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 (e.g. online)
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, ,sympy, pandas, scikit-learn).

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: knowledgeacquiredduringthelectureisverifiedbya45-minutecolloquiumconsistingofvariously scored questions (test and open). Passing threshold: 50% of points. Final issues on the basis of which questions are prepared will be forwarded to students during the lecture preceding the colloquium, or sent by e-mail using the university's e-mail system;
Laboratory classes& Projects/seminars: skills acquired as part of the laboratory are verified on the basis of developed projects and final test. Passing threshold: 50% of points.

Programme content

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

Course topics

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

Lab:
- working with various types of files (json, csv, excel)
- data processing and analysis using libraries:
snumpy, matplotlib, pandas, Scikit-Learn, sympy

Project:
- setting the research goal
- finding relevant data
- preparing data for analysis
- data processing using libraries: numpy, pandas, scikit-Learn,
- 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);
• detailed 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:
• 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