COURSE SHEET

Machine Learning
Academic year 2022-2023

1. About the program

1.1	University	University of Piteşti
1.2	Faculty	Sciences, Physical Education and Computer Science
1.3	Department	Mathematics-Computer Science
1.4	Field of study	Informatics
1.5	Cycle of studies	Master
1.6	Study Program / Qualification	Advanced techniques for information processing/ Advanced techniques for information processing

2. Discipline data

2.1	Name of the discipline					*Machine Learning*					
2.2	The holder of the course activities					Lect. PhD. Maria MIROIU					
2.3	Holder of laboratory activities					Lect. PhD. Maria MIROIU					
2.4	Year of study	2	2.5	Semester	2	2.6	Type of assessment	Exam	2.7	Discipline regimen	A

3. Estimated total time

3.1	Number of hours per week	2	3.2	of which course	1	3.3	laboratory	1
3.4	Total hours of the curriculum	24	3.5	of which course	12	3.6	laboratory	12

Distribution of the time fund	hours
Study by textbook, course support, bibliography and notes	24
Additional documentation in the library, on specialized electronic platforms and in the field	38
Preparation of seminars/ laboratories, themes, papers, portfolios, essays	28
Tutoring	12
Examination	12
Other activities: projects and homework evaluation	12

3.7	Total hours of self-study	126
3.8	**Total hours per semester**	**150**
3.9	**Number of credits**	**6**

4. Preconditions (where applicable)

4.1	Curriculum	Probability and statistics, mathematical analysis, algebra
4.2	Skills	Acquaried competences at the following subjects: Computational Intelligence, Pattern Recognition, Probability and mathematical statistics, Mathematical analysis, Algebra, Programming in Matlab, Python, Java, C# and C++.

5. Conditions (where applicable)

5.1	Conduct of the course	Room with video projector
5.2	Conducting the seminar/laboratory	Laboratory room with video projector and computer equipment

6. Acquired specific skills

Professional skills	Operation with scientific concepts and methods in the field of information processing in information systems; Development of theoretical concepts and practical methods regarding the process of development and maintenance of computer applications; Advanced information processing; Realization of it projects in an interdisciplinary context; Conceiving, designing and implementing information systems; Management of information systems.
Transversal competences	Applying the rules of organized and efficient work, of responsible attitudes towards the scientific-professional field, for the creative capitalization of one's own potential, respecting the principles and norms of professional ethics; Efficiently carrying out the activities organized in an interdisciplinary team by assuming execution and leadership functions, with the development of empathic capacities of inter-personal communication, networking and collaboration with various groups; Elaboration of own professional development project; the use of effective methods and techniques for learning, information, research and capacity development, for valuing knowledge, for adapting to the requirements of a dynamic society and for communicating in Romanian and English.

7. The objectives of the discipline

7.1 The general objective of the discipline	The acquisition by students of the basic knowledge, methods and techniques from the Machine Learning, as well as the modalities of implementation and application to concrete situationsof these methods and techniques.
7.2 Specific objectives	*Cognitive objectives:* Knowing the methods of parametric, non-parametrical, Bayesian statistical estimation. Knowing regression and classification methods. Understanding the design of the linear classifiers. Knowing SVMs. Knowing the and applying the HMMs.

	Procedural objectives: Appropriate use of the specific concepts and methods. Identifying and implementing the concrete situation of applying the specific methods and techniques. *Attitudinal objectives:* Showing interest and curiosity. Demonstrating rigurosity in knowing, applying, and implementating the specific methods and techniques.

