Study programme(s): Applied Mathematics – Data Science

Level: master studies

Course title: Distributed optimization with applications

Lecturer: Nataša M. Krklec Jerinkić

Status: obligatory

ECTS: 6

Requirements: Basics of optimization, multivariate calculus, linear algebra, and probability

Learning objectives

- Understanding of a wide range of modern optimization methods for large scale, parallel, and distributed optimization
- Ability to select appropriate algorithms for the problem at hand
- Ability to implement the taught algorithms in MATLAB

Learning outcomes

- Ability and experience in applying the taught algorithms on real-world problems
- Ability to apply the taught algorithms on research problems from a wide variety of application areas
- Ability to synthesize and analyze efficient distributed algorithms for a given application

Syllabus

Theoretical instruction

Modern first-order methods for large-scale optimization: proximal gradient; accelerated Nesterov gradient; accelerated gradient for non-smooth optimization (FISTA); Randomized methods: randomized coordinate gradient; stochastic/online gradient; online gradient method under privacy constraints; Parallel and distributed methods: primal decomposition; dual decomposition; augmented Lagrangian; ADMM; distributed gradient; distributed dual averaging; distributed approximate Newton.

Practical instruction

Application examples in telecom, electric grid (smart grid), machine learning, sensor networks, etc.; Implementation of the taught methods in MATLAB; Application of selected methods on real-world examples through the course project.

Literature

Main:

18. Selected papers in the field of distributed optimization

Textbooks (additional):

19. S. Boyd and L. Vandenberghe: Convex Optimization, Cambridge University Press, 2004
20. D. Bertsekas, Nonlinear Programming, Athena Scientific, 2004
21. D. Bertsekas and J. Tsitsiklis: Parallel and Distributed Computation: Numerical Methods, Prentice-Hall, 1989

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 within the course project.

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