MODULE DESCRIPTION CARD – SYLLABUS

This module is a part of the Intensive International Education Programs in the field of the … organised at Poznan University of Technology as part of the „IMPACT – Innowacyjne Międzynarodowe Programy w AI, Cyberbezpieczeństwie i Teleinformatyce" project implemented SPINAKER Program of the National Agency for Academic Exchange, financed by the European Social Development Fund 2021–2027 (ESDF).

Module name:	Number of hours:	Lecturer:
Data Visualization	10	Dariusz Brzezinski, PhD

Module Descriptions:

The module serves as an introduction to scientific data visualization, i.e., the creation of computer-based visual representations of datasets that help people carry out tasks more effectively. The course will cover what (data abstraction), why (task abstraction), and how (visual idiom) can be visualized. Students will also learn visualization critique, specialized plots for networks, trees, and spatial data, interactive visualizations, and the basics of storytelling with data. There will also be a dedicated lecture on visualizations for machine learning.

Purpose of the support under Module:

The overarching goal of this course is to help students develop practical skills of conveying information and enhancing decision-making through static and interactive visualizations. The course will equip students with scientific data visualization competencies, including:

- visualization critique and visual encoding,
- knowledge of the basics of human visual perception,
- scientific plot validation through visualization rules of thumb,
- design of interactive visualizations,
- specialized plots for trees, networks, and spatial data,
- storytelling with data,
- visualization for machine learning.

Method of support under Module:

Support within the module is provided with the participation of the instructor and is divided into the following elements:

- 6-week self-study program using teaching materials provided by the instructor on the e-learning platform;
- 6 weeks of support from the instructor in the form of online consultations using tools that enable meetings to be held;
- a test to verify the acquisition of competences.

Module-related learning outcomes:

Descriptions of the new competences:

Participants gain new skills in data visualization and can design information-dense plots and dashboards that are perceptually effective. Students will learn what distinguishes a well-designed visualization from a plot using default plotting library settings. Finally, participants will learn data storytelling techniques that guide visualization viewers through scientific results.

Knowledge:

1. The student has extensive, well-grounded knowledge regarding key visualization concepts (dataset and attribute types, actions and targets, idioms, geometric markers and visual channels, graphic density, data-ink ratio)
2. knows and understands visualization best practices and validation methods for different dataset types and tasks

Skills:

1. The student is capable of formulating and solving complex data visualization problems
2. can visualize data analysis results and draw conclusions from them
3. knows how to adapt existing and implement new visualization methods, using at least one of the existing tools/libraries
4. is capable of acquiring, analyzing, and visualizing different types of data, and combining the results with existing knowledge to solve a wide range of problems occurring during the work of an AI/Data Science specialist, including problems related to industrial, scientific, business, and administrative data
5. knows how to use visualization techniques and tools at different stages of the software development process; the student is capable of preparing a well-documented overview of a problem, communicating issues using professional language, as well as discussing opinions among non-specialist partners.

Social competences:

1. The student understands that data visualization is an ongoing field of study, and that one must keep learning to be up to date with the state-of-the-art
2. knows the impact that data visualization can have on solving practical tasks in companies, and its potential effect on entire societies
3. can think and act in an entrepreneurial way, finding commercial applications to the visualization systems being created, while also taking into account the social and legal aspects of visualizing information

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Criteria for verifying learning outcomes

Learning outcomes are verified through an online single-choice test that assesses the student's knowledge of data visualization theory, specialized plots, and techniques. The test checks both theoretical understanding and the ability to interpret and design data visualizations correctly. A minimum of 51% of the answers must be correct to pass.

Method of verification/validation of learning outcomes

Verification is conducted via an online single-choice test delivered on the dedicated e-learning platform. The test is conducted individually, without access to supporting materials, and evaluates the extent to which the student has achieved the intended knowledge, skills, and

social competencies. The results are automatically recorded and validated according to predefined assessment criteria.

Workload

25 h (including work with teaching materials provided by the lecturer, consultation, and the student's own work) – 1 ECTS point

Level of the European Qualifications Framework