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| **WSB University Branch/Department of Jaworzno** | | | | | | | | | | |
| **Field of study: Computer Science** | | | | | | | | | | |
| **Subject: Artificial intelligence methods** | | | | | | | | | | |
| **Educational profile: practical** | | | | | | | | | | |
| **Level of education: undergraduate studies** | | | | | | | | | | |
| **Number of hours**  **per semester** | | 1 | | | 2 | | | 3 | | 4 |
| I | II | | III | | IV | V | **VI** | VII |
| **Full-time studies**  (w/w/lab/pr/e)\* | |  |  | |  | |  |  | **16w/16lab** |  |
| **Part-time studies**  (w/æw/lab/pr/e) | |  |  | |  | |  |  | **12w/12lab** |  |
| **LANGUAGE OF INSTRUCTION** | | Polish | | | | | | | | |
| **LECTURER** | | D. Eng. Rafał Deja, Prof. AWSB | | | | | | | | |
| **FORM OF ACTIVITIES** | | Lecture, laboratory, consultation | | | | | | | | |
| **SUBJECT OBJECTIVES** | | Introduction to: basic issues and methods of artificial intelligence, variety of methods based on mimicking nature, heuristic methods based on search with constraints, and knowledge representations and inference. | | | | | | | | |
| **Reference to learning outcomes** | | | | **Description of the learning outcomes** | | | | **Means of verification of the effect**  **learning** | | |
| **Directional effect** | **PRK** | | |
| **NEWS** | | | | | | | | | | |
| INF\_W02  INF\_W09 | P6S\_WG | | | The student knows and understands machine learning algorithms based on, among other things, neural networks. | | | | Completion of neural network configuration and learning tasks, written exam | | |
| INF\_W02  INF\_W09 | P6S\_WG | | | The student knows and understands the problem of classification and prediction and the problems associated with uncertain and incomplete knowledge. | | | | Performance of classification tasks and quality assessment of the classifier by cross-validation, written examination | | |
| INF\_W02  INF\_W09 | P6S\_WG | | | The student knows and understands heuristic algorithms their meaning and application in particular evolutionary and genetic algorithms. | | | | Tasks to prepare a suitable algorithm for a given optimisation problem, written examination | | |
| **SKILLS** | | | | | | | | | | |
| INF\_U10  INF\_U02  INF\_U08  INF\_U12 | P6S\_UW | | | The student is able to design a simple neural network model and can verify the proposed model in a data classification task | | | | Performing the tasks, providing a description of the configuration | | |
| INF\_U07  INF\_U08  INF\_U11 | P6S\_UW | | | The student is able to solve a given optimisation problem using heuristic algorithms. | | | | Execution of tasks, provision of optimisation results for a given problem | | |
| INF\_U10 | P6S\_UW | | | Students can design a simple controller using fuzzy sets | | | | Carrying out tasks, providing an example of inference | | |
| INF\_U01  INF\_U02  INF\_U03 | P6S\_UW | | | Able to independently acquire the relevant knowledge and skills necessary to complete tasks. | | | | Performance of tasks requiring independent knowledge | | |
| **Student workload (in teaching hours 1h =45 minutes)\*\*** | | | | | | | | | | |
| **Stationary**  attendance at lectures = 16  participation in exercises/laboratories = 16  Preparation for exercises/laboratory = 23  lecture preparation = 20  Exam preparation/assessment = 15  implementation of project tasks =  e-learning =  credit/examination = 6  other (consultation) = 4  **TOTAL: 100h**  **Number of ECTS credits: 4**  **including in practical classes: 2** | | | | | | **Part-time**  attendance at lectures = 12  participation in exercises/laboratories = 12  Preparation for exercises/laboratory = 28  lecture preparation = 23  Exam preparation/assessment = 15  implementation of project tasks =  e-learning =  credit/examination = 6  other (consultation) = 4  **TOTAL: 100h**  **Number of ECTS credits: 4**  **including in practical classes: 2** | | | | |
| **PREREQUISITES** | Fundamentals of computer programming, knowledge of languages and paradigms and object-oriented programming. Fundamentals of mathematical logic | | | | | | | | | |
