Study programme(s): Applied Mathematics – Data Science	

Level: Master studies

Course title: Pattern recognition and machine learning

Lecturer: Dušan Jakovetić, Miloš Radovanović

Status: obligatory

ECTS: 6

Requirements: Basics of linear algebra and probability

Learning objectives
- Understanding of a wide range of pattern recognition/machine learning methods
- Understanding of advantages/disadvantages of the taught methods
- Ability to select appropriate methods for the problem at hand
- Ability to implement the taught methods in MATLAB

Learning outcomes
- Ability and experience in applying the taught methods on real-world problems
- Ability to apply the taught methods on research problems from a wide variety of application areas

Syllabus

Theoretical instruction

Statistical Pattern Recognition: Bayesian Decision Theory, Quadratic Classifiers, Parameter and Density Estimation, Nearest Neighbors; Neural network approaches: Linear Discriminants, Multilayer Perceptrons, Radial Basis Functions, Validation; Clustering: Mixture models and EM algorithm, Statistical Clustering, Self-Organizing Maps; Dimensionality Reduction: Principal Components Analysis, Fisher's Discriminants Analysis, Feature Subset Selection; Advanced topics: Support Vector Machines, Hidden Markov Models, Ensemble Learning, Evolutionary algorithms.

Practical instruction

Application examples in electric grid (smart grid), computer vision, medical imaging, speech recognition, agriculture, etc.; Implementation of the taught methods in MATLAB; Application of selected methods on real-world examples through the course project.

Literature

Main textbook:
12. C. Bishop: Pattern recognition and machine learning, Springer, 2006

Textbook (additional):
13. T. Hastie, R. Tibshirani and J. Friedman: Elements of Statistical Learning. Springer, 2009
14. R.O. Duda, P.E. Hart and D.G. Stork: Pattern Classification, Wiley, 2000.
15. S. Theodoridis, K. Koutroumbas: Pattern Recognition, Academic Press, 2008.

Weekly teaching load				Other: 0
Lectures: 2	Exercises: 3	Other forms of teaching: 0	Student research: 0	

Teaching methodology

Lectures; revisions of the material; active students' participation in problem solving; knowledge tests – colloquia; application of the taught material on real-world examples.

Grading (maximum number of points 100)				
Pre-exam obligations		**Points**	**Final exam**	**points**
Colloquia	Course project	60 = 30 (Colloquia) + 30 (Course project)	written exam	40