COURSE DESCRIPTION CARD - SYLLABUS

Course name
Programming with elements of machine learning [S1MNT1>PzEUM]

Course

Field of study
Mathematics of Modern Technologies

Year/Semester
1/2

Area of study (specialization)
–

Profile of study
general academic

Level of study
first-cycle

Course offered in
Polish

Form of study
full-time

Requirements
compulsory

Number of hours

Lecture
15

Laboratory classes
30

Other
0

Tutorials
0

Projects/seminars
15

Number of credit points

5,00

Coordinators

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Lecturers

Prerequisites

The student starting this subject should have knowledge and skills of the course Introduction to Programming and Information Technologies from the first semester. Should know the limits of their own knowledge and understand the need for further education.

Course objective

The aim of the course is to familiarize the student with useful numerical and symbolic packages related to data analysis and machine learning. Appropriate Python libraries are used for this purpose (numpy, matplotlib, pandas, scikit-learn, TensorFlow).

Course-related learning outcomes

Knowledge:
• student knows and understand selected tools of mathematics used in data mining [K_W01(P6S_WG), K_W02(P6S_WG)];

• student has deepened and theoretically founded knowledge of computer science, including numerical methods; knows at least one software package or a programming language in detail [K_W 01(P 6S_W G), K_W02(P6S_WG)].

Skills:
• the student is able to apply theoretical knowledge, in particular in mathematics, to process and analyze data and to formulate appropriate conclusions [K_U 04(P 6S_U W), K_U 05(P 6S_U W), K_U 06(P 6S_U W)];
• the student is able to collect / process data and evaluate their quality [K_U06(P6S_UW)];
• studentcanconstructanalgorithmforsolvingacomplexengineeringtaskorasimpleresearchproblem and implement and test it in a selected programming environment [K_U11(P6S_UW)];
• student is able to use equipment and tools, in accordance with general requirements and technical documentation; knows how to apply the principles of health and safety at work [K_U17(P6S_UU)].

Social competences:
• the student is ready to support other scientific units / industry, etc. in the field of mathematical modeling / statistical inference / data analysis and processing for the benefit of the social environment [K_K01(P6S_KK), K_K02(P6S_KK)];
• studentisawareofthelevelofhisknowledgeinrelationtoresearchintechnicalsciences[K_K01(P6S_KK)];
• student is aware of the deepening and expanding knowledge to solve new technical problems [K_K02(P6S_KK)].

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lectures: knowledge acquired during the lecture is verified during the final test. The scoring rules are as follows:

Result Grade
0% - 49% Insufficient
50% - 59% Satisfactory
60% - 69% Satisfactory plus
70% - 79% Good
80% - 89% Good plus
90% -100% Very good

Laboratories
1. During the semester, there will be two equally scored tests (30 points each).

2. There will be no retakes on tests.

3. Students may receive additional points for activity during classes, no more than 10% (i.e. a maximum of 6 points).

4. Attendance at laboratory classes is mandatory.

5. Passing at least 75% of the tasks during classes is mandatory.

6. The sum of points obtained from tests and activity during classes translates into the final grade according to the table below.

Result Grade
0% - 49% Insufficient
50% - 59% Satisfactory
60% - 69% Satisfactory plus
70% - 79% Good
80% - 89% Good plus
90% -100% Very good

7. A student who does not receive a positive grade is entitled to a retake colloquium in the retake session.

Project
1. The maximum number of points for the project is 60 points.

2. The following criteria will be taken into account when assessing the project:
• Code performance and quality
• Machine learning methods and results analysis
• Data selection
• Project complexity
• Documentation
• Project presentation
3. The student may receive additional points for sprints during classes - no more than 10% (i.e. a maximum of 6 points).
4. The sum of points obtained for the project and activity during classes translates into the final grade according to the table below:

Result Grade
0% - 49% Insufficient
50% - 59% Satisfactory
60% - 69% Satisfactory plus
70% - 79% Good
80% - 89% Good plus
90% -100% Very good

5. A student who does not receive a positive grade has the right to present the project in a retake session.

Programme content

Selected elements of the Python language and selected libraries related to data analysis, machine learning.

Course topics

Lectures
• dictionaries;
• working with files (including csv files, json library);
• numerical calculations - numpy library;
• data processing - pandas library.
- basic of machine learning (perceptron, types of learning)s
- using method and models of module Scikit-Learn and TensorFlow

Lab:
- working with various types of files (json, csv, excel)
- data processing and analysis using selected machine learning methods
snumpy, matplotlib, pandas, Scikit-Learn, TensorFlow

Project:
- setting the research goal
- finding relevant data
- preparing data for analysis
- data processing
- using teamwork methods (Scrum methodology)

Teaching methods

Lectures:
• lecture with presentation supplemented with examples given on the board;
• a lecture conducted in an interactive manner with formulating questions to a group of students or to specific students indicated;
• students' activity during classes is taken into account when issuing the final mark;

• during the lecture initiating the discussion;
• theory presented in close connection with practice;
• theory presented in connection with the current knowledge of students;
• presenting a new topic preceded by a reminder of related content known to students in other subjects.

Lectures& Laboratory classes& Projects/seminars:
• laboratories supplemented with multimedia presentations (including: drawings, photos, animations, sound, films);
• reviewing of reports by the laboratory chair and discussions on comments;
• using tools that enable students to perform tasks at home (eg open source software);
• demonstrations;
• work in teams;
• computational experiments.

Bibliography

Basic (recommended latest editions):

Geron, A. Hands-On Machine Learning with Scikit-Learn, Kera and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems

• McKinney W., Python w analizie danych. Przetwarzanie danych za pomocą pakietów Pandas i NumPy oraz środowiska IPython, Wydawnictwo Helion, 2018;
• Gągolewski M., Bartoszuk M., Cena A., Przetwarzanie i analiza danych w języku Python, Wydawnictwo Naukowe PWN, Warszawa, 2022;
• Grus J., Data science od podstaw. Analiza danych w Pythonie, Wydawnictwo Helion, 2020.

Additional:
• Larose D. T., Metody i modele eksploracji danych, Wydawnictwo Naukowe PWN;
• Larose D. T., Odkrywanie wiedzy z danych, Wydawnictwo Naukowe PWN, Warszawa 2006;
• Morzy T., Eksploracja danych. Metody i algorytmy, Wydawnictwo Naukowe PWN, Warszawa 2013 .

Breakdown of average student's workload

	Hours	ECTS
Total workload	125	5,00
Classes requiring direct contact with the teacher	60	2,50
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	65	2,50