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## ONE WORLD OPTIMIZATION SEMINAR

June 8<sup>th</sup>, 2020 @ 15:00 CEST (Central European Summer Time)

### VOLKAN CEVHER

(EPFL - Swiss Federal Institute of Technology in Lausanne)

#### Scalable semidefinite programming

**Abstract.** This talk first introduces new convex optimization methods based on linear minimization oracles to obtain numerical solutions to semidefinite programs with a low-rank matrix streaming model. This streaming model provides us an opportunity to integrate sketching as a new tool for developing storage optimal convex optimization methods that can solve semidefinite programs (SDP) efficiently within space required to write down the problem and its solution.

In particular, for SDP formulations, we obtain an approximate solution within an  $\varepsilon$ -error region in the objective residual and distance to feasible set, after a total of  $C\varepsilon^{-5/2} \log(n/\varepsilon)$  matrix vector multiplications for the linear minimization oracle (approximate eigenvalue calculation), and an additional  $\mathcal{O}(\max(n,d)/\varepsilon^2)$  arithmetic operations for the remaining arithmetics. The constant  $C$  is problem independent.

We then discuss a practical inexact augmented Lagrangian method for non-convex problems with nonlinear constraints and contrast this approach to the convex one for solving SDPs. We characterize the total computational complexity of the non-convex method subject to a verifiable geometric condition, followed by numerical demonstrations that include, max-cut, unsupervised clustering, and quadratic assignment problems.

The talk is based on joint work with several collaborators, including Alp Yurtsever, Olivier Fercoq, Joel A. Tropp, Madeleine Udell, Fatih Sahin, Armin Eftekhari, and Ahmet Alacaoglu.

*The link of the zoom-room of the meeting and the corresponding password will be announced the day before the talk on the mailing list of the seminar, to which one can subscribe on <https://owos.univie.ac.at>.*