SYLLABUS

Data Visualization

University year 2025-2026

1. Information regarding the programme

1.1. Higher education institution	**Babeş Bolyai University**
1.2. Faculty	**Faculty of Mathematics and Computer Science**
1.3. Department	**Department of Computer Science**
1.4. Field of study	**Computer Science**
1.5. Study cycle	**Master**
1.6. Study programme/Qualification	**Data Science for Industry and Society**
1.7. Form of education	**Full time**

2. Information regarding the discipline

2.1. Name of the discipline	**Data Visualization**					Discipline code	**MME8186**
2.2. Course coordinator				**Prof. Dr. Camelia Chira**			
2.3. Seminar coordinator				**Prof. Dr. Camelia Chira**			
2.4. Year of study	**2**	2.5. Semester	**3**	2.6. Type of evaluation	**E**	2.7. Discipline regime	**Compulsory**

3. Total estimated time (hours/semester of didactic activities)

3.1. Hours per week	**4**	of which: 3.2 course	**2**	3.3 seminar/laboratory/project	**1 lab + 1 project**
3.4. Total hours in the curriculum	**56**	of which: 3.5 course	**28**	3.6 seminar/laboratory/project	**28**

Time allotment for individual study (ID) and self-study activities (SA)	**hours**
Learning using manual, course support, bibliography, course notes (SA)	40
Additional documentation (in libraries, on electronic platforms, field documentation)	40
Preparation for seminars/labs, homework, papers, portfolios and essays	52
Tutorship	4
Evaluations	8
Other activities:	-
3.7. Total individual study hours	**144**
3.8. Total hours per semester	**200**
3.9. Number of ECTS credits	**8**

4. Prerequisites (if necessary)

4.1. curriculum	Algorithms, data structures, statistics
4.2. competencies	Average programming skills

5. Conditions (if necessary)

5.1. for the course	Projector
5.2. for the seminar /lab activities	Computers, specific development environment

6.1. Specific competencies acquired [1]

Professional/essential competencies	• Capability of information analysis and synthesis • Acquire skills needed to transform large amounts of information into complex projects, by using a wide range of quantitative and qualitative methods
Transversal competencies	• Team work capabilities; able to fulfill different roles • Professional communication skills; concise and precise description, both oral and written, of professional results , negociation abilities

6.2. Learning outcomes

Knowledge	The student knows: • Collection, representation, analysis and visualization of data from various fields (eg economics, finance, biology, natural sciences) • Use specific techniques and methods of visual representation and interaction, such as histograms, diffusion diagrams, surface graphs, tree maps and parallel coordinate plots, which can be used to present abstract numerical and non-numerical data, to reinforce understanding of this information by people.
Skills	The student is able to: • Exploitation, discovery and innovation of analysis methods through interdisciplinary investigations • Visual presentation of data, such as graphs or diagrams, to facilitate their understanding and exploitation
Responsibility and autonomy:	The student has the ability to work independently to obtain: • Building the skills of exploration, analysis, management and visualization of large volumes of data using intelligent analysis techniques • Collaboration within the team

7. Objectives of the discipline (outcome of the acquired competencies)

7.1 General objective of the discipline	• Learn data visualization concepts and tools to facilitate understanding and/or interpretation data
7.2 Specific objective of the discipline	• Study data visualization techniques and learn the concepts and methods used in the field of data modelling and visualization. • Use visualization to learn and explore the data, solve problems and study real phenomena.

[1] One can choose either competences or learning outcomes, or both. If only one option is chosen, the row related to the other option will be deleted, and the kept one will be numbered 6.

