COURSE DESCRIPTION CARD - SYLLABUS

Course name
Data visualization

Course

Field of study	Year/Semester
Artificial intelligence	2/4
Area of study (specialization)	Profile of study
	general academic
Level of study	Course offered in
First-cycle studies	English
Form of study	Requirements
full-time	elective

Number of hours

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

Number of credit points

3

Lecturers

Responsible for the course/lecturer:
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Responsible for the course/lecturer:

Prerequisites

The student should have basic programming skills (Python, R, Javascript) and basic knowledge of statistics. The student should also be capable of finding information on his own and be willing to work as part of a team.

Course objective

Introduction to data visualization, i.e. creating computer-based visual representations of datasets that help people carry out tasks more effectively. Teaching what (data abstraction), why (task abstraction), and how (visual idiom) can be visualized. Helping develop practical skills of conveying information and enhancing decision-making through static and interactive visualizations.

Course-related learning outcomes

Knowledge

1. The student has extensive, well-grounded knowledge regarding key visualization concepts (dataset

and attribute types, vis 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 upon them;

3. knows how to adapt existing and how to 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 combine 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-document 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.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lecture: a written test involving multiple choice questions, short answer questions, simple hand-drawn visualizations. At least 50% of points required to pass.

Labs: an evaluation based on reports from visualization projects; the ability to work in a team will also be a part of the assessment.

Programme content

Lecture:

1. What is visualization, what is its goal, and when to use it. Data abstractions, dataset types, attributes, data semantics.

2. Task abstractions, actions, and visualization targets. Four levels of validation, differences between user and designer goals.

3. Marks and channels. Rules of thumb and (general) best practices in vis design.

4. Selecting idioms for tables, spatial data, networks, and trees.

5. Human perception, color mapping, and rules for encoding other visual channels.

6. Interactive visualizations, faceted views, manipulation and navigation.

7. Reduction operations, embedding methods, hierarchical visualizations.

8. Recap through use case analyses.

Labs:

1. Basic visualization libraries. Practical resources for selecting efficient marks and visual channels. Tidy data.

2. The grammar of graphics in Python and R.

3. Visualizations as part of Literate Statistical Programming.

4. Interactive visualizations for the Web.

5. Dashboards and other navigation techniques.

6-8. Case studies (classification, clustering, social networks, 3D images, data streams and time-changing data).

Teaching methods

Lecture: multimedia presentations, whiteboard examples, quizzes, brainstorming.

Lab: multimedia presentations, whiteboard examples, visualization and dashboard programming, teamwork.

Bibliography

Basic

Munzner, Tamara. Visualization analysis and design. CRC press, 2014.

Tufte, Edward R. The visual display of quantitative information. Vol. 2. Cheshire, CT: Graphics press, 2001.

Additional

Wilkinson, Leland. The grammar of graphics. Springer Science & Business Media, 2013.

Wickham, Hadley. "Tidy data." Journal of Statistical Software 59.10 (2014): 1-23.

Larkin, Jill H., and Herbert A. Simon. "Why a diagram is (sometimes) worth ten thousand words." Cognitive science 11.1 (1987): 65-100.

Mathis, Lukas. Designed for use: Create usable interfaces for applications and the web. Pragmatic Bookshelf, 2016.

Tufte, Edward R., Nora Hillman Goeler, and Richard Benson. Envisioning information. Vol. 126. Cheshire, CT: Graphics press, 1990.

Sedlmair, Michael, Miriah Meyer, and Tamara Munzner. "Design study methodology: Reflections from the trenches and the stacks." IEEE transactions on visualization and computer graphics 18.12 (2012): 2431-2440.

Breakdown of average student's workload

	Hours	ECTS
Total workload	75	3,0
Classes requiring direct contact with the teacher	30	1,2
Student's own work (literature studies, preparation for laboratory classes, preparation for tests, project preparation) [1]	45	1,8

[1] delete or add other activities as appropriate