COURSE SYLLABUS

Academic year 2024-2025

1. Programme Information

Instituția de învățământ superior	**Lucian Blaga University of Sibiu**
Facultatea	Faculty of Engineering
Departament	Department of Computer Science and Electrical and Electronics Engineering
Domeniul de studiu	Computer Science and Information Technology
Ciclul de studii	Master
Specializarea	EMBEDDED SYSTEMS

2. Course Information

2.1. Name of course	Machine Learning			Code	ES.201.RO
2.2. Course coordinator	Assoc. Prof. Ionel Daniel MORARIU, PhD				
2.3. Seminar/laboratory coordinator	Assoc. Prof. Ionel Daniel MORARIU, PhD				
2.4. Year of study[1]	1	2.5. Semester[2]	2	2.6. Evaluation form[3]	E
2.7. Course type[4]	O	2.8. The formative category of the course[5]			R

3. Estimated Total Time

3.1. Course Extension within the Curriculum – Number of Hours per Week					
3.1.a. Lecture	3.1.b. Seminar	3.1.c. Laboratory	3.1.d. Project	3.1.e. Other	Total
2		1	1		**4**
3.2. Course Extension within the Curriculum – Total Number of Hours within the Curriculum					
3.2.a. Lecture	3.2.b. Seminar	3.2.c. Laboratory	3.2.d. Project	3.2.e. Other	Total[6]
28		14	14		**56**

Time Distribution for Individual Study[7]	**Hours**
Learning by using course materials, references and personal notes	28
Additional learning by using library facilities, electronic databases and on-site information	28
Preparing seminars / laboratories, homework, portfolios and essays	56
Tutorial activities[8]	7
Exams[9]	0
3.3. Total Individual Study Hours[10] ($NOSI_{sem}$)	**119**
3.4. Total Hours in the Curriculum ($NOAD_{sem}$)	**56**
3.5. Total Hours per Semester[11] ($NOAD_{sem} + NOSI_{sem}$)	**175**
3.6. No. of Hours / ECTS	**25**
3.7. Number of credits[12]	**7**

4. Prerequisites (if needed)

4.1. Courses that must be successfully completed first (from the curriculum)[13]	Knowledge of artificial intelligence and machine learning
4.2. Competencies	knowledge in some programming languages

5. Conditions (where applicable)

5.1. For course/lectures[14]	Active participation in classes, lecture + discussion, video-projector, whiteboard
5.2. For practical activities (lab/sem/pr/app)[15]	Develop and support the planned labs

6. Specific competencies acquired[16]

Number of credits assigned to the discipline[17]		7	Credits distribution by competencies[18]
6.1. Professional competencies	PC2	perform project management	1
	PC3	operate open source software	1,5
	PC5	perform scientific research	1
	PC12	promote the transfer of knowledge	1
	PC15	apply statistical analysis techniques	1
	PC16	analyse big data	1
6.2. Transversal competencies	TC3	assume responsibility	0,5

7. Course objectives (resulted from developed competencies)

7.1. Main course objective	Knowledge and understanding the general principles for the subject Knowledge and work adequately with notions Attainment capacity for integrate obtained knowledge from other classes Identity the main information sources Critical analysis form theoretical models, ideas and usually used broach. Capacity to realize a concrete project and a afferent report
7.2. Specific course objectives	Stimulation moral attitude and fairness in evaluating and auto evaluating. Appreciation of work into a team and a work of each member from the team

8. Content

8.1 Lectures[19]		**Teaching methods[20]**	**Hours**
Lecture 1	Introduction. Neural Network classification.	Lecture	2
Lecture 2	Concept Learning	Lecture	2
Lecture 3	Decision Tree Learning	Lecture	2
Lecture 4	Learning Sets of Rules	Lecture	2
Lecture 5	Computational Learning Theory	Lecture	2
Lecture 6	Evaluating Hypotheses	Lecture	2
Lecture 7	Artificial Neural Networks	Lecture	2
Lecture 8	Artificial Neural Networks	Lecture	2
Lecture 9	Genetic Algorithms	Lecture	2
Lecture 10	Instance-Based Learning	Lecture	2

Lecture 11	Bayesian Learning	Lecture	2
Lecture 12	Analytical Learning	Lecture	2
Lecture 13	Combining Inductive and Analytical Learning	Lecture	2
Lecture 14	Reinforcement Learning	Lecture	2
		Total lecture hours:	**28**

8.2 Practical activities

8.2.b. Laboratory		**Teaching methods[21]**	**Hours**
Laboratory 1	Training Data Production	Laboratory	2
Laboratory 2	k-Means Algorithm	Laboratory	2
Laboratory 3	Kohonen Neural Networks	Laboratory	2
Laboratory 4	Decision Tree Learning Algorithm	Laboratory	2
Laboratory 5	k-Nearest Neighbours	Laboratory	2
Laboratory 6	Perceptron Algorithm	Laboratory	2
Laboratory 7	Backpropagation Algorithm	Laboratory	2
		Total laboratory hours:	14

8.2.c. Project		**Teaching methods[22]**	**Hours**
Project 1	Each student chooses a subject on the area of the course and start doing research; On every week I coordinate their activities and direct them in a direction. At the end they must do a program to simulate something in the subject studied and to present to the other students, the theory and the results.	debates and conversation	14
		Total project hours:	

