TAO JIANG

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EDUCATION

Cornell University, United States   *September 2020 - present*
- Ph.D. in Operations Research, School of Operations Research and Information Engineering   *CGPA: 4.115/4.0*
- Thesis advisor: Prof. Damek Davis
- Committee members: Prof. James Renegar, Prof. Adrian Lewis, Prof. Anil Damle, Prof. Katya Scheinberg

University of Waterloo (UW), Canada   *September 2018 - August 2020*
- Master of Mathematics (Thesis), Department of Combinatorics and Optimization   *CGPA: 95/100*
- Thesis advisor: Prof. Stephen Vavasis
- Committee members: Prof. Levent Tunçel, Prof. Henry Wolkowicz
- Thesis: Sum-of-norms clustering: theoretical guarantee and algorithms

Singapore University of Technology and Design (SUTD), Singapore *May 2015 - August 2018*
- Bachelor of Engineering, Summa Cum Laude, Engineering Systems and Design *CGPA: 4.79/5.00*
- Majors: Operations Research, Business Analytics

University of California, Berkeley, United States   *June - August 2016*
- Summer exchange program, Department of Applied Mathematics   *CGPA: 3.85/4.00*

INDUSTRY EXPERIENCES

Data Science Analyst, GIC Private Limited, Singapore   *July - September 2017*
- Forecast NAREIT Index price value performance using Regression and Tree Ensemble on a monthly basis with 50,000 public data points, producing prediction results with a 2% MAPE

Client Services Analyst, Goldman Sachs, Singapore   *May - July 2017*
- Enhanced client onboarding process and web application with 3 hours reduced per request
- Assisted client services for the trading of listed derivatives and advisory of trades discrepancies

RESEARCH INTEREST

Continuous optimization and its applications in data science.

PUBLICATIONS AND WORKING PAPERS

Jiang, T., Wang, S., Zhang, R., Qin, L., Wu, J., Wang, D., & Ahipasaoglu, S. D. (2019). An inexact l2-norm penalty method for cardinality constrained portfolio optimization. *The Engineering Economist*, 64(3), 289297. doi: 10.1080/0013791x.2019.1636169
We analyze and solve a single-period portfolio optimization problem with non-convex constraints, which address practical concerns of investment such as the active share weights of sectors and the number of stocks held in a portfolio. We reformulate the problem to simplify the computation and propose an inexact l2-norm penalty method to solve the problem.

Jiang, T., Vavasis, S., Zhai, C. W. (2020). Recovery of a Mixture of Gaussians by Sum-of-norms Clustering. Journal of Machine Learning Research, 21(225), 1-16.
Sum-of-norms clustering is a method for assigning n points in R^d to K clusters using convex optimization. Recently, Panahi et al.(2017) proved that sum-of-norms clustering is guaranteed to recover

a mixture of Gaussians under the restriction that the number of samples is not too large. The purpose of this note is to lift this restriction, that is, show that sum-of-norms clustering can recover a mixture of Gaussians even as the number of samples tends to infinity.

Jiang, T., Vavasis, S. (2020). Certifying clusters from sum-of-norms clustering. arXiv preprint arXiv:2006.11355.
All algorithms for sum-of-norms clustering yield approximate solutions, even though an exact solution is demanded to determine the correct cluster assignment. The purpose of this paper is to close the gap between the output from existing algorithms and the exact solution to the optimization problem. We propose a clustering test that identifies and certifies the correct cluster assignment from an approximate solution yielded by any primal-dual algorithm. Moreover, we show the correct cluster assignment is guaranteed to be certified by a primal-dual path following algorithm after sufficiently many iterations.

Davis, D., Jiang, T. (2022). A fast and condition-free Gauss-Newton-Polyak subgradient method for nonsmooth nonconvex optimization. (Working paper.)
While subgradient methods achieve locally linear convergence when solving nonsmooth and nonconvex problems, the convergence rate depends on the condition number of the objective function. In this paper, we study a fast and scalable algorithm for a wide family of nonsmooth and nonconvex problems, and prove that the convergence rate is independent of the condition number.

