Z1-PU7	WYDANIE N1

(*faculty stamp*)

COURSE DESCRIPTION

1. Course title: MACHINE LEARNING, Classifiers	**2. Course code ML_C**
3. Validity of course description: 2018/2019	
4. Level of studies: MSc programme	
5. Mode of studies: intramural studies	
6. Field of study: CONTROL, ELECTRONIC AND INFORMATION ENGINEERING (MACRO)	(FACULTY SYMBOL) RAU-2
7. Profile of studies: ACADEMIC	
8. Programme: DATA SCIENCE	
9. Semester: 1	
10. Faculty teaching the course: Faculty of Automatic Control, Electronics and Computer Science	
11. Course instructor: Prof. dr hab. inż. Krzysztof Fujarewicz	
12. Course classification: common courses	
13. Course status: compulsory ~~/elective~~	
14. Language of instruction: English	
15. Pre-requisite qualifications: Algebra and analytic geometry, Calculus and differential equations, Physics, Computer programming, Optimization methods, Numerical methods, Statistics and probability theory, Algorithms and data structures.	
16. Course objectives: The aim of the course is making students familiar with problem and methods related to supervised and unsupervised classification methods. The contents of the course are presented in the aspect of wide spectrum of applications, in particular in engineering, automatic control, electronics and information technologies.	

17. Description of learning outcomes:

Nr	Learning outcomes description	Method of assessment	Teaching methods	Learning outcomes reference code
1.	Student understands the notion of classification problem. Understands applications of classification in engineering, automatic control, electronics, informatics.	Credit	Lecture	K2A_W13, K2A_W14
2.	Student distinguishes between supervised and unsupervised classification problems.	Credit	Lecture	K2A_W03, K2A_W04
3.	Student is able to construct, in scientific programming environments, all major variants of classifiers.	Laboratory tasks	Laboratory	K2A_U16, K2A_U20, K2A_U23
4.	Student has orientation in existing tools for classification.	Credit	Laboratory	K2A_U11, K2A_U12
5.	Student is able to use existing tools for classification.	Laboratory tasks	Lecture	K2A_U11, K2A_U12

6.	Student understands the problem of classifiers validation and understands the phenomenon of information leak.	Credit	Lecture	K2A_U01, K2A_U02, K2A_U03, K2A_U04, K2A_K05, K2A_K06
7.	Student is able to validate classifiers.	Laboratory tasks	Laboratory	K2A_U01, K2A_U04, K2A_K06
8.				
9.				

18. Teaching modes and hours

Lecture 30 / ~~BA /MA Seminar / Class / Project~~ / Laboratory 30

19. Syllabus description:

Lecture:

1. Introductory information. Supervised and unsupervised classifiers. Applications of classifiers in engineering, automatic control, electronics, information technologies and biocybernetics.
2. Supervised classification algorithms. Linear discriminant classifiers, neural networks, support vector machines, k-nearest neighbor classifiers.
3. Training - validation scenarios for supervised classifiers. Leave-one-out validation. Multiple random validation. Information leak avoidance. Boosting and bagging algorithms.
4. Unsupervised classification. Clustering. Variants of hierarchical clustering algorithms. K-means algorithms. Self organizing maps. Principal component analyses. Biclustering algorithms. Independent component analysis (ICA).
5. Unsupervised algorithms and dimensionality reduction.
6. Nonlinear PCA and nonlinear dimensionality reduction. Kernel trick. Mercer's theorem.

Laboratory:

1. Supervised classification algorithms I.
2. Supervised classification algorithms II.
3. Unsupervised classification algorithms I.
4. Unsupervised classification algorithms II.
5. Principles of validation I.
6. Principles of validation II.

20. Examination: semester: NO

21. Primary sources:

T. Hastie, R. Tibshirani, J. Friedman, (2008), The elements of statistical learning, Springer
S. Theodoridis, K. Koutroumbas, (2003), Pattern recognition, Elsevier.

22. Secondary sources:

R. Duda, P. Hart, D. Stork, (2000), Pattern classification, Wiley.

23. Total workload required to achieve learning outcomes

Lp.	Teaching mode :	Contact hours / Student workload hours
1	Lecture	30/30
2	Classes	/
3	Laboratory	30/30
4	Project	/
5	BA/ MA Seminar	/
6	Other	/
	Total number of hours	60/60

24. Total hours: 120

25. Number of ECTS credits: 3

26. Number of ECTS credits allocated for contact hours: 2

27. Number of ECTS credits allocated for in-practice hours (laboratory classes, projects): 2

26. Comments:

Approved:

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(date, Instructor's signature)

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(*date , the Director of the Faculty Unit signature)*