TIANZE JIANG

tjiang@mit.edu ⋄ 165 Main St., Cambridge, MA, 02142

EDUCATION

Bachelor of Science, Massachusetts Institute of Technology **2020 - 2024**

Majors: Mathematics and Computer Science (Concentration: Economics) **GPA: 5.0/5.0**

Selected Coursework (Advanced Graduate Level):

*Grouped roughly in the spectrum from applied to theoretical.

- 6.867 (Machine Learning), 6.864 (Advanced NLP)

- 6.437 (Inference and Information), 6.438 (Algorithms for Inference), 6.840 (Theory of Computation), 6.860 (Statistical Learning Theory), 6.251 (Mathematical Optimization), 18.425 (Cryptography & Cryptanalysis)

- 6.265 (Modern Discrete Probability), 18.656 (Math Stats: Non-Asymptotics), CS224 (Adv. Algos for Data Science)

- 18.675 (Probability Theory), 18.676 (Stochastic Calculus), 18.657 (Statistical Optimal Transport)

Academic Advisors: Nike Sun (Math), Guy Bresler (EECS).

SELECTED RESEARCH

*Papers in this section are *all* under joint first-authorship ordered *alphabetically* unless they are not.

1. Yanjun Han, **TJ**, Yihong Wu, "*Optimal Prediction from Compression.*" (2024+) Submitted.

2. Patrik Gerber, **TJ**, Yury Polyanskiy, Rui Sun, "*Density estimation using the perceptron.*" (2024+) Submitted. Paper.

3. Patrik Gerber, **TJ**, Yury Polyanskiy, Rui Sun, "*Kernel-based Tests for Likelihood-Free Hypothesis Testing.*" In: *Proc 37th Adv Neural Inf Process Syst (NeurIPS 2023)*, December 2023. Paper.

4. Guy Bresler and **TJ**, "*Detection-Recovery and Detection-Refutation Gaps via Reductions from Planted Clique.*" In: *Proc Conf on Learning Theory (COLT 2023)*, July 2023. Paper.

5. Quanlin Chen, **TJ**, Yuxiao Wang, "*On the Generational Behavior of Gaussian Binomial Coefficients at Roots of Unity*". MIT PRIMES (2020). Paper.

6. Sihui Zhang and **TJ**, "*A Note on Primitive Heronian Triangles*". In: *Chinese Ann. of Mathematics (2019)*. Paper.

SELECTED RESEARCH EXPERIENCES

Optimal Prediction and Compression in Hidden Markov Processes (Yale University) May. 2023 - Feb. 2024
Advised by Prof. Yihong Wu (Yale Stats).
- Established constant-optimal risks on HMM prediction with discrete hidden process and discrete/Gaussian emission.
- Identified polynomial-time algorithms and statistical-computational gaps in different parameter regimes.

Statistical-Computation gaps via average-case reductions (MIT LIDS) Mar. 2022 - May. 2023
Advised by Prof. Guy Bresler (MIT EECS).
- Proved (partial) computational detection-recovery gap in the Planted Dense Subgraph problem via reductions from the Planted Clique hypothesis, a well-known problem in the community.
- Proved optimal computational refutation hardness and the detection-refutation gap in PDS via Planted Clique.
- Worked on computational reductions from dense to sparse graphs, an important problem left open by prior literature.

Learning distributions from slicing with random halfspaces (MIT LIDS) Sep. 2022 - Jan. 2023
Advised by Prof. Yury Polyanskiy (MIT EECS), joint work with Patrik Gerber and Rui Sun (both MIT Math).
- Characterized a generalized Energy Distance (between two distributions) with slicing halfspaces and proved (minimax) tight lower bounds given L_2 separation in Sobolev-smooth distributions and Gaussian mixtures.
- Derived log-optimal ERM convergence rate for (smooth) density learning, with proposed empirical benefits.

Likelihood-free inference via MMD distances (MIT LIDS) Sep. 2022 - Jan. 2023
Advised by Prof. Yury Polyanskiy (MIT EECS), joint work with Patrik Gerber and Rui Sun (both MIT Math).
- Proved almost-tight minimax upper/lower bounds for Likelihood-Free Hypothesis Testing from thresholding the Max-Mean Discrepancy (MMD) distance with a fixed kernel.
- Proposed a framework for learning deep kernels parameterized by NN maximizing the test power for likelihood-free testing. Confirmed the existence of experimentation-observation tradeoff empirically.

OTHER PROJECTS

Statistical Query lower bounds in learning Neural Nets   Aug. 2023 - Dec. 2023
Advised by Prof. Sitan Chen (Harvard SEAS)
- Established (C)SQ hardness in PAC learning binary nets with log-depth with fully random weights.
- Working on analyzing the tradeoff between randomness in parameters versus network depth.

Off-line Inverse Reinforcement Learning (MIT LIDS)   Nov. 2022 - Mar. 2023
Advised by Dr. Jiawei Zhang, joint work with Kihyun Kim (both MIT EECS).
- Worked on optimal policy in offline inverse RL via bi-level programming with a LP formulation.
- Proved a strong duality between Max-Likelihood and Min-KL formulations of IRL, which leads to a global optima.

SGD generalization from a scale-invariant perspective   Sep. 2021 - Dec. 2021
Advised by Dr. Akshay Rangamani (MIT CBMM), joint work with Hui Li (Harvard Stats).
- Analyzed network minima with respect to equivalence classes in terms of Riemann Hessian generalization and SGD selection.
- Improved baseline generalization and training time on real datasets (CIFAR10, MNIST) with shallow networks

Evaluating attribution- and sample-based interpretations of black-boxes (MIT CSAIL)   Sep. 2021 - Jan. 2022
Advised by Dr. Yilun Zhou (MIT EECS).
- Analyzed a variety of gradient-based methods for interpretability in NLP tasks.
- Introduced a novel framework of generating counterfactual texts and its interpretability applications.

HONORS AND AWARDS

- William Lowell Putnam Math Competition, N1 (Top 15th Overall)	2021
- International Math Olympiad (IMO) Team USA, Silver Medal	2020
- USA Math Olympiad (USAMO) winner, 5th place nationwide	2020
- Asian Pacific Math Olympiad, 3rd place worldwide	2020
- International Olympiad of Metropolises, Gold Medal (2nd place worldwide)	2018
- Chinese International Math Olympiad (IMO) Team Candidate (Top 15)	2018

PRESENTATIONS

Talks I've given in various group meetings.

- Sampling via stochastic localization, Bresler Research Group, MIT	Nov. 2023
- Computational lower bounds via avg. case reductions, Chen Research Group, Harvard	Oct. 2023
- Slicing with random half-spaces, Pilanci Research Group, Stanford	Apr. 2023
- Slicing with random half-spaces, Bresler Research Group, MIT	Mar. 2023
- Likelihood-Free Inference with kernels, Polyanskiy Research Group, MIT	Dec. 2022

OTHER EXPERIENCES

- **Teaching Assistant**, 6.3700: Introduction to Probability.	SP2023
- **Teaching Assistant**, 6.7810: Algorithms for Inference (Approved Advanced Graduate Subject).	FA2022
- **Teaching Assistant**, Math Olympiad Program (MOP).	SU2021
- **Research Intern (Quant)**, Tong Deng Capital.	SU2021
- **Grader, Test Reviewer**, IMO (USA) Team Selection Tests.	2021
- **Student Researcher**, MIT PRIMES-USA.	2020

SKILLS

- **Programming**: Python (Pytorch, NumPy, Pandas), Assembly (RISC-V), HDL (Bluespec), Cpp, Julia.
- **Languages**: Native in English and Mandarin.