COURSE DESCRIPTION CARD - SYLLABUS

Course name
Knowledge engineering and data mining in medicine [S2IBio1-UMiR>IW]

Course

Field of study
Biomedical Engineering

Year/Semester
2/3

Area of study (specialization)
Medical and Rehabilitation Devices

Profile of study
general academic

Level of study
second-cycle

Course offered in
Polish

Form of study
full-time

Requirements
elective

Number of hours

Lecture
15

Laboratory classes
15

Other
0

Tutorials
0

Projects/seminars
0

Number of credit points

2,00

Coordinators

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Lecturers

Prerequisites

Basic knowledge from the fields of computing and statistics

Course objective

Practical skill of knowledge engineering and medical data analysis using machine learning methods

Course-related learning outcomes

Knowledge:
Student knows the basic concepts of machine learning and artificial intelligence.
Student knows algorithms of induction of knowledge from collected examples

Skills:
Student is able to process and analyze data in order to obtain the knowledge

Social competences:
The student is able to think and act in a creative way in solving technical and non-technical problems

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Learning outcomes presented above are verified as follows:
Lecture: exam based on a test, 15 closed questions, passing the subject -50% of the maximum points
Laboratory: short tests and report on the implementation of the final task, passing the subject- 50% of the maximum points

Programme content

Lecture: basic concepts in the field of knowledge engineering and machine learning, including rule induction algorithms, fuzzy systems, classification and grouping algorithms.
Laboratories:
Creating Python scripts using Pandas, matplotlib, numpy and scikit learn libraries to solve medical data analysis problems

Course topics

Lecture: Basic concepts related to knowledge engineering, expert systems in medicine, knowledge representation methods and data mining. Expert systems - rule induction methods, rule processing and reasoning. Hybrid expert systems using fuzzy inference, fuzzy rule induction and fuzzy inference. Evolution of fuzzy systems. Methods Pittsburgh and Michigan in fuzzy rule induction. Basic concepts related to self learning systems.. General overview of classification and grouping methods. Distance methods (k-NN and its various varieties). Decision tree induction and classifier ensembles. OvA method. SVM method. Naive Bayes classifier. Cluster analysis. Hierarchical methods, k-means method.
Testing machine learning systems. Selection of diagnostic features.
Logistic regression. Multiple linear and non-linear regression for classification, approximation and prediction. Transformations and methods
data dimension reduction. Neural networks and their applications (estimation, classification and forecast). MLP networks with softmax layer, Elman networks, RBF networks, Kohenen networks, LVQ networks. TSK fuzzy neural networks (Takagi Sugeno Kanga). Deep neural networks - CNN.
Lab:
Creating a program in Python to classify data using various methods. Data dimension reduction, data evaluation and selection in Python..
Testing the classifier. Application of neural networks for classification, approximation and prediction. Implementation of the algorithm
k-means HCM clustering and fuzzy clustering. Analysis of sample medical data.

Teaching methods

Lecture: multimedia presentation with theory and examples, discussion and problem analysis.
Laboratory exercises: practical exercises, problem solving

Bibliography

Basic
1.D. T. Larose, Odkrywanie wiedzy z danych, PWN, Warszawa 2006
2.L. Rutkowski, Metody i techniki sztucznej inteligencji, PWN, Warszawa 2005
3.S. Osowski, Metody i narzędzia eksploracji danych, BTC, Legionowo 2013
4. J. Jagielski, Inżynieria wiedzy, Uniwersytet Zielonogórski, Zielona Góra 2005
5. A. Geron, Uczenie maszynowe z użyciem Scikit-Learn i TensorFlow, Helion

Additional
1.M. Białko, Sztuczna inteligencja i elementy hybrydowych systemów ekspertowych, Wydawnictwo Uczelniane Politechniki Koszalińskiej, Koszalin 2005
2.P. Cichosz, Systemy uczące się, WNT Warszawa 2000
3. J. Kornacki, J. Ćwik, Statystyczne systemy uczące się, WNT, Warszawa 2005

Breakdown of average student's workload

	Hours	ECTS
Total workload	50	2,00
Classes requiring direct contact with the teacher	30	1,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	20	1,00