

## COURSE DESCRIPTION

### *Special Chapters of Data Analysis*

Academic year 2026-2027

#### 1. Programme-related data

1.1. Higher Education Institution	Babeş-Bolyai University
1.2. Faculty	Faculty of Mathematics and Computer Science
1.3. Doctoral School	Doctoral School of Mathematics and Computer Science
1.4. Field of study	Computer Science
1.5. Level of study	Doctoral

#### 2. Course-related data

2.1. Course title	<b>Special Chapters of Data Analysis</b>			Course code	<b>MDE8171</b>
2.2. Course coordinator	Prof. dr. Horia F. Pop				
2.3. Seminar coordinator	Prof. dr. Horia F. Pop				
2.4. Year of study	1	2.5. Semester	1	2.6. Type of assessment	Viva voce
2.7. Course status	Optional			2.8. Course type	Core subject

#### 3. Total estimated time (hours per semester of teaching activities)

3.1. Number of hours per week	3	of which: 3.2. course	2	3.3. seminar/ laboratory/ project	1
3.4. Total of hours in the curriculum	36	of which: 3.5. course	24	3.6. seminar/ laboratory	12
<b>Time allocation for individual study (IS) and self-taught activities (ST)</b>					<b>hours</b>
Learning from textbooks, course materials, bibliography, and notes (IS)					50
Additional research in the library, on subject-specific electronic platforms, and on-site					64
Preparing seminars/ laboratories/ projects, assignments, reports, portfolios, and essays					60
Tutoring (professional guidance)					25
Examinations					15
Other activities					
<b>3.7. Total hours of individual study (IS) and self-taught activities (ST)</b>				<b>214</b>	
<b>3.8. Total hours per semester</b>				<b>250</b>	
<b>3.9. Number of credits</b>				<b>10</b>	

#### 4. Prerequisites (where applicable)

4.1. curriculum-related	
4.2. skills-related	

#### 5. Specific conditions (where applicable)

5.1. course-related	Students will attend the course with their mobile phones shut down
5.2. seminar/laboratory-related	Students will attend the seminar with their mobile phones shut down

## 6. Subject-specific learning outcomes

<b>Knowledge</b>
1. Explains the fundamental concepts of data analysis: data types, preprocessing, dimensionality reduction, and model evaluation.
2. Describes the main algorithms for classification, regression, clustering, and association rule mining.
3. Understands validation methods and performance metrics (accuracy, precision, recall, F1, AUC, etc.).
4. Explains the principles of feature selection and dimensionality reduction (PCA, filter-based methods, and learning-based methods).
5. Describes anomaly detection methods and time series analysis techniques.
6. Understands the ethical implications and limitations of data analysis models (bias, overfitting, interpretability).
7. Knows the stages of a complete data analysis process (from data collection to interpretation and reporting).
<b>Skills</b>
1. Prepares and cleans real-world datasets for analysis.
2. Selects and applies appropriate algorithms to solve a given problem.
3. Implements data mining models using specific environments and libraries.
4. Evaluates and compares the performance of multiple models and justifies the final choice.
5. Interprets the obtained results and draws relevant conclusions for the analysed problem.
6. Identifies risks of overfitting and applies appropriate validation techniques.
7. Develops a structured technical report on the conducted analysis.
<b>Responsibility and autonomy</b>
1. Independently approaches the solution of a data analysis problem, from defining the objective to validating the solution.
2. Makes well-argued decisions regarding the selection of methods and model parameters.
3. Adheres to ethical principles concerning data use and protection.
4. Assumes responsibility for the correctness of the analysis and the interpretation of results.
5. Collaborates effectively within a team to carry out a data analysis project.
6. Identifies the need for deeper study and continuous updating of knowledge in the field.

## 7. Contents

<b>7.1. Course</b>	<b>Teaching and learning methods</b>	<b>Remarks<sup>1</sup></b>
Week 1: Administration and organization	Interactive exposure, Explanation, Conversation	
Week 2: Introduction Reference: [Han, ch. 1], [Mitchell, ch. 1]	Interactive exposure, Explanation, Conversation	
Week 3: Introduction to Fuzzy sets Reference: [Klir, ch. 2, 3]	Interactive exposure, Explanation, Conversation	
Week 4: Fuzzy logic, fuzzy reasoning Reference: [Klir, ch. 8, 10]	Interactive exposure, Explanation, Conversation	

<sup>1</sup> For example, organisational aspects, recommendations for students, specific aspects relating to the course/seminar, such as inviting experts in the field, etc.

