# The University of Chicago

# Department of Computer Science & Mathematics

# Combinatorics & Theoretical Seminar

**PRESENTS:**



**Sepideh Mahabadi**

University of Chicago, TTIC

Title: “Nonlinear Dimension Reduction via Outer Bi-Lipschitz Extension”

Abstract: We introduce and study the notion of an outer bi-Lipschitz extension of a map between Euclidean spaces. We show that for every map f there exists an outer bi-Lipschitz extension f' whose distortion is greater than that of f by at most a constant factor. This result can be seen as a counterpart of the classic Kirszbraun theorem but for outer bi-Lipschitz extensions. We present applications of our results to prioritized and terminal dimension reduction problems. \* We prove a prioritized variant of the Johnson--Lindenstrauss lemma: given a set of points $X\subset R^d$ of size $N$ and a permutation (``priority ranking'') of X, there exists an embedding f of X into $R^{O(log N)}$ with distortion $O(log log N)$ such that the point of rank j has only $O(log^{3 + \eps} j)$ non-zero coordinates -- more specifically, all but the first $O(log^{3+\eps} j)$ coordinates are equal to 0; the distortion of f restricted to the first j points (according to the ranking) is at most $O(log log j)$. \* We prove that given a set X of N points in $R^d$, there exists a terminal dimension reduction embedding of $R^d$ into $R^{d'}$, where $d' = O((log N)/(\eps^4))$, which preserves distances $||x-y||$ between points $x\in X$ and $y \in R^d$, up to a multiplicative factor of $1+\eps$.

This is a joint work with Konstantin Makarychev, Yury Makarychev and Ilya Razenshteyn.

Tuesday, October 23, 2018

Ry. 251 @ 3:30 pm

(Refreshments will be served prior to the talk in Ry. 255 @ 3:00pm)