8. Content

8.1 Course	Teaching methods	Remarks
1. Introduction to Data Visualization	• Interactive exposure • Presentation • Explanation • Practical examples • Case-study discussions	
2. Understanding data, representation, variability		
3. Visualization techniques, basic plotting with matplotlib		
4. Basic visualization tools: bar charts, area plots, histograms		
5. Specialized visualization tools: pie charts, box plots, scatter plots, bubble plots		
6. Data exploration for categorical data, time series data		
7. Data visualization using seaborn, statistical graphics, regression plots, word clouds, waffle charts		
8. Visualizing geospatial data, introduction to folium and map styles		
9. Network data visualization, introduction to NetworkX		
10. Plotly and dashboard creation		
11-12. SAS Visual Analytics		
13-14. Applied research presentations		

Bibliography

1. Few, S., Data Visualization: Past, Present, and Future, 2007, http://www.perceptualedge.com/articles/Whitepapers/Data_Visualization.pdf.
2. Few, S., Show me the numbers: Designing tables and graphs to enlighten. Burlingame, CA: Analytics Press, 2012.
3. T. Munzner, Visualization Analysis and Design (VAD), CRC press, 2014. (http://www.cs.ubc.ca/~tmm/vadbook/)
4. Sosulski, K., Data Visualization Made Simple: Insights into Becoming Visual. New York: Routledge, 2019.
5. Spence, R., Information Visualization, Addison Wesley, 2001.
6. Yau, N., Data Points: Visualization that means something. Indianapolis: O'Reilly, 2013.
7. SAS white paper, https://www.sas.com/content/dam/SAS/en_us/doc/whitepaper1/data-visualization-techniques-106006.pdf

8.2 Seminar / laboratory	Teaching methods	Remarks
1. Setup Python working environment and libraries used (matplotlib, seaborn, folium, networkx)	• Interactive exposure • Explanation • Conversation • Didactical demonstration	
2. Basic visualization techniques		
3. Specialized visualization techniques		
4. Preparation of projects: what is the data, what are the tasks and objectives.		
5. Project progress and feedback		
6. Project progress and feedback		
7. Project demonstration and presentations		

Bibliography

1. Few, S., Show me the numbers: Designing tables and graphs to enlighten. Burlingame, CA: Analytics Press, 2012.
2. T. Munzner, Visualization Analysis and Design (VAD), CRC press, 2014. (http://www.cs.ubc.ca/~tmm/vadbook/)
3. Sosulski, K., Data Visualization Made Simple: Insights into Becoming Visual. New York: Routledge, 2019.
4. Yau, N., Data Points: Visualization that means something. Indianapolis: O'Reilly, 2013.
5. Hubspot, An Introduction to Data Visualization, https://offers.hubspot.com/data-visualization-guide?_ga=2.184014562.553434431.1574535637-863373805.1574535637.

9. Corroborating the content of the discipline with the expectations of the epistemic community, professional associations and representative employers within the field of the program

- The course exists in the curriculum of many universities in the world.
- The results of course are considered by software companies particularly useful and topical, developing needed abilities in modelling and visualization of data.

10. Evaluation

Activity type	10.1 Evaluation criteria	10.2 Evaluation methods	10.3 Percentage of final grade
10.4 Course	Know concepts and methods from the domain of data visualization	Written exam	10%
		Research report and presentation	40%
10.5 Seminar/laboratory	Apply data visualization techniques in real problems	Project implementation and presentation	50%
10.6 Minimum standard of performance			
Each student should obtain minimum 5 for the research report and for the final grade. To obtain the minimum grade 5, the student must demonstrate the mastery of the basic concepts, visualization techniques and methods used in the domain of data visualization.			

11. Labels ODD (Sustainable Development Goals)[2]

Not applicable.

Date:	Signature of course coordinator	Signature of seminar coordinator
14.04.2025	Prof. dr. Camelia Chira	Prof. dr. Camelia Chira

Date of approval:
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Signature of the head of department

Assoc.prof.phd. Adrian STERCA

[2] Keep only the labels that, according to the *Procedure for applying ODD labels in the academic process*, suit the discipline and delete the others, including the general one for *Sustainable Development* – if not applicable. If no label describes the discipline, delete them all and write „*Not applicable*.”.