including preprocessing using Scikit-learn tools. | INF\_U13 INF\_U19 INF\_U21 | X |  | X |  |
| U2 | Is able to implement machine learning models such as classifiers, regressors, and clustering algorithms. | X |  | X |  |
| U3 | Can evaluate models using metrics such as accuracy, F1-score or ROC-AUC. | X |  | X |  |
| U4 | Can visualize model results and present them in the form of a report. | X |  | X |  |
| After completing the course, the student is ready to take part in **social competences.** |
| K1 | Understands the importance of machine learning in data analysis and decision-making. | INF\_K02 | X |  | X |  |

3.3. Forms of teaching and their number of hours - Full-time studies (ST), Part-time studies (NST)

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| Path | Lecture | Exercises | Design | Workshop | Laboratory | Seminar | Lecturer | Classes conducted using distance learning methods and techniques in the form of a lecture | Other | **ECTS points** |
| **ST** |  |  |  |  | 30 |  |  | 20 |  | 5 |
| **NST** |  |  |  |  | 15 |  |  | 10 |  | 5 |

3.4. Content of education (separately for each form of classes: (W, ĆW, PROJ, WAR, LAB, LEK, OTHER). It should be marked (X) how the given content will be implemented (classes at the university or classes on the e-learning platform conducted using distance learning methods and techniques)

TYPE OF CLASS: LECTURE

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| No. | Content of the course | Reference to subject-specific learning outcomes | Method of implementation (mark "X") |
| ST | NST |
| **Classes at the University** | **Activities on the platform** | **Classes at the University** | **Activities on the platform** |
| 1. | Scikit-learn basics: Library structure and key features. | W1 |  | X |  | X |
| 2. | Data processing in Scikit-learn: Normalization, standardization, and variable coding. | W3 |  | X |  | X |
| 3. | Classification techniques in Scikit-learn: Implementing classifiers such as SVM, KNN, and decision trees. | W2, W4 |  | X |  | X |
| 4. | Regression methods in Scikit-learn: Linear, logistic regression models, and other predictive approaches. | W2, W4 |  | X |  | X |
| 5. | Clustering Algorithms in Scikit-learn: Introduction to K-means, DBSCAN and other clustering methods. | W2, W4 |  | X |  | X |
| 6. | Practical applications and results visualization: Data presentation and analysis of model results. | W5 |  | X |  | X |
| 7. | Reporting Analysis: A Practical Approach to Presenting Results and Preparing Documentation | W5 |  | X |  | X |
| 8. | Summary of classes and discussion of grades |  |  | X |  | X |

TYPE OF CLASS: LABORATORY

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| No. | Content of the course | Reference to subject-specific learning outcomes | Method of implementation (mark "X") |
| ST | NST |
| **Classes at the University** | **Activities on the platform** | **Classes at the University** | **Activities on the platform** |
| 1. | Introduction to the Scikit-learn library. structure and basic functions. | K1 | X |  | X |  |
| 2. | Data preprocessing in Scikit-learn, normalization, standardization, variable coding. | U1 | X |  | X |  |
| 3. | Classification in Scikit-learn, implementing classifiers such as SVM, KNN, decision trees. | U2 | X |  | X |  |
| 4. | Regression in Scikit-learn, linear regression models, logistic and other predictive methods. | U2 | X |  | X |  |
| 5. | Clustering in Scikit-learn, algorithms such as K-means or DBSCAN. | U2, U3 | X |  | X |  |
| 6. | Practical applications and visualization of results. Presenting results and creating reports. | U4 | X |  | X |  |

3.5 . Methods of verifying learning outcomes (indication and description of methods of conducting classes and verification of achievement of learning outcomes and method of documentation)

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| Subject Effects | Teaching methods | Methods of verifying learning outcomes | Documentation methods |
| KNOWLEDGE |
| W1-W5 | Multimedia Presentation using tools | Theoretical colloquium (testing knowledge of the theoretical foundations of data analysis methods using Scikit-learn and the ability to understand and apply them in context). | Colloquium archived on the platform |
| SKILLS |
| U1-U4 | Practical classes performed at computer stations | Project: Building and Evaluating a Machine Learning Model Using Scikit-learn Description:Students prepare data, implement and train a machine learning model, and then evaluate it and interpret the results. | The project was placed on the platform |
| SOCIAL COMPETENCES |
| K1 | Practical classes performed at computer stations | Project: Building and Evaluating a Machine Learning Model Using Scikit-learn Description:Students prepare data, implement and train a machine learning model, and then evaluate it and interpret the results. | The project was placed on the platform |

3.6. Assessment criteria for the achieved learning outcomes

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| Learning effect | For a grade of 3 or "pass."the student knows and understands/is able to/is ready to | For a grade of 3.5, the student knows and understands/is able to/is ready to | For a grade of 4, the student knows and understands/is able to/is ready to | For a grade of 4.5, the student knows and understands/is able to/is ready to | For a grade of 5, the student knows and understands/is able to/is ready to |
| W | 51-60% of knowledge indicated in learning outcomes | 61-70% of knowledge indicated in learning outcomes | 71-80% of knowledge indicated in learning outcomes | 81-90% of knowledge indicated in learning outcomes | 91-100% of knowledge indicated in learning outcomes |
| U | 51-60% of skills indicated in learning outcomes | 61-70% of skills indicated in learning outcomes | 71-80% of skills indicated in learning outcomes | 81-90% of skills indicated in learning outcomes | 91-100% of skills indicated in learning outcomes |
| K | 51-60% of skills indicated in learning outcomes | 61-70% of skills indicated in learning outcomes | 71-80% of skills indicated in learning outcomes | 81-90% of skills indicated in learning outcomes | 91-100% of skills indicated in learning outcomes |

3.7. Literature

**Basic**

1. Ameisen Emmanuel; Building Machine Learning Powered Applications : Going from Idea to Product O'Reilly; Sebastopol 2020
2. Raschka S., Mirjalili V., "Python Machine Learning. Wydanie III", Helion, 2021.
3. Grus J., "Data Science z wykorzystaniem Pythona", Helion, 2020

**Supplementary**

1. Julian David Designing machine learning systems with Python; Packt Publishing; Birmingham 2016
2. Beazley David, Python Zwięzłe kompendium dla programisty, Helion, 2024
3. Wróblewski Piotr, Machine learning i natural language processing w programowaniu.. Podręcznik z ćwiczeniami w Pythonie, Helion, 2024

4. Student workload - ECTS points balance

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| **Types of student activity** | **Student Load** |
| **ST** | **NST** |
| **Classes requiring direct contact between the student and the academic teacher at the university premises** | **50** | **25** |
| Classes included in the study plan | 50 | 25 |
| **Student's own work** | **75** | **100** |
| Ongoing preparation for classes, preparation of project work/presentations/etc. | 40 | 50 |
| Preparation for passing classes | 35 | 50 |
| **TOTAL STUDENT HOURLY LOAD** | **125** | **125** |
| **Number of ECTS points** | **5** | **5** |

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| Last change date | 30/09/2024 |
| The changes were introduced | INF Education Quality Team |
| The changes were approved | Arkadiusz Gwarda, M.A. |