

SYLLABUS

ADVANCED METHODS IN DATA ANALYSIS

University year *2025/2026*

1. Information regarding the programme

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| 1.1. Higher education institution | Babeş-Bolyai University |
| 1.2. Faculty | Mathematics and Computer Science |
| 1.3. Department | Computer Science |
| 1.4. Field of study | Computer Science |
| 1.5. Study cycle | Master |
| 1.6. Study programme/Qualification | Artificial Intelligence for Connected Industries |
| 1.7. Form of education | Full time studies |

2. Information regarding the discipline

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|-----------------------------|--|-----------------------------------|---------------|--|------------------------|-------------------------|-----------------|---|------------------------|--|----------|--|
| 2.1. Name of the discipline | | Advanced Methods in Data Analysis | | | | | Discipline code | | MME8048 | | | |
| 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 evaluation | | E | 2.7. Discipline regime | | Optional | |

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

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|---|-----|----------------------|----|--------------------------------|--------------|
| 3.1. Hours per week | 4 | of which: 3.2 course | 2 | 3.3 seminar/laboratory/project | 2 |
| 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) | | | | | 30 |
| Additional documentation (in libraries, on electronic platforms, field documentation) | | | | | 37 |
| Preparation for seminars/labs, homework, papers, portfolios and essays | | | | | 40 |
| Tutorship | | | | | 4 |
| Evaluations | | | | | 8 |
| Other activities | | | | | - |
| 3.7. Total individual study hours | 119 | | | | |
| 3.8. Total hours per semester | 175 | | | | |
| 3.9. Number of ECTS credits | 7 | | | | |

4. Prerequisites (if necessary)

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| 4.1. curriculum | Algorithmics, data structures, statistics |
| 4.2. competencies | Ability to write computer programs in a high level programming language |

5. Conditions (if necessary)

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| 5.1. for the course | Students will attend the course with their mobile phones shut down |
| 5.2. for the seminar /lab activities | Students will attend the seminar with their mobile phones shut down Room with computers as needed; high level programming language environment |

6.1. Specific competencies acquired ¹

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.

| | |
|-------------------------------------|--|
| Professional/essential competencies | <ul style="list-style-type: none"> • <i>understanding and working with basic concepts in computational intelligence;</i> • <i>ability to approach and solve complex problems using various techniques of computational intelligence;</i> |
| Transversal competencies | <ul style="list-style-type: none"> • <i>capability of information analysis and synthesis;</i> • <i>etic and fair behaviour, commitment to professional deontology;</i> • <i>good English communication skills.</i> |

6.2. Learning outcomes

| | |
|------------------------------|--|
| Knowledge | <ul style="list-style-type: none"> • <i>The graduate has the necessary knowledge to devise, model and design of complex software applications in the field of computational intelligence</i> • <i>The graduate possesses the fundamental knowledge for modelling, being able to analyse real life problems and to translate them in concrete requirements and to design a corresponding software model</i> |
| Skills | <ul style="list-style-type: none"> • <i>The graduate can use specific language and terminology for the field of computational intelligence being able to communicate and interact with members of a team</i> • <i>The graduate proves the capacity to reflect over own learning resources</i> |
| Responsibility and autonomy: | <ul style="list-style-type: none"> • <i>The graduate proves knowledge related to specifying the requirements of research activities in the domain of computer science in general and computational intelligence in particular and he/she understands the role of research in promoting progress</i> • <i>The graduate knows and respects the ethical and legal principles and rules in scientific research</i> |

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

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| 7.1 General objective of the discipline | <i>To introduce the student in advanced methods of data analysis</i> |
| 7.2 Specific objective of the discipline | <i>To present the field of intelligent data analysis as a novel research and application domain.</i> <i>To induce the necessity of intelligent data analysis methods by studying some relevant practical applications</i> <i>To offer the student the instruments that will allow him/her to develop different data analysis applications.</i> |

8. Content

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|------------------------------------|---|---------|
| 8.1 Course | Teaching methods | Remarks |
| 1: Administration and organization | <ul style="list-style-type: none"> • <i>Interactive exposure</i> | |
| 2: Introduction | <ul style="list-style-type: none"> • <i>Explanation</i> | |

| | | |
|---|---|---------|
| Reference: [Han, ch. 1], [Mitchell, ch. 1] | <ul style="list-style-type: none">• Conversation• Didactical demonstration | |
| 3: Introduction to Fuzzy sets Reference: [Klir, ch. 2, 3] | | |
| 4: Fuzzy logic, fuzzy reasoning Reference: [Klir, ch. 8, 10] | | |
| 5: Fuzzy control systems Reference: [Klir, ch. 12] | | |
| 6: Introduction to Rough sets Reference: [Pawlak] | | |
| 7: Applications of Rough sets Reference: [Ye, ch. 1], [5, ch. 3] | | |
| 8, 9: Fuzzy Clustering Reference: [Han, ch. 7], [Ye, ch. 10] | | |
| 10, 11: Multivariate analysis Reference: [Ye, ch. 7, 8] | | |
| 12: Feature extraction, Performance analysis Reference: [Ye, ch. 16, 17] | | |
| 13, 14: Applications of data analysis Reference: [Ye, ch. 21, 24, 27], [Han, ch. 10, 11] | | |
| 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 | | |
| 8.2 Seminar / laboratory | Teaching methods | Remarks |
| 1. Administration. Survey of information sources available on Internet and Intranet. Chosing the paper topics and scheduling the presentations. | <ul style="list-style-type: none">• Interactive exposure• Explanation• Conversation | |
| 2-3. Work to prepare the reports | | |
| 4-5. Delivery of theoretical report | | |
| 6-7. Delivery of experimental report | | |
| 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 | | |

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 content of the discipline is consistent with the similar disciplines from other Romanian universities and universities from abroad, as well as with the requirements that potential employers would have in the intelligent data analysis field.

10. Evaluation

| Activity type | 10.1 Evaluation criteria | 10.2 Evaluation methods | 10.3 Percentage of final grade |
|-------------------------|--|---|--------------------------------|
| 10.4 Course | The correctness and completeness of the accumulated knowledge. | Written exam (in the regular session) | 40% |
| | | | |
| 10.5 Seminar/laboratory | Two research reports, on experiments performed by the student, with given requirements, should be prepared and presented | Evaluation of the research reports (a written paper of about 10 pages and an oral presentation for each report) | 2x20% |

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|---|--------------------------------------|--|------------|
| | <i>Class attendance and activity</i> | | <i>20%</i> |
| 10.6 Minimum standard of performance | | | |
| <p><i>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 these knowledge in a coherent form, that (s)he has the ability to establish certain connections and to use the knowledge in solving different problems.</i></p> <p><i>Penalty points are awarded for delays in submission of proposed topic choices and submission of final reports.</i></p> <p><i>Successful passing of the exam is conditioned by the final grade that has to be at least 5; the written exam grade has to be at least 5; the semester projects overall grade has to be at least 5. No reports may be submitted after the end of the 14-th school week</i></p> | | | |

11. Labels ODD (Sustainable Development Goals)²

Not applicable.

Date:
10/4/2025

Signature of course coordinator

Prof. dr. Horia F. Pop

Signature of seminar coordinator

Prof. dr. Horia F. Pop

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.“.*