YIXIN TAO

yt851@nyu.edu

EDUCATION

New York University *Sept 2014 - present*
Ph.D. in Computer Science
Advisor: Professor *Richard Cole*

Shanghai Jiao Tong University *Sept 2010 - June 2014*
B.A. in Computer Science
ACM Honors Class

RESEARCH INTEREST

Algorithmic Game Theory, Optimization

EXPERIENCE

Microsoft Research Asia, Beijing *Sept 2013 - Feb 2014*
Research intern

CONFERENCE PAPERS

On the Existence of Pareto Efficient and Envy Free Allocations (Arxiv 1906.07257)
Richard Cole and *Yixin Tao*

Parallel Stochastic Asynchronous Coordinate Descent: Tight Bounds on the Possible Parallelism (Arxiv 1811.05087)
Yun Kuen Cheung, *Richard Cole* and *Yixin Tao*

(Near) Optimal Parallelism Bound for Fully Asynchronous Coordinate Descent with Linear Speedup (Arxiv 1811.03254)
Yun Kuen Cheung, *Richard Cole* and *Yixin Tao*

An Analysis of Asynchronous Stochastic Accelerated Coordinate Descent (Arxiv 1808.05156)
Richard Cole and *Yixin Tao*

Dynamics of Distributed Updating in Fisher Markets (EC'18)
Yun Kuen Cheung, *Richard Cole* and *Yixin Tao*

Large Market Games with Near Optimal Efficiency (EC'16)
Richard Cole and *Yixin Tao*

Generalized Second Price Auction with Probabilistic Broad Match (EC'14)
Wei Chen, *Di He*, *Tie-Yan Liu*, *Tao Qin*, *Yixin Tao* and *Liwei Wang*

Spring: A Strategy-proof and Privacy Preserving Spectrum Auction Mechanism (INFOCOM'13)
Qianyi Huang, *Yixin Tao* and *Fan Wu*

AWARDS AND SCHOLARSHIPS

Harold Grad Memorial Prize, CIMS, NYU *2017*
MacCracken Fellowship, GSAS, NYU *2014-2019*
Zhiyuan Excellent Student Scholarship, SJTU *2014*
Microsoft Young Fellow Scholarship *2014*

Research Summary

My research interest is mainly in Algorithmic Game Theory and Optimization. In Algorithmic Game Theory, my work mainly focuses on market efficiency and market dynamics; and in Optimization, my work mainly focuses on asynchronous implementations of coordinate descent, a form of gradient descent.

- **Market Efficiency** In the standard economic model, many classes of markets have efficient equilibria, but this depends on agents being non-strategic, i.e. that they declare their true demands when offered goods at particular prices, or in other words, that they are price-takers. An important question is how much the equilibria degrade in the face of strategic behavior, i.e. what is the Price of Anarchy (PoA) of the market viewed as a mechanism? We mainly focus on two types of market, Walrasian equilibria for indivisible goods and Fisher Markets for divisible goods. Our main result is that, given suitable assumptions, in the large market setting, the Nash Equilibrium (NE), which includes pure NE, mixed NE, and Bayes NE can be almost efficient, i.e. the PoA tends to 1 as the market size increases.
- **Market Dynamics** A major goal in Algorithmic Game Theory is to justify equilibrium concepts from an algorithmic and complexity perspective. One appealing approach is to identify natural distributed algorithms that converge quickly to an equilibrium. In the Fisher Market setting, we established new convergence results for two generalizations of Proportional Response in Fisher markets with buyers having CES utility functions. The starting points are respectively a new convex and a new convex-concave formulation of such markets. The two generalizations correspond to suitable mirror descent algorithms applied to these formulations. Several of our new results are a consequence of notions of strong Bregman convexity and of new strong Bregman convex-concave functions, and associated linear rates of convergence.
- **Asynchronous Optimization** Gradient descent, and coordinate descent, in particular, are core tools in machine learning and elsewhere. Large problem instances are common. To help solve them, two orthogonal approaches are known: acceleration and parallelism. One important issue in parallel implementations is whether the different processors are all using up-to-date information for their computations. To ensure this requires considerable synchronization, locking, and consequent waiting. Avoiding the need for the up-to-date requirement, i.e. enabling asynchronous updating, was a significant advance. The advantage of asynchronous updating is it reduces and potentially eliminates the need for waiting. In our work, we give a comprehensive analysis of Asynchronous Stochastic Accelerated Coordinate Descent. We show the following results: 1. A linear speedup for strongly convex functions so long as the parallelism is not too large. 2. A substantial, albeit sublinear, speedup for strongly convex functions for larger parallelism. 3. A substantial, albeit sublinear, speedup for convex functions.