



Short course on "Multi-agent convex optimization over asynchronous and lossy networks"

3-4 July 2022

Speakers

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Course description

This is a short course on distributed convex optimization over networks with a specific attention to asynchronous implementations which are robust under lossy communication. The course is self-contained and no prior knowledge of distributed optimization is expected and it intends to expose the participants to the most popular ideas and algorithms that have been proposed in this area in the last decades. The course will start with real-world applications which motivate the need of distributed optimization. It will then introduce the consensus algorithms with its properties and its application to distributed optimization. It will then propose an alternative approach to consensus based on non-expansive operator theory which is particularly effective when asynchronous implementation with unreliable communication. The course will also presents prospective and an outlook on recent advancements on Federate Learning and time-varying distributed optimization. Finally, the course will include a hands-on Matlab laboratory where some of the presented algorithms are implemented and compared (Python implementations are also available up-on request). The class is supported with slides and detailed PDF notes. Only basic knowledge of linear algebra, discrete-time linear dynamical systems and convex optimization (Lagrangians, primal-dual problems, optimality gap) is necessary.

Schedule

Sunday 3 July 2022

9:00-9:45 Introduction and applications

9:45-10:30 Consensus problem: Definitions and formulation

Coffee break

10:45-11:30 Consensus problem: convergence conditions and rate

11:30-12:15 Consensus problem: extension to time-varying graphs

Lunch Break

15:00-15:45 Consensus problem: the robust ratio/Push-Pull consensus

15:45-16:30 Consensus problem: accelerated consensus and consensus tracking

Coffee break

16:45-17:30 Consensus-based optimization: Newton-Raphson

17:30-18:15 Consensus-based optimization: first order methods (AB-Push/Pull)

Monday 4 July 2022

9:00-9:45 Introduction to operator theory

9:45-10:30 Non-expansive operators for convex optimization

Coffee break

10:45-11:30 Non-expansive operators and their relation with ADMM (Alternating direction method multipliers)

11:30-12:15 Stochastic Non-expansive operators for lossy and asynchronous networks

Lunch Break

15:00-15:45 Distributed optimization versus federating learning

15:45-16:30 Time-varying distributed optimization

Coffee break

16:45-17:30 MATLAB Hands-on: consensus-based algorithms

17:30-18:15 MATLAB Hands-on: non-expansive operator-based algorithms

Venue

The short course will take place in building ETZ, room E81, at walking distance from the main conference venue (building HG).