

NAME OF THE COURSE		Machine learning in bioinformatics and medicine			
Code	PMIH23	Year of study	2		
Course teacher	Željko Agić, PhD, Assistant Professor	Credits (ECTS)	3		
Associate teachers	Antonela Matana, PhD	Type of instruction (number of hours)	P	P	P
			30		15
Status of the course	Elective	Percentage of application of e-learning	33%		
COURSE DESCRIPTION					
Course objectives	The objective of the course is to introduce students to the basic concepts and methods of machine learning with applications in bioinformatics and medicine.				
Course enrolment requirements and entry competences required for the course	Course enrolment requirements: None. Entry competence required for the course: The basics of programming and statistics.				
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	<p>Upon completion of the course, students will be able to:</p> <ul style="list-style-type: none"> Define basic machine learning concepts. Explain the theoretical assumptions, advantages and disadvantages of basic machine learning algorithms. Assess the suitability of a machine learning algorithm for a given task. Recognize the possibilities of using machine learning in bioinformatics and medicine. 				
Course content broken down in detail by weekly class schedule (syllabus)	<ol style="list-style-type: none"> Introduction to machine learning. Machine learning theory. Model evaluation. Structure of machine learning methods. Support vector machine algorithm. K-nearest neighbors algorithm. Example: Breast cancer detection. Linear regression. Logistic regression. Example: Genome-wide association study: Identification of the genetic variants associated with thyroid hormone levels. Ensemble methods. Random Forest algorithm. Example: Classification of diabetic retinopathy. Feature selection and dimensionality reduction. Principal component analysis. Example: Dietary patterns. Deep learning. Example: Gene expression analysis. Neural Networks. Multilayer perceptron. Convolutional neural networks. Recurrent neural networks. Recursive neural networks. Example: Heart disease prediction, Autism screening. Opportunities and obstacles for machine learning in bioinformatics and medicine. 				
Format of instruction	<input checked="" type="checkbox"/> lectures <input type="checkbox"/> seminars and workshops <input checked="" type="checkbox"/> exercises <input type="checkbox"/> <i>on line</i> in entirety <input type="checkbox"/> partial e-learning <input type="checkbox"/> field work		<input type="checkbox"/> independent assignments <input type="checkbox"/> multimedia <input type="checkbox"/> laboratory <input type="checkbox"/> work with mentor <input type="checkbox"/> (other)		
Student responsibilities	Attend classes, active participation in the teaching process, exams				

Screening student work (name the proportion of ECTS credits for each activity so that the total number of ECTS credits is equal to the ECTS value of the course)	Class attendance	1.0	Research		Practical training	
	Experimental work		Report		(Other)	
	Essay		Seminar essay	1.0	(Other)	
	Tests		Oral exam	1.0	(Other)	
	Written exam		Project		(Other)	
Grading and evaluating student work in class and at the final exam	Seminar essay (50%), Oral exam (50%).					
Required literature (available in the library and via other media)	Title				Number of copies in the library	Availability via other media
	Cleophas T, Zwinderman A. Machine Learning in Medicine – a Complete Overview. Springer International Publishing. 2015					
	https://www.udemy.com/course/applied-machine-learning-for-healthcare/					
	Ching T, Himmelstein DS, Beaulieu-Jones BK, et al. Opportunities and obstacles for deep learning in biology and medicine. J R Soc Interface. 2018;15(141).					
Optional literature (at the time of submission of study programme proposal)	Leung MKK, Delong A, Alipanahi B, Frey BJ. Machine Learning in Genomic Medicine: A Review of Computational Problems and Data Sets. P Ieee. 2016;104(1):176-197 Min S, Lee B, Yoon S. Deep learning in bioinformatics. Briefings in Bioinformatics. 2017;18(5):851-869. Lan K, Wang DT, Fong S, Liu LS, Wong KKL, Dey N. A Survey of Data Mining and Deep Learning in Bioinformatics. J Med Syst. 2018;42(8).					
Quality assurance methods that ensure the acquisition of exit competences	Student evaluation through an anonymous survey and exam success.					
Other (as the proposer wishes to add)	-					