9. Bibliography

9.1. Recommended Bibliography	Tom M. Mitchell – „Machine Learning", McGraw-Hill, 1997;
	Stuart Russel, Peter Norvig – „Artificial Intelligence: a modern approach", Prentice-Hall, 1995;
	Ethem Alpaydin - Introduction to Machine Learning, fourth edition (Adaptive Computation and Machine Learning series) - The MIT Press; fourth edition (March 24, 2020)
	Volovici, D. – "Aplicaţii ale reţelelor neuronale şi inteligenţei artificiale la conducerea proceselor tehnologice" – Editura Universitaţii din Sibiu, 1995;
9.2. Additional Bibliography	Luger, G. F., Stubblefield, W. A., - „Artificial Intelligence", Addison Wesley Longman, Third Edition, 1998;
	Ian, H., Witten, E. F., - „Data Mining, Practical Machine Learning Tools and Techniques with Java implementation", Morgan Kaufmann, 2000;

10. Conjunction of the discipline's content with the expectations of the epistemic community, professional associations and significant employers of the specific study program[23]

Periodical discussions with representatives of companies in the area of Computer Engineering.

11. Evaluation

Activity Type	11.1 Evaluation Criteria	11.2 Evaluation Methods		11.3 Percentage in the Final Grade	Obs.[24]
11.4a Exam / Colloquy	• Theoretical and practical knowledge acquired (quantity, correctness, accuracy)	Tests during the semester[25]:	50%	67%	
		Homework:	15%		
		Other activities[26]:	5%		
		Final evaluation:	0%		
11.4d Project	• The quality of the project, the correctness of the project documentation, the appropriate justification of the chosen solutions	• Self-evaluation, project presentation • Critical evaluation of a project		33%	
11.5 Minimum performance standard[27] Minimum grade equal with 5,00					

The Course Syllabus will encompass components adapted to persons with special educational needs (SEN – people with disabilities and people with high potential), depending on their type and degree, at the level of all curricular elements (skills, objectives, contents, teaching methods, alternative assessment), in order to ensure fair opportunities in the academic training of all students, paying close attention to individual learning needs.

Filling Date: 09.09.2024

Department Acceptance Date: 16.09.2024

	Academic Rank, Title, First Name, Last Name	Signature
Course Teacher	Assoc. Prof. Ionel Daniel MORARIU, PhD	
Study Program Coordinator	Prof. Arpad GELLERT, PhD	
Head of Department	Assoc. Prof. Radu George CREȚULESCU, PhD	
Dean	Prof. Maria VINȚAN, PhD	

[1] *1-4 for bachelor, 1-2 for master*
[2] *1-8 for bachelor, 1-3 for master*
[3] *Exam, colloquium or VP A/R - from the curriculum*
[4] *Course type: R = Compulsory course; E = Elective course; O = Optional course*
[5] *Formative category: S = Specialty; F = Fundamental; C = Complementary; I = Fully assisted; P = Partially assisted; N = Unassisted*
[6] *Equal to 14 weeks x number of hours from point 3.1 (similar to 3.2.a.b.c.)*
[7] *The following lines refer to individual study; the total is completed at point 3.37.*
[8] *Between 7 and 14 hours*
[9] *Between 2 and 6 hours*
[10] *The sum of the values from the previous lines, which refer to individual study.*
[11] *The sum (3.5.) between the number of hours of direct teaching activity (NOAD) and the number of hours of individual study (NOSI) must be equal to the number of credits assigned to the discipline (point 3.7) x no. hours per credit (3.6.)*
[12] *The credit number is computed according to the following formula, being rounded to whole neighbouring values (either by subtraction or addition*

$$No.credits = \frac{NOCpSpD \times C_C + NOApSpD \times C_A}{TOCpSdP \times C_C + TOApSdP \times C_A} \times 30\ credits$$

Where:

- NOCpSpD = Number of lecture hours / week / discipline for which the credits are calculated
- NOApSpD = Number of application hours (sem./lab./pro.) / week / discipline for which the credits are calculated
- TOCpSdP = Total number of course hours / week in the Curriculum
- TOApSdP = Total number of application hours (sem./lab./pro.) / week in the Curriculum
- C_C/C_A = Course coefficients / applications calculated according to the table

Coefficients	**Course**	**Applications (S/L/P)**
Bachelor	2	1
Master	2,5	1,5
Bachelor - foreign language	2,5	1,25

[13] *The courses that should have been previously completed or equivalent will be mentioned*
[14] *Board, video projector, flipchart, specific teaching materials, online platforms, etc.*
[15] *Computing technology, software packages, experimental stands, online platforms, etc.*
[16] *Competences from the Grids related to the description of the study program, adapted to the specifics of the discipline*
[17] *From the curriculum*
[18] *The credits allocated to the course are distributed across professional and transversal competences according to the specifics of the discipline*
[19] *Chapter and paragraph titles*
[20] *Exposition, lecture, board presentation of the studied topic, use of video projector, discussions with students (for each chapter, if applicable)*
[21] *Practical demonstration, exercise, experiment*
[22] *Case study, demonstration, exercise, error analysis, etc.*
[23] *The relationship with other disciplines, the usefulness of the discipline on the labour market*
[24] *CPE – Conditions Exam Participation; nCPE – Does Not Condition Exam Participation; CEF - Conditions Final Evaluation; N/A – not applicable*
[25] *The number of tests and the weeks in which they will be taken will be specified*
[26] *Scientific circles, professional competitions, etc.*
[27] *The minimum performance standard in the competence grid of the study program is customized to the specifics of the discipline, if applicable*