| **SUBJECT CONTENT**  (broken down into  face-to-face and e-learning classes) | Lecture:  Content delivered in a face-to-face format:   * Introduction:   1. History of the development of AI, areas of application. Awareness,   2. Related sciences - cognitive sciences, robotics, expert systems * Problems solved by artificial intelligence methods   1. classification, clustering, regression, optimisation   2. examples of real-life problems. * Teaching methods   1. supervised, unsupervised learning   2. reinforcement learning   3. machine learning * Neural networks   1. perceptron, construction of sigmoidal neuron, types of neural network learning, radial basis function neuron, , self-organizing networks, recurrent networks, types of networks in relation to artificial intelligence problems   2. Hebb methods, back propagation method * Other artificial intelligence methods   1. population-based methods (PSO, artificial immunology)   2. approximate yields * Artificial intelligence systems and languages: TensorFlow, J4DL, Cafee   Content delivered via e-learning:   * Deep learning (DL)   1. Boltzman machine, limited Boltzman machine, braided networks   2. basic learning methods for multilayer neural networks in DL architecture * Evolutionary algorithms   1. Basic: concept of evolutionary algorithm, genetic algorithm, genetic programming, evolutionary strategies, exploration and exploitation, genetic operators. Convergence of evolutionary algorithms.   2. examples of applications of evolutionary algorithms. * Fuzzy logic   1. Concept of fuzzy set, fuzzy number, fuzzy logic, fuzzy controller, fusification, defuzzification, fuzzy networks.   2. examples of application of fuzzy logic, types of fuzzy networks   Lab:  Content delivered in a face-to-face format:   * Artificial neural networks. A machine learning algorithm with backward error propagation. Classification problems. * Evolutionary methods and genetic algorithms. * Logic-based methods and expert systems.   1. Inference using rough set theory   2. Inference using fuzzy set theory * Classification algorithm using decision trees   Content delivered via e-learning: not applicable | | | | | | | | | |
| **LITERATURE**  **COMPULSORY** | * Deep Learning Tutorial, Release 0.1. LISA lab, University of Montreal, June 29, 2015 * Mariusz Flasinski, Introduction to artificial intelligence, PWN latest edition * L. Rutkowski: Methods and techniques of artificial intelligence. (2nd ed.), Warsaw : PWN, latest edition. * Ian Goodfellow and Yoshua Bengio and Aaron Courville : Deep Learning; An MIT Press book; www.deeplearningbook.org. | | | | | | | | | |
| **LITERATURE**  **SUPPLEMENTARY**  (including min. 2 items in English; book publications or articles) | * Cichosz, Pawel. Data mining algorithms: explained using R. John Wiley & Sons, 2014. * S. Russell and P. Norvig, Artificial Intelligence: A Modern Approach, 3rd Ed., Pearson, 2010. * Cichosz P., Systemy uczące się, WNT Warsaw, 2000, ISBN 83-204-2544 | | | | | | | | | |
| **TEACHING METHODS**  (broken down  face-to-face classes and e-learning) | In direct form:   * Slide show, demonstration of a sample program, traditional method with a whiteboard * Lesson and lecture structure, * Exercises using computers   In the form of e-learning: material in the form of slides and articles on artificial intelligence methods, video presentations of the material, assignments and tests | | | | | | | | | |
| **LEARNING AIDS** | Video-projector, e-learning platform (Moodle) | | | | | | | | | |
| **PROJECT**  (insofar as it is carried out in the course module) | Not applicable | | | | | | | | | |
| **FORM AND CONDITIONS OF PASSING**  (broken down into  face-to-face and e-learning classes) | * Lecture - exam * Laboratory - pass/fail * Evaluation of activities in lecture and on the e-learning platform * Evaluation of the performance of tasks, carried out in teams. A description of the solution should be presented in the form of documentation. | | | | | | | | | |