THE UNIVERSITY OF CHICAGO

Department of Statistics

DISSERTATION PROPOSAL

PINHAN CHEN

Department of Statistics
The University of Chicago

Rank, Ranking and Phase Transition

WEDNESDAY, November 18, 2020, at 2:00 PM
ZOOM Meeting

ABSTRACT

This talk consists of three parts.

The first part deals with the topic of ranking. Given partially observed pairwise comparison data generated by the Bradley-Terry-Luce model, we study the problem of optimally identifying the set of top-k players. We derive the minimax rate with respect to a normalized Hamming loss, which is the first result quantifying the proportion of mistakes in the literature of ranking. The maximum likelihood estimator is shown to achieve the minimax lower bound. On the other hand, we show another popular algorithm, the spectral method, is in general sub-optimal. The proof replies on a much more delicate leave one out analysis as well as the interplay between MLE, regularized MLE, and constrained MLE.

The second part outlines an interesting phase transition phenomenon when estimating permutations. Estimating a permutation is also closely related to the ranking problem if our target is to recover the full ranking of players. This phenomenon demonstrates that it is possible for an estimation problem to have both polynomial and exponential rate. Several typical models with this new phenomenon and some future work will be discussed.

The third part discusses Bayesian procedures to estimate low rank matrices. While frequentists' low rank estimators obtained from nuclear norm minimization have existed for years, little is known about its Bayesian counterpart. Given the data matrix generated from a low rank matrix

---

For information about building access for persons with disabilities, please contact Keisha Prowoznik at 773.702-0541 or send an email to kprowoznik@statistics.uchicago.edu. If you wish to subscribe to our email list, please visit the following web site: https://lists.uchicago.edu/web/subscribe/statseminars.

perturbed by Gaussian noise, we aim to provide a Bayesian estimator with optimal posterior contraction rate. The journey to the proof of contraction borrows insights from geometry and random matrix theory. We will also talk about the possibility of rank adaptation and future work.