“Tao” Uthaipon Tantipongpipat

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Research Topics

- Privacy and fairness in learning – differential privacy in growing database; its deployment in deep learning models such as RNNs, LSTMs, autoencoders, and GANs; differentially private synthetic data generation; fair principle component analysis (fair PCA) using convex optimization and low-rank property of matrices in linear and semi-definite programming (LP and SDP)
- Approximation algorithms in optimal design in statistics, as known as design of experiments (DoE) using combinatorial optimization. Diversity and representative sampling.

Other Interests: fair, explainable, and interpretable machine learning; privacy and security; model compression

Education

Georgia Institute of Technology, Atlanta, GA, United States Expected May 2020
PhD in Algorithms, Combinatorics, and Optimization (ACO), School of Computer Science
Minor in Computational Learning Theory. GPA 4.00/4.00
Advisor: Dr. Mohit Singh
Thesis: **Machine Learning under Budget and Fairness Constraints**

University of Richmond, Richmond, VA, United States 2012-2016
BS in Mathematics (Honors with Thesis in algebraic combinatorics and discrete geometry)
Minor in Computer Science. GPA: 3.97/4.00
Full-merit Robins Science scholarship covering tuition, fees, accommodations, and meals

University of Oxford, Oxford, United Kingdom 2014-2015
Study Abroad Program in Mathematics and Computer Science
Grade: first-class level (equivalent to A/A+)

Publications

* papers whose authors are in alphabetical order, which is conventional in theoretical computer science community.

Conferences	1. **Uthaipon Tantipongpipat**, Samira Samadi, Mohit Singh, Jamie Morgenstern, and Santosh Vempala. *Multi-Criteria Dimensionality Reduction with Applications to Fairness.* Neural Information Processing Systems (NeurIPS), 2019, Spotlight (top 2.5% of submitted papers)

2. * Vivek Madan, Mohit Singh, **Uthaipon Tantipongpipat**, and Weijun Xie. *Combinatorial Algorithms for Optimal Design.* Conference on Learning Theory (COLT), pages 2210–2258, 2019
3. * Aleksandar Nikolov, Mohit Singh, and **Uthaipon Tantipongpipat**. *Proportional Volume Sampling and Approximation Algorithms for A-Optimal Design.* ACM-SIAM Symposium on Discrete Algorithms (SODA), 2019
4. Samira Samadi, **Uthaipon Tantipongpipat**, Jamie Morgenstern, Mohit Singh, and Santosh Vempala. *The Price of Fair PCA: One Extra Dimension.* Neural Information Processing Systems (NeurIPS), 2018
5. * Rachel Cummings, Sara Krehbiel, Kevin A Lai, and **Uthaipon Tantipongpipat**. *Differential Privacy for Growing Databases.* Neural Information Processing Systems (NeurIPS), 2018

Manuscripts

6. * Vivek Madan, Aleksandar Nikolov, Mohit Singh, and **Uthaipon Tantipongpipat**. *Maximizing Determinants under Matroid Constraints.* 2019
7. **Uthaipon Tantipongpipat**, Chris Waites, Digvijay Boob, Amaresh (Ankit) Siva, and Rachel Cummings. *Differentially Private Mixed-Type Data Generation for Unsupervised Learning*. 2019

Journals

8. **Uthaipon Tantipongpipat**. *A Combinatorial Approach to Ebert's Hat Game with Many Colors*. The Electronic Journal of Combinatorics, 21(4):4–33, 2014

Workshops

9. * Digvijay Boob, Rachel Cummings, Dhamma Kimpara, **Uthaipon Tantipongpipat**, Chris Waites, and Kyle Zimmerman. *Differentially Private Synthetic Data Generation via GANs.* Theory and Practice of Differential Privacy (TPDP 2018) workshop, 2018

Theses

10. **Uthaipon Tantipongpipat**. *Cameron-Liebler Line Classes and Partial Difference Sets.* Undergraduate Thesis, University of Richmond, 2016

Work Experiences

2019

Microsoft Research Intern, Redmond, WA
Algorithms group. Supervisor: Janardhan Kulkarni and Sergey Yekhanin.

- Implemented privacy guarantee on large-scale Natural Language Processing models (RNNs and LSTMs) to protect against privacy deidentification due to model usage
- Developed novel correlation clustering algorithm and its corresponding privacy analysis
- Researched on private submodular optimization and surveyed state-of-the-art technique for private stochastic gradient descent for training deep learning models

Talks and Presentations

1. *Multi-Criteria Dimensionality Reduction with Applications to Fairness* (earlier version: Fair Dimensionality Reduction and Iterative Rounding for SDPs)
    a. **Invited talk**: Second Conference on Discrete Optimization and Machine Learning at RIKEN Center for Advanced Intelligence Project (AIP), Tokyo, Japan, July 2019
    b. **Invited talk**: Cornell Operations Research and Information Engineering (ORIE) workshop, Ithaca, NY, USA, October 2019
    c. **Invited talk**: INFORMS Annual Meeting, Seattle, WA, USA, October 2019
    d. **Spotlight and accepted for poster**: Conference on Neural Information Processing Systems (NeurIPS), Vancouver, Canada, December 2019