8. Contents

8.1. Course		No. of hours	Teaching methods	Observations Resources used
1	Unidimensional and Multidimensional Linear Regression	1	Explanation Description and exemplification Demonstration Problematization Heuristic conversation Exercise	Blackboard Pen tablet Computer Video projector E-learning platform Zoom
2	Logistic Regression	1		
3	Parametric Estimation (ML)	2		
4	Nonparametric Estimation (Parzen, kNN)	2		
5	Bayesian Estimation	2		
6	Support Vector Machines	2		
7	HMMs, Baum-Welch and Viterbi Algorithms	4		

Bibliography

1. Note de curs și laborator (2020) – electronic support – Maria Miroiu.
2. Taeho Jo, Machine Learning Foundation: Supervised, unsupervised, and Advanced Learning, Springer Publisher, 2021.
3. Cucker, F., Zhou, D.X., Learning Theory. An Approximation Theory Viewpoint, Cambridge University Press, 2007.
4. Bishop, C.M., Pattern Recognition and Machine Learning, Springer, 2006.
5. Shigeo, A., Support Vector Machines for Pattern Classification, Springer, 2010.
6. Marsland, S., Machine Learning. An Algorithmic Perspective, CRC Press, 2009.
7. Alpaydin, E., Introduction to Machine Learning, MIT Prerss, 2010.
8. Barber,D., Bayesian Reasoning and Machine Learning, CRC Press, 2011.
9. Wang, L.(ed), Support Vector Machines: Theory and Applications, Springer, 2005.
10. Friedman, J., Hastie, T., Tibshirani, R., The Elements of Statistical Learning, Springer, 2008.
11. Cappe, O., Moulines, E., Ryden, T., Inference in Hidden Markov Models, Sporinger, 2007.

8.2. Applications – Laboratory		No. of hours	Teaching methods	Observations Resources used
1	Applications and Implementation for Unidimensional and Multidimensional Linear Regression, and Logistic Regression	2	Explanation Description and exemplification Case study Exercise Problematization Individual themes Group work Debate	Blackboard Pen tablet Computer Video projector Documentary support E-learning platform Zoom
2	Applications and Implementations for Parametric Estimation	3		
3	Applications and Implementation for Bayesian Estimation	3		
4	Implementation for SMO Algorithm for Linear Separable Data	3		
5	Implementations for Baum-Welch și Viterbi Algorithms	3		

Bibliography

1. Note de curs și laborator (2020) – suport electronic – Maria Miroiu
2. Taeho, J., Machine Learning Foundation: Supervised, unsupervised, and Advanced Learning, Springer Publisher, 2021.
3. Bishop, C.M., Pattern Recognition and Machine Learning, Springer, 2006.
4. Shigeo, A., Support Vector Machines for Pattern Classification, Springer, 2010.
5. Marsland, S., Machine Learning. An Algorithmic Perspective, CRC Press, 2009.
6. Herbrich, R., Learning Kernel Classifier.Theory and Algorithms, MIT Press, 2002.

9. Corroborating the contents of the discipline with the expectations of the representatives of the epistemic community, professional associations and employers in the field related to the program

The content of the subject is correlated with those of similar disciplines in prestigious universities in the country and abroad and adjusted after discussions with representatives of local IT employers (such as Crystal System, Renault Group, Endava, Roweb, Draexlmaier, Prodinf, Osf Digital, Alten Kepler, Vauban).

10. Evaluation

Activity Type	10.1 Assessment criteria	10.2 Assessment methods	10.3 Percent of final grade
10.4 Course	Final evaluation	Written final test	50%
10.5 Seminar/ Laboratory	Projects implementation Homework	Projects evaluation Knowledge evaluation based on homework solving	30% 20%
10.6 Minimum performance standard	Grade of at least 5 for the final evaluation and at least 5 for the project evaluation. Minimal knowledge for passing the final exam: linear regression, parametric estimation, Bayesian estimation, SVM.		

Date of completion:
15.09.2022

Course holder:
Lect. PhD. Maria MIROIU

Laboratory holder:
Lect. PhD. Maria MIROIU

Date of approval in the Department:
15.09.2022

Director Department (provider):
Assoc.prof. PhD Doru CONSTANTIN

Director Department (beneficiary):
Assoc.prof.PhD Doru CONSTANTIN