

## SYLLABUS

### 1. Information regarding the programme

1.1 Higher education institution	<b>Babeş Bolyai University</b>
1.2 Faculty	<b>Faculty of Mathematics and Computer Science</b>
1.3 Department	<b>Department of Computer Science</b>
1.4 Field of study	<b>Computer Science</b>
1.5 Study cycle	<b>Master</b>
1.6 Study programme / Qualification	<b>Data Science for Industry and Society</b>

### 2. Information regarding the discipline

2.1 Name of the discipline (en) (ro)	<b>Data Visualization</b> <b>Vizualizarea Datelor</b>						
2.2 Course coordinator	<b>Prof. Dr. Camelia Chira</b>						
2.3 Seminar coordinator	<b>Prof. Dr. Camelia Chira</b>						
2.4. Year of study	<b>2</b>	2.5 Semester	<b>3</b>	2.6. Type of evaluation	<b>E</b>	2.7 Type of discipline	<b>Compulsory</b>
2.8 Code of the discipline	<b>MME8186</b>						

### 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	1 lab + 1 project
3.4 Total hours in the curriculum	56	Of which: 3.5 course	28	3.6 seminar/laboratory	28
Time allotment:					hours
Learning using manual, course support, bibliography, course notes					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	<ul style="list-style-type: none"> <li>Algorithms, data structures, statistics</li> </ul>
4.2. competencies	<ul style="list-style-type: none"> <li>Average programming skills</li> </ul>

## 5. Conditions (if necessary)

5.1. for the course	<ul style="list-style-type: none"><li>• Projector</li></ul>
5.2. for the seminar /lab activities	<ul style="list-style-type: none"><li>• Computers, specific development environment</li></ul>

## 6. Specific competencies acquired

<b>Professional competencies</b>	<p><b>C3.3</b> Use of models and instruments from computer science and mathematica for solving problems specific to the application domain</p> <p><b>C3.4</b> Analysis of data and models</p> <p><b>C4.4</b> Use of simulation to study the behaviour of created models and performance evaluation</p>
<b>Transversal competencies</b>	<p><b>CT1.</b> Application of efficient work rules and responsible attitudes towards the scientific domain, for the creative exploitation of one's own potential according to the principles and rules of professional ethics</p> <p><b>CT2.</b> Efficient conduct of activities organized in an interdisciplinary group and development of empathic capacity of interpersonal communication, networking and collaboration with diverse groups</p> <p><b>CT3.</b> Use of efficient methods and techniques for learning, information, research and development of abilities for knowledge exploitation, for adapting to the needs of a dynamic society and for communication in a widely used foreign language.</p>

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

7.1 General objective of the discipline	<ul style="list-style-type: none"><li>• Learn data visualization concepts and tools to facilitate understanding and/or interpretation data</li></ul>
7.2 Specific objective of the discipline	<ul style="list-style-type: none"><li>• Study data visualization techniques and learn the concepts and methods used in the field of data modelling and visualization.</li><li>• Use visualization to learn and explore the data, solve problems and study real phenomena.</li></ul>

## 8. Content

8.1 Course	Teaching methods	Remarks
1. Introduction to Data Visualization	<ul style="list-style-type: none"> <li>• Interactive exposure</li> <li>• Presentation</li> <li>• Explanation</li> <li>• Practical examples</li> <li>• Case-study discussions</li> </ul>	
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](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](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)	<ul style="list-style-type: none"> <li>• Interactive exposure</li> <li>• Explanation</li> <li>• Conversation</li> <li>• Didactical demonstration</li> </ul>	
2. Basic visualization techniques		
3. Specialized visualization techniques		
4. Preparation of individual 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](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

Type of activity	10.1 Evaluation criteria	10.2 Evaluation methods	10.3 Share in the 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/lab activities	Apply data visualization techniques in real problems	Project implementation and presentation	50%
10.6 Minimum performance standards			
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.			

Date

24.04.2024

Signature of course coordinator

Prof. dr. Camelia Chira

Signature of seminar coordinator

Prof. dr. Camelia Chira

Date of approval

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Signature of the head of department

Conf. dr. Adrian Sterca