#### card of course

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| Subject name | Neural networks part III |

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 | 3 |
| 2.3. Language of lectures | Polish |
| 2.4. Semesters in which the subject is taught | V |
| 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 | Learn to train, optimize, and deploy large models in production environments. |
| C2 | Solving complex problems such as image processing, natural language processing, or temporal data analysis. |
| C3 | Connecting neural networks with big data, IoT and cloud computing. |

* 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 effects  learning (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 practical applications of advanced neural network models in various fields, such as computer vision, natural language processing, and temporal data analysis. | INF\_W07 INF\_W10 INF\_W19 INF\_W20 | X |  | X |  |
| W2 | Understands the methods of integrating neural networks with big data and IoT technologies. | X |  | X |  |
| W3 | Knows model optimization methods such as pruning and quantization and their applications in improving performance. | X |  | X |  |
| W4 | Understands the principles of implementing neural network models into production environments, taking into account scalability and efficiency. | X |  | X |  |
| W5 | Has knowledge of the use of DevOps tools and containerization in working with AI models. | X |  | X |  |
| After passing the course, the student is **able** to: | | | | | | |
| U1 | Can integrate neural networks with big data and IoT systems. | INF\_U12  INF\_U13 INF\_U19 INF\_U21 | X |  | X |  |
| U2 | Can optimize neural network models, taking into account performance and hardware limitations. | X |  | X |  |
| U3 | Can deploy models to production environments using containerization and DevOps tools. | X |  | X |  |
| U4 | Is able to analyze complex problems and implement solutions using neural networks in practical applications. | X |  | X |  |
| U5 | Is able to effectively present the results of his/her work by creating reports and technical presentations. | X |  | X |  |
| After completing the course, the student is ready to take part in **social competences.** | | | | | | |
| K1 | Understands the importance of interdisciplinary collaboration in projects using neural networks. | INF\_K05 | X |  | X |  |
| K2 | Is aware of the ethical and social aspects of AI model applications. | 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 |  |  |  |  | 3 |
| **NST** |  |  |  |  | 15 |  |  |  |  | 3 |

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: 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. | Hybrid learning and integration with other technologies, combining neural networks with IoT, big data, etc. | W3, U3, K2 | X |  | X |  |
| 2. | Optimization of large-scale models, pruning, quantization, optimization of computation times. | W5, U4 | X |  | X |  |
| 3. | Deploying models to production environments, containerization, scalability, DevOps tools for AI. | W4, U5 | X |  | X |  |
| 4. | Practical applications of neural networks in various fields, image processing, natural language, temporal data analysis. | W1, W2, U1, U2, U3 | X |  | X |  |
| 5. | Presentation of final projects.  Discussion of results, discussion and evaluation. | K1 | 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 | Knowledge provided during the laboratory | Term project: Comprehensive implementation of a large-scale neural network model  Description:Students design and implement an advanced neural network model, optimizing it for performance and integrating it with big data or IoT technologies. | The project was placed on the platform |
| SKILLS | | | |
| U1-U5 | Practical classes performed at computer stations | Term Project: Comprehensive Implementation of a Large-Scale Neural Network Model  Description:  Students design and implement an advanced neural network model, optimizing it for performance and integrating it with big data or IoT technologies. | The project was placed on the platform |
| SOCIAL COMPETENCES | | | |
| K1-K2 | Practical classes performed at computer stations | Term project: Comprehensive implementation of a large-scale neural network model  Description:Students design and implement an advanced neural network model, optimizing it for performance and integrating it with big data or IoT technologies. | 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. Julian David; Designing machine learning systems with Python; Packt Publishing; Birmingham 2016
2. Raschka S., Mirjalili V., "Python Machine Learning. Wydanie III", Helion, 2021.
3. Sarah Guido, Andreas C Muller, Machine Learning, Python i data science, Helion, 2023

**Supplementary**

1. Ameisen Emmanuel; Building Machine Learning Powered Applications : Going from Idea to Product O'Reilly; Sebastopol 2020
2. 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** | **30** | **15** |
| Classes included in the study plan | 30 | 15 |
| **Student's own work** | **45** | **60** |
| Ongoing preparation for classes, preparation of project work/presentations/etc. | 25 | 30 |
| Preparation for passing classes | 20 | 30 |
| **TOTAL STUDENT HOURLY LOAD** | **75** | **75** |
| **Number of ECTS points** | **3** | **3** |

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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. |