Week 5: Rough sets Reference: [Pawlak]	Interactive exposure, Explanation, Conversation	
Week 6: Applications of rough sets Reference: [Ye, ch. 1], [5, ch. 3]	Interactive exposure, Explanation, Conversation	
Week 7, 8: Fuzzy Clustering Reference: [Han, ch. 7], [Ye, ch. 10]	Interactive exposure, Explanation, Conversation	
Week 9: Multivariate analysis Reference: [Ye, ch. 7, 8, 16, 17]	Interactive exposure, Explanation, Conversation	
10: Characteristics extraction, performance analysis Reference: [Ye, cap. 16, 17]	Interactive exposure, Explanation, Conversation	
11, 12: Applications of data analysis Reference: [Ye, cap. 21, 24, 27], [Han, cap. 10, 11]	Interactive exposure, Explanation, Conversation	

#### Bibliography

J. Han, M. Kamber, Data Mining: Concepts and Techniques, Academic Press, 2001  
G.J. Klir, B. Yuan, Fuzzy Sets and Fuzzy Logic, Prentice Hall, 1995  
T. Mitchell, Machine Learning, McGraw Hill, 1996  
Z. Pawlak, Rough Sets, Polish Academy of Sciences, Gliwice, 2004  
N. Ye, The Handbook of Data Mining, Lawrence Elbaum Associates Publishers, 2003

7.2. Seminar/ laboratory	Teaching and learning methods	Remarks
1. Administration. Investigation of available information sources. Selection of paper topics and schedule of presentations.	Interactive exposure, Explanation, Conversation	
2-3. Work to prepare the reports	Interactive exposure, Explanation, Conversation	
4-5. Presentation of the first report	Interactive exposure, Explanation, Conversation	
6-7. Presentation of the second report	Interactive exposure, Explanation, Conversation	

#### Bibliography

J. Han, M. Kamber, Data Mining: Concepts and Techniques, Academic Press, 2001  
G.J. Klir, B. Yuan, Fuzzy Sets and Fuzzy Logic, Prentice Hall, 1995  
T. Mitchell, Machine Learning, McGraw Hill, 1996  
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N. Ye, The Handbook of Data Mining, Lawrence Elbaum Associates Publishers, 2003

## 8. Evaluation

Type of activity	8.1 Evaluation criteria <sup>2</sup>	8.2 Evaluation methods <sup>3</sup>	8.3 Percentage in the final grade
8.4. Course	One research report, on experiments performed by students, with given requirements, should be prepared and presented	Evaluation of the research report (a written paper of about 10 pages and an oral presentation)	50%
8.5. Seminar/ laboratory	One research report, on experiments performed by students, with given	Evaluation of the research report (a written paper of	50%

<sup>2</sup> The evaluation criteria must directly reflect the learning outcomes targeted at the level of the degree programme respectively at the level of the subject. More specifically, the learning outcomes set out in the expected learning outcomes are assessed.

<sup>3</sup> Both final evaluation methods and ongoing evaluation strategies should be established.

	requirements, should be prepared and presented	about 10 pages and an oral presentation)	
8.6 Minimum standard for passing			
Each student has to prove that (s)he acquired an acceptable level of knowledge and understanding of the Intelligent Data Analysis domain, that (s)he is capable of stating this knowledge in a coherent form, that (s)he has the ability to establish certain connections and to use the knowledge in solving different problems. Penalty points are awarded for delays in submission of proposed topic choices and submission of final reports. Successful passing of the class is conditioned by the final grade that has to be at least 5. No reports may be submitted after the end of the semester.			

### 9. SDG labels (Sustainable Development Goals)<sup>4</sup>

	<input checked="" type="radio"/>	Sustainable Development Generic Label						
								
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	*	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
								No label applies
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>					

Date of entry:  
19 February 2026

Signature of course coordinator

Prof. dr. Horia F Pop



Signature of seminar coordinator

Prof. dr. Horia F. Pop



Date of approval in the department:

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Signature of the head of department

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<sup>4</sup> Select a single label which, according to the [Implementation of SDG labels in the academic process](#), best matches the subject. If the subject addresses sustainable development in a generic manner (i.e. by presenting/introducing the general framework of sustainable development, etc.), then the Sustainable Development generic label may be applied. If none of the labels describe the subject, select the last option: "No label applies."