Jiang, T., Tan, S., Vavasis, S. (2022). A New Family of Features That Strengthens Recovery Guarantees of Sum-of-Norms Clustering. (Working paper.)
Sum-of-norms clustering also has some limitations including its inability to recover clusters if the convex hulls of the supports of the clusters in the underlying distribution are not disjoint (Nguyen and Mamitsuka, 2021), or if the underlying disjoint supports are close (Dunlap and Mourrat, 2021). We propose a new family of features, called "leapfrog distances", that improve the recovery guarantees of SON clustering. When the original data points are replaced by these new features, clusters are recovered from points sampled from arbitrary distributions provided clusters have disjoint supports. Points sampled from mixtures of Gaussians are recovered for a less restrictive choice of standard deviations.

TALKS

Recovery of a mixture of Gaussians by sum-of-norms clustering	*August 2019*
ICCOPT 2019, Berlin, Germany	
Certifying clusters from sum-of-norms clustering	*July 2022*
ICCOPT 2022, Bethlehem, PA, USA	
Leapfrog distance strengthens recovery guarantees of SON clustering	*September, October 2022*
SIAM MDS22, San Diego, CA, USA	
Informs Annual Meeting 2022, Indianapolis, IN, USA	

HONORS AND AWARDS

Ministry of Education, Singapore: SM2 Undergraduate Scholarship
SUTD: SRX Operations Research Award, top student in Operations Research, SUTD Honors List for all academic terms
UW: William Tutte Postgraduate Scholarship, Sinclair Graduate Scholarship, MATH Senate Graduate Scholarship, UW Graduate Scholarship, TA, RA fellowship, Travelling Research Assistantship for *ICCOPT*
Cornell: Eleanor and Howard Morgan PhD 68 Graduate Fellowship
SIAM: SIAM Student Travel Awards

TEACHING EXPERIENCES

Graduate Teaching Assistant, Cornell University, USA

ORIE 5380 Optimization Methods	*2022 Fall*
ORIE 4740 Statistical Data Mining	*2022 Spring*
ORIE 4741 Big Messy Data	*2021 Fall*
ORIE 3310 Optimization II	*2021 Spring*

Graduate Teaching Assistant, UW, Canada

CO 671 Semidefinite Programming	*2020 Spring*
CO 663 Convex Optimization and Analysis	*2020 Winter*
CO 250 Introduction to Optimization, teaching assistant and coordinator	*2019 Fall*

- Coordinated a group of eight TAs with assignment marking, exam proctoring and office hours
- Wrote and revised solutions for two midterms and one final exam

CO 250 Introduction to Optimization	*2019 Winter, Spring*
Math 114 Linear Algebra for Science	*2018 Fall*

Undergraduate Teaching Assistant, SUTD, Singapore

10.007 Modelling the Systems World	*2017 Winter, 2018 Spring*
40.002 Optimization	*2017 Fall*
10.004 Advanced Mathematics II (Linear Algebra)	*2016 Fall*

SKILLS AND SELECTED PROJECTS

- Proficient in Python, R, Julia, Matlab, AMPL, Latex
- Bilingual and biliterate in English, native in Chinese
- Built an interactive web application for a financial institution which takes satellite images and other auxiliary data sources, to perform automated retail catchment analysis by machine learning
- Performed revenue maximization for Wind Flower Florist, with tools of statistics, Newsvendor model, dynamic pricing and data of sales and supply in the past 24 months
- Developed an algorithm for a car-sharing company, Car Club, which dynamically recommends the best plan to allocate vehicles across 78 stations weekly, boosting usage rate by 12%

PERSONAL INTEREST

- 1-year rock climber
- 4.5-year ballroom dancer in standard ballroom dance and Latin, champion in the beginner category of multiple international dance competitions
- 8-year flutist with grade nine in Arts Grade Examination of China
- 1-year fencer with a specialty in foil
- Owner of 3 patents; Slippers with an embedded massaging function, kitchen knives that provide a cleaner cut on vegetables and foldable toothbrush incorporating four useful tools