Study program:Artificial Intelligence

Name of the subject: Fundamentals of Numerical Optimization

Teacher(s): Nataša Krejić, Nataša Krklec Jerinkić

Status of the subject: obligatory

Number of ECTS credits:6

Conditions: none

Subject goal

The objective of this course is to introduce the basic understanding of optimality conditions for unconstrained and constrained optimization as well as the main algorithms for solving nonlinear optimization problems. Practical implementation of the algorithms is also an objective of the course.

Outcome of the subject

Functional knowledge of optimality conditions and the main algorithms for unconstrained and constrained optimization - smooth, semi-smooth and stochastic.

Subject content

Theory

Linear programming problems. Optimality conditions for unconstrained nonlinear optimization. Gradient type methods. Newton type methods. Optimality conditions for constrained problems. Methods of the first and second order. Large scale problems. Semi-smooth problems, optimality conditions. Sub-gradient methods. Newton type methods for semi-smooth problems. Stochastic optimization - Sample Average Approximation and Stochastic Approximation methods.

Practical learning

Practical implementation of the methods covered by theoretical instructions in Python.

Literature

1. Nocedal, J., Wright, S., Numerical Optimization, Springer, 2011
2. D. Bertsekas, Convex Optimization Algorithms, Athena Scientific, 2015.
3. Qi, L., Sun, D., Ulbrich, M., Semismooth and Smoothing Newton Methods, Springer 2016.
4. Shapiro, A., Dentcheva, D., Ruszcynski, A., Introduction to stochastic Programming, SIAM 2014.
5. A. Friedlander, N. Krejić, N. Krklec Jerinkić, Lectures on Fundamentals of Numerical Optimization, University of Novi Sad Faculty of Sciences, 2019.

Number of active teaching classes	**Theoretical teaching:3**	**Practical teaching:2**

Method of carrying out the teaching

Lectures; revisions of the material; active students' participation in problem solving; lab reports, application of the taught material on real-world examples

Evaluation of knowledge (maximum number of points 100)

Pre-exam obligations	points	**Final exam**	points
Written exam	50	Oral exam	50