SYLLABUS

Name: ***Data Visualization (MakAu-DS>SM2DV19)***
Name in Polish:
Name in English: ***Data Visualization***

Information on course:

Course offered by department: Faculty of Automatic Control, Electronics and Computer Science
Course for department: Silesian University of Technology

Default type of course examination report:

ZAL

Language:

English

Course homepage:

https://platforma2.polsl.pl/rau2/course/view.php?id=924

Short description:

The aim of the course is to make the student familiar with methods, algorithms and tools for visualization of different types of data – numeric, continuous and discrete, categories, relations, multidimensional, time series and data streams. The importance of visualization techniques for data analyses and for data-based inference is stressed.
Form of classes: in-person
Prerequisites: engineering-level programming skills

Description:

Course format: lectures and laboratory classes

ECTS: 2
TOTAL hours: 60h (30h in-person, 30h self-study)
- Lecture 15h
- Laboratory 15h

Student's self-study:lab preparation

Subjective description:
Lecture
• Introductory issues. Importance of visualization techniques for data analyses and for data based inference. Overview of the course contents.
• Simple numerical data, numbers, sizes, orders. Bar graphs, histograms, linę graphs, pie graphs, scatter plots, symbols, colors.
• Multidimensional and time series data, categories, relations. Venn diagrams, graphs, flow diagrams, tree maps, heat maps, symbolic layouts, keyword density layouts.
• Examples of tools for data visualization I.
• Visualization of data streams. Scenarios, image sequences, films. Mixing, scaling times, dynamie warping scenarios, patching, imputation.
• Examples of tools for data visualization II. Visualizing data streams.
• Algorithms and heuristics behind visualization layouts. Hierarchical clustering, biclustering. Examples of applications.

Laboratory
• Algorithms and tools for visualizing numbers, sizes, orders, series, relations.
• Tools for visualization of data streams.
• Developing an algorithm for a chosen visualization layout.

Teaching Methods

The course is delivered through a combination of instructional formats:

Lectures – introducing key concepts, methods, and tools for data visualization, supported by practical examples and demonstrations.

Laboratory sessions – conducted in the form of group-based projects, where students collaboratively design, implement, and present data visualization solutions using real or synthetic datasets.

Bibliography:

C. Chen, W. Hardle, A. Unwin, (2008), Handbook of Data Visualisation, Springer
N. Illinsky, J. Steele, (2011), Designing Data Visualisations, O'Relly

Learning outcomes:

KNOWLEDGE: The student knows and understands

K2A_W05: Advanced issues specific to the studied specialization, concerning methods of analysis and synthesis of complex control, electronic, or information systems.

In this course, students will become familiar with advanced concepts related to the analysis and synthesis of complex information systems through data visualization. They will learn how to transform multidimensional, computational, or system-level data into clear and interpretable visual representations. As part of the coursework, students will design and develop visual analytics solutions that support the examination, understanding, and communication of complex electronic, control, or information processes.

K2A_W13: Advanced issues related to the tasks, structures, and operating principles of advanced algorithms relevant to the studied specialization.

In this course, students will learn about algorithms used for correlation analysis, the computation and visualization of statistical measures, histogram construction, and the analysis and visual representation of motion data and skeletal animation.

SKILLS: The student is able to:

K2A_U14: carry out an engineering task and propose improvements to existing hardware and software solutions in the areas of automation, electronics, and computer science

During the course, students will complete three engineering projects related to data visualization—covering two-dimensional data, multidimensional datasets, time series, and motion data.

K2A_U16: solve complex engineering problems, including atypical tasks, in the areas of automation, electronics, and computer science

As part of the assigned projects, students will be required to independently carry out the full engineering workflow, including identifying and selecting suitable datasets, assessing their quality and relevance, and then designing and implementing appropriate visualizations. They will also interpret the results from the perspective of a potential client, addressing non-standard analytical challenges that may arise from the characteristics of real-world data.

Assessment methods and assessment criteria:

Assessment is based on: (1) execution of projects and (2) project reports, and (3) a final test. Students complete three group engineering projects, each covering a full data-visualization workflow: finding and selecting datasets, assessing data quality, implementing visualizations, and preparing a 5–6 page scientific-style report. Projects are carried out in groups of up to three students, with independent contributions evaluated individually. Each report must be submitted within one week after the final lab of the block; late submissions reduce the score. The final grade for the course is computed from the three project blocks, provided all are passed and attendance requirements are met.

The syllabus is valid from academic year 2024/2025 and its content cannot be changed during the semester

Course credits in various terms:

<without a specific program>

Type of credits	Number	First term	Last term
European Credit Transfer System (ECTS)	2	2020/2021-Z	