



COURSE DESCRIPTION CARD - SYLLABUS

Course name

Knowledge engineering and data mining in medicine [S2IBio1E-UMiR>IW]

Course

Field of study	Year/Semester
Biomedical Engineering	2/3
Area of study (specialization)	Profile of study
Medical and Rehabilitation Devices	general academic
Level of study	Course offered in
second-cycle	English
Form of study	Requirements
full-time	elective

Number of hours

Lecture	Laboratory classes	Other
15	15	0
Tutorials	Projects/seminars	
0	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: Fundamentals of knowledge engineering, expert systems and data mining. Hybrid expert systems, fuzzy rules, induction of fuzzy rules from data, inference from data. Methods of induction of knowledge from data. Induction of fuzzy rules. Evolution of fuzzy systems. Pittsburgh and Michigan methods in induction of fuzzy rules. Basic concepts of data mining, machine learning. General review of classification and grouping methods. Distance methods (k-NN and its various variants). Induction of decision trees and ensembles of classifiers. OvA method. SVM method. Induction of rules and induction of association rules. Naive Bayes classifier. Cluster analysis. Hierarchical methods, k-means method. Testing of classifiers. Selection of diagnostic features. Logistic regression. Multiple linear and nonlinear regression for classification, approximation and prediction purposes. Transformations and methods of data dimension reduction. Fuzzy classification and grouping. Neural networks and their applications (approximation, classification and forecast). MLP networks, Elman networks, RBF networks, Kohonen networks, LVQ networks. TSK fuzzy neural networks (Takagi Sugeno Kang). Deep learning -CNN.

Lab:

Creating a MATLAB program for classification by the method of k nearest neighbors and by means of multiple regression. Implementation of the classifier assessment and its optimization. Reduction of the data dimension, evaluation and selection of data in MATLAB. Classifier testing. Construction of classification trees, naive Bayes classifier, SVM classifier. The use of neural networks for classification and approximation. Implementation of the HCM k-means grouping algorithm and fuzzy grouping.

Analysis of sample data.

Course topics

none

Teaching methods

Lecture: multimedia presentation with theory and examples, discussion and problem analysis.

Laboratory exercises: practical exercises, problem solving

Bibliography

Basic

1. Daniel T. Larose, Odkrywanie wiedzy z danych, PWN, Warszawa 2006
2. Leszek Rutkowski, Metody i techniki sztucznej inteligencji, PWN, Warszawa 2005
3. Stanisław Osowski, Metody i narzędzia eksploracji danych, BTC, Legionowo 2013
4. Jan Jagielski, Inżynieria wiedzy, Uniwersytet Zielonogórski, Zielona Góra 2005

Additional

1. Michał Biały, Sztuczna inteligencja i elementy hybrydowych systemów ekspertowych, Wydawnictwo Uczelniane Politechniki Koszalińskiej, Koszalin 2005
2. Paweł Cichosz, Systemy uczące się, WNT Warszawa 2000
3. Jacek Kornacki, Jan 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