2. *The Price of Fair PCA: One Extra Dimension*
    a. **Accepted for poster**: Conference on Neural Information Processing Systems (NeurIPS), Montreal, Canada, December 2018

3. *Proportional Volume Sampling and Approximation Algorithms for A-Optimal Design*
    a. **Accepted paper presentation**: ACM-SIAM Symposium on Discrete Algorithms (SODA), San Diego, California, January 2019
    b. **Talk**: Machine learning theory group, Georgia Institute of Technology, November 2018
    c. **Poster**: Machine Learning in Science and Engineering (MLSE) Conference, Carnegie Mellon University, June 2018
    d. **Poster**: Algorithms and Randomness, Algorithms and Randomness Center (ARC) workshop, Georgia Institute of Technology, May 2018
    e. **Talk**: Algorithms, Combinatorics, and Optimization (ACO) seminar, Georgia Institute of Technology, April 2018

4. *Differential Privacy for Growing Databases*
    a. **Accepted for poster**: Conference on Neural Information Processing Systems (NeurIPS), Montreal, Canada, December 2018
    b. **Talk**: Privacy reading group, Georgia Institute of Technology, February 2018
    c. **Accepted for poster**: Theory and Practice of Differential Privacy workshop (TPDP), Dallas, Texas, October 2017

Awards and Fellowships

2019	Best Reviewers (top 10%) of NeurIPS (Conference on Neural Information Processing Systems). Awarded free registration
2018	First prize winner and People's Choice Awards ($20,000 total prize), Privacy Engineering Challenge, National Institute of Standards and Technology (NIST), Public Safety Communications Research Divisions (PSCR). https://www.herox.com/UnlinkableDataChallenge
2018	Algorithm and Randomness Center (ARC) and Transdisciplinary Research Institute for Advancing Data Science (TRIAD) Fellowship, Georgia Institute of Technology

2016	Finalist, ITA Tech Challenge programming competition, Illinois Technology Association, IL
2016	David C. Evans Awards for Outstanding Achievement in Scholarship, Annual Honors Convocation, University of Richmond, VA. • Awarded to a few students each year for achievements in arts and sciences. In press: https://news.richmond.edu/features/article/-/13415/2016-david-c.-evans-awards-school-of-arts-and-sciences-recognizes-outstanding-achievement.html
2012-2016	Robins Science Scholar, University of Richmond (merit scholarship covering full tuition, fees, accommodations, and meals for four years)
2016	Phi Beta Kappa (most prestigious honor society for liberal arts and sciences)
2015	Honorable Mention (top 2.5%), William Lowell Putnam Mathematical Competition • Widely considered to be the most prestigious undergraduate-level mathematics examination
2015	Second Place, Mid-Atlantic Regional ACM Programming Contest, Christopher Newport University site

Prior to Undergraduate Education:

2010-2012	3-Year Finalist, International Mathematical Olympiad (IMO) selection, Thailand
2012	Honorable Mention, Nern-Thong-Khong-Mee-Ka National Contest in Economics, Thailand
2011	Honorable Mention, Finance and Economics National Competition, National Bank of Thailand
2010, 2011	Bronze Medal and Honorable Mention, Asia-Pacific Mathematics Olympiad (APMO)
2008, 2009	Gold and Bronze Medals, IWYMIC International Mathematics Competition
2008, 2009	Two Gold Medals, Thailand Mathematical Olympiad

Codes

1. **Fair PCA project.** Semi-definite program and multiplicative weight heuristics for solving multi-criteria principle component analysis. In MATLAB and CVXOPT on Python. Publicly available at https://github.com/sdpforall (a website of the project is at https://sites.google.com/site/ssamadi/fair-pca-homepage).
2. **DPautoGAN.** Combining autoencoder and GAN to generate synthetic data with privacy protection guarantee. In Python and using Pytorch for neural networks. Publicly available at https://github.com/DPautoGAN/DPautoGAN.

Academic Service

2018-Now	Reviewer for NeurIPS (Conference on Neural Information Processing Systems), FOCS (Symposium on Foundations of Computer Science), MAPR (Mathematical Programming journal)
2018-2019	Co-organizer of ACO student seminar, Georgia Institute of Technology

Teaching Experience

2019	Teaching Assistant, CS7520/ISYE8813 Approximation Algorithms, Georgia Institute of Technology
2018	Teaching Assistant, CS6550 Graduate Algorithms, Georgia Institute of Technology
2015-2016	Language Partner, Self-Directed Language Acquisition Program, University of Richmond
2014	Grader, MATH245 Linear Algebra, University of Richmond
2011-2017	Teacher and tutor for middle- and high-school competitive mathematics, Bangkok Christian College, Bangkok, Thailand

Skills

Technical	Python, Pytorch, Pandas, CVXOPT, Java, C++, MATLAB, Mathematica, LaTeX, MS Word, MS Excel, MS PowerPoint
Communication	Public speaking – Toastmaster
Languages	Thai (native speaker); English (fluent)