

Specification for the book of courses

Study program		Communications and Information Technologies		
Module		Communications and Information Processing		
Type and level of studies		Master studies		
The name of the course		Statistical Learning in Signal Processing		
Lecturer (for lectures)		Perić H. Zoran, Jovanović Ž. Aleksandra, Nikolić R. Jelena		
Lecturer/associate (for exercises)		Jovanović Ž. Aleksandra, Nikolić R. Jelena		
Lecturer/associate (for OFE)				
Number of ECTS		4	Course status (obligatory/elective)	Elective
Prerequisites				
Course objectives		Introduction to the basic elements of statistical learning and adaptive signal coding. Training students to acquire knowledge on specific project tasks related to statistical learning in processing the given real signals (speech, images, ECG, audio).		
Course outcomes		Theoretical and practical knowledge in statistical processing of signals.		
Course outline				
Theoretical teaching		Estimation of the signal probability density function. The approximation of signal probability density function. Kernel approximation of signal probability density function. Linear regression. Nonlinear regression. Piecewise linear regression. Application of the theory of regression in the design of encoders and quantizers. Estimation of parameters for probability density function. Adaptive signal coding. Correlation analysis of signals. Signal prediction. Adaptive prediction based on the LMS algorithm. Adaptive methods of statistical learning. Statistical adaptive signal coding. Adaptive estimation of parameters for signal coding. Estimation of correlation coefficients and of prediction coefficients for adaptive differential coding. Adaptive learning methods for backward estimation of parameters.		
Practical teaching (exercises, OFE, study and research)		Theoretical and practical knowledge is acquired by solving tasks and some practical problems in statistical learning and students have the opportunity to understand the importance of applying statistical learning in solving real-life issues in the mentioned field.		
Textbooks/references				
1	G. James, D. Witten, T. Hastie, R. Tibshirani, An Introduction to Statistical Learning with Applications in R, Springer, 2017.			
2	U. Spagnolini, Statistical Signal Processing in Engineering, Wiley, 2018.			
3	V. N. Vapnik, Statistical Learning Theory, Wiley-Interscience, 1998.			
4	T. Hastie, R. Tibshirani, J. Friedman, The Elements of Statistical Learning: Data Mining, Inference, and Prediction, 2nd Edition, Springer, 2009.			
5	A. R. Webb, K. D. Copsey, Statistical Pattern Recognition, Wiley, 3rd Edition, 2011.			
Number of classes of active education per week during semester/trimester/year				
Lectures	Exercises	OFE	Study and research work	Other classes
2	1	0	0	0
Teaching methods		Lectures, Power Point presentations, practical exercises, practical training on computers, homework assignments, consultations.		
Grade (maximum number of points 100)				
Pre-exam duties		Points	Final exam	Points
Activity during lectures		5	Written exam	20
Exercises		20	Oral exam	20
Colloquia				
Projects		35		