

# Waseda Seminar on Computational Statistics

Date: October 6 (Mon.), 2025

Venue: Meeting Room (Dept of Pure & Appl. Math), Building 63-1, Nishi-Waseda Campus,  
Waseda University

(Access map: <https://www.waseda.jp/top/en/access/nishiwaseda-campus>)

## Program

13:10 ~ 14:00

*Solving a linear program via a single unconstrained minimization*

**Adilet Otemissov** (Nazarbayev University)

Abstract: We propose a novel approach for solving linear programs. We reformulate a primal-dual linear program as an unconstrained minimization of a convex and twice continuously differentiable merit function. When the optimal set of the primal-dual pair is nonempty, its optimal set is equal to the optimal set of the proposed merit function. Minimizing this merit function poses some challenges due to its Hessian being singular at some points in the domain, including the optimal solutions. We handle singular Hessians using the Newton method with Levenberg-Marquardt regularization. We show that the Newton method with Levenberg-Marquardt regularization yields global convergence to a solution of the primal-dual linear program in at most  $O(\epsilon^{-3/2})$  iterations requiring only the assumption that the optimal set of the primal-dual linear program is bounded. Testing on random synthetic problems demonstrates convergence to optimal solutions to very high accuracy significantly faster than the derived worst-case bound. We further introduce a modified merit function that depends on a scalar parameter  $\nu > 0$ , whose Hessian is nonsingular for all  $\nu > 0$  and which reduces exactly to the original merit function when  $\nu = 0$ . Based on this formulation, we propose a heuristic scheme that performs Newton steps while gradually decreasing  $\nu$  toward zero. Numerical experiments indicate that this approach achieves faster convergence, particularly on higher-dimensional problems.

14:00 ~ 14:15

Integrated Discussion

Bio: Dr. Adilet Otemissov is an Assistant Professor in the Department of Mathematics at Nazarbayev University's School of Sciences and Humanities. He received his bachelor's degree in mathematics from Nazarbayev University, a master's in Applied Mathematics from the University of Manchester, and a PhD in Optimization from the University of Oxford in 2021, supported by a scholarship from the Alan Turing Institute. His research lies at the intersection of optimization and machine learning, focusing on scalable methods for high-dimensional global optimization and linear programming problems.