COURSE DESCRIPTION CARD - SYLLABUS

Course name

Machine learning

Course

Field of study

Bioinformatics

Year/Semester

3/ 5

Area of study (specialization)

-

Profile of study

general academic

Level of study

First-cycle studies

Course offered in

Polish

Form of study

full-time

Requirements

compulsory

Number of hours

Lecture	Laboratory classes	Other (e.g. online)
30	15	
Tutorials	Projects/seminars	

Number of credit points

4

Lecturers

Responsible for the course/lecturer:

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Responsible for the course/lecturer:

Prerequisites

A student starting this module should have basic knowledge of algorithms, human-computer communication and databases. His knowledge should cover development trends and the most important achievements in computer science, bioinformatics and in selected related scientific disciplines. In terms of skills, proficiency is required in solving basic bioinformatics problems, independent writing, modification and testing of computer programs, along with the ability to obtain information from the indicated sources. The student should also have basic knowledge of inference techniques, probability calculus, mathematical statistics, vector and matrix algebra. He should have basic programming skills (using Python, C ++ and selected libraries).

Course objective

The aim of the course is to provide students with knowledge of the basic concepts of machine learning with their practical application. An additional goal of the course is to develop students 'skills of reasoning, solving engineering problems and the selection of appropriate learning algorithms based on the analysis and generalization of the experience record in the form of examples, and to develop students' analytical approach to solving decision support problems with a focus on bioinformatics problems.

Course-related learning outcomes

Knowledge

The student knows mathematical methods, including statistical ones and machine learning, used for interpretation of biological processes

The student knows and understands issues in the field of mathematics useful for formulating and solving simple bioinformatics tasks, including discrete mathematics, algebra, mathematical analysis, probability calculus and statistics

The student knows and understands the basic methods, techniques and tools used in the process of solving bioinformatics tasks, mainly of an engineering nature

Skills

The student is able to obtain information from literature, databases and other properly selected sources, also in English

The student is able to integrate and interpret the obtained information, as well as draw conclusions and formulate and justify their opinions

The student is able to use analytical, simulation and experimental methods to formulate and solve research tasks under the supervision of a research tutor

The student is able to use basic statistical methods as well as algorithms and information techniques to describe biological processes and analyze data

The student is able to design and create computer software in accordance with the given specification, using appropriate methods, techniques and tools

The student can see systemic and non-technical aspects of bioinformatics tasks while analyzes biomedical data

Social competences

The student is ready to learn throughout his life and improve his competences

The student is ready to cooperate and work in a group, assuming different roles in it

The student is ready to define priorities for the implementation of a task defined by himself or others

The student is ready to take responsibility for the decisions made

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Formative assessment:

a) in the field of lectures, verification of the assumed learning outcomes is carried out by:

• answers to questions about the material discussed in previous lectures

b) in the field of exercise laboratories, the verification of the assumed learning outcomes is carried out by:

• assessment of skills related to the implementation of laboratory exercises

• continuous assessment, during each class (oral answers) - rewarding the increase in the ability to use the learned rules and methods

• evaluation of reports prepared partly during the classes and partly after their completion

• assessment and "defense" of laboratory exercises carried out by the student

Summative assessment:

a) in the field of lectures, verification of the assumed learning outcomes is carried out by:

• assessment of the knowledge and skills demonstrated in the problem-based written exam in the form of a test consisting of multiple-choice questions as well as open-ended questions and tasks.

b) in the field of laboratories / exercises, verification of the assumed learning outcomes is carried out by:

• assessment of knowledge and skills related to the content conveyed in the exercises on the basis of work during classes and the results of reports related to the implementation of assigned problems and the ability to use the tools presented in the laboratories.

Activity during classes is rewarded with additional points, in particular for:

• discussion of additional aspects of the issue,

• effectiveness of applying the acquired knowledge while solving a given problem

Programme content

The lecture program includes:

• basic concepts in the field of machine learning,

• supervising the learning of concepts

• selection of attributes

- criteria for assessing classification systems,
- supervised and unsupervised learning algorithms
- the phenomenon of overfitting and strategies to avoid it
- creation and representation of teaching and test examples
- induction of decision trees,
- creating rules and their interpretation
- probabilistic classifiers
- basics of neural networks
- self-learning networks
- application of neural networks and machine learning methods
- methodology for creating and applying learning systems

Teaching methods

Lecture:

multimedia presentation, presentation illustrated with examples given on the board, solving simple tasks, multimedia show, discussion.

Laboratory exercises:

solving tasks, practical exercises with limited programming using the indicated libraries with the implementation of algorithms, team work, performing experiments and analyzes, discussion

Bibliography

Basic

1. Machine Learning: The Art and Science of Algorithms that Make Sense of Data, P.Flach, Cambridge University Press, 2012

2. Pattern recognition and machine learning. Ch. Bishop, Springer, 2006

3. Systemy uczące się, P. Cichosz, WNT, Warszawa, 2000

4. Uczenie maszynowe i sieci neuronowe, K.Krawiec, J.Stefanowski, Wydawnictwo PP, Poznań, 2004

Additional

1. Sieci neuronowe, Duch W., Korbicz J., Rutkowski L., Tadeusiewicz R., Exit, Warszawa, 2000.

Breakdown of average student's workload

	Hours	ECTS
Total workload	100	4,0
Classes requiring direct contact with the teacher	45	2,0
Student's own work (literature studies, preparation for laboratory classes/tutorials, preparation for tests/exam, project) [1]	55	2,0

[1] delete or add other activities as appropriate