COURSE DESCRIPTION CARD - SYLLABUS

Course name

Knowledge engineering and data mining in medicine

Course

Field of study

Biomedical Engineering

Area of study (specialization)

UMR

Level of study

Second-cycle studies

Form of study

full-time

Year/Semester

1/2

Profile of study

general academic

Course offered in

polish

Requirements

elective

Number of hours

Lecture

15

Laboratory classes

15

Other (e.g. online)

Tutorials

Projects/seminars

Number of credit points

2

Lecturers

Responsible for the course/lecturer:

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Responsible for the course/lecturer:

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:

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 minning. 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 nolinear 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, Kohenen 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.

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 Białko, 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	2,0
Classes requiring direct contact with the teacher	35	1,5
Student's own work (literature studies, preparation for lecture, for laboratory classes, preparation for tests) [1]	15	0,5

[1] delete or add other activities as appropriate