

University of Chicago and Toyota Technological Institute at Chicago Machine Learning Seminar Series

PRESENTS:



Shay Moran, Technion

Title: Convex Set Disjointness, Distributed Learning of Halfspaces and LP Feasibility

Abstract: We study the Convex Set Disjointness (CSD) problem, where two players have input sets taken from an arbitrary fixed domain $U \subseteq \mathbb{R}^d$ of size $|U| = n$. Their mutual goal is to decide using minimum communication whether the convex hulls of their sets intersect (equivalently, whether their sets can be separated by a hyperplane).

Different forms of this problem naturally arise in distributed learning and optimization: it is equivalent to Distributed Linear Program (LP) Feasibility — a basic task in distributed optimization, and it is tightly linked to Distributed Learning of Halfspaces in \mathbb{R}^d .

In communication complexity theory, CSD can be viewed as a geometric interpolation between the classical problems of Set Disjointness (when $d \geq n-1$) and Greater-Than (when $d=1$).

We establish a nearly tight bound of $\tilde{\Theta}(d \log n)$ on the communication complexity of learning halfspaces in \mathbb{R}^d .

For Convex Set Disjointness (and the equivalent task of distributed LP feasibility) we derive upper and lower bounds of $\tilde{O}(d^2 \log n)$ and $\tilde{\Omega}(d \log n)$. These results improve upon several previous works in distributed learning and optimization.

Unlike typical works in communication complexity, the main technical contribution of this work lies in the upper bounds. In particular, our protocols are based on a Container Lemma for Halfspaces and on two variants of Carathéodory's Theorem, which may be of independent interest. These geometric statements are used by our protocols to provide a compressed summary of the players' input.

Joint work with Mark Braverman, Gillat Kol, and Raghuvansh R. Saxena (Princeton University).

Bio: Shay Moran is a visiting researcher at Google Brain, Princeton. He graduated from the Technion in late 2016 and since then he spent one year in California (UCSD and Simons Institute) and two years in Princeton (IAS and Princeton University). In October '20 he will join the mathematics department at the Technion as an assistant Professor. His research interests revolve around mathematical problems in computer science, with a special focus on combinatorial-geometric problems inspired by machine learning.

Host: Rebecca Willett

Friday, October 25, 10:30 – 11:30 am
TTIC, 6045 S. Kenwood Avenue,
5th Floor, Room 526