Z1-PU7	WYDANIE N1

(*faculty stamp*)

COURSE DESCRIPTION

1. Course title: MACHINE LEARNING, Evolutionary algorithms	**2. Course code ML_EA**
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: Dr hab. inż. Robert Czabański	
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. Classifiers	
16. Course objectives: The aim of the course is making students familiar with issues related to evolutionary algorithms and their applications to engineering constructions in automation, electronics, informatics and biocybernetics. Relations between evolutionary algorithms and optimization theory and classification methods are underlined.	
17. Description of learning outcomes:	

Nr	Learning outcomes description	Method of assessment	Teaching methods	Learning outcomes reference code
1.	Student understands the notion of evolutionary algorithms and their importance to modeling, optimization, classification, data analyses	Credit	Lecture	K2A_W20, K2A_W25
2.	Student understands ideas and constructions behind basic types of evolutionary algorithms, genetic, memetic, simulated annealing, ant colony, particle swarm, nature inspired.	Credit	Lecture	K2A_W20, K2A_W26
3.	Student is able to elaborate, in R and Python environment, implementations of chosen evolutionary algorithms.	Laboratory tasks	Laboratory	K2A_U05, K2A_U09
4.	Student is able to compare and validate quality of different evolutionary algorithms.	Laboratory tasks	Laboratory	K2A_U09, K2A_U10

5.	Student is able to perform analysis of the exemplary dataset, with the use of the chosen evolutionary algorithms.	Laboratory tasks	Laboratory	K2A_U04, K2A_U08, K2A_K06
6.				
7.				
8.				
9.				

18. Teaching modes and hours

Lecture 15 / ~~BA /MA Seminar / Class / Project~~ / Laboratory 15

19. Syllabus description:

Lecture:

1. Introductory facts on evolutionary algorithms for learning and optimization. Evolutionary programming, evolutionary strategies.
2. Applications of evolutionary algorithms in engineering, automatic control, electronics, biocybernetics.
3. Computational complexity and evolutionary algorithms. Evaluation of efficiency of evolutionary algorithms. Stopping criteria for evolutionary algorithms.
4. Genetic algorithms, Memetic algorithms
5. Simulated annealing, probabilistic background and relations to optimization theory.
6. Ant colony optimization, particle swarm algorithms
7. Immune algorithms, nature inspired programming

Laboratory:

1. Application of genetic algorithm for the traveling salesman problem
2. Software development for the estimation problem by using a chosen evolutionary algorithm
3. Analysis of a real dataset by using evolutionary algorithm. Comparison to application of a
4. publicly available tool.

20. Examination: semester NO

21. Primary sources:

X. Yu, M. Gen, (2010), Introduction to Evolutionary Algorithms, Springer.
D. Simon, (2013), Evolutionary optimization algorithms, Wiley.

22. Secondary sources:

Richard S. Sutton and Andrew G. Barto, (2017), Reinforcement Learning: An Introduction, The MIT Press, Cambridge, Massachusetts, London, England.

23. Total workload required to achieve learning outcomes

Lp.	Teaching mode :	Contact hours / Student workload hours
1	Lecture	15/30
2	Classes	/
3	Laboratory	15/30
4	Project	/
5	BA/ MA Seminar	/
6	Other	/
	Total number of hours	30/360

24. Total hours: 90

25. Number of ECTS credits: 3

26. Number of ECTS credits allocated for contact hours: 1

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)*