Minh Nguyen

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RESEARCH INTERESTS

Optimal Transport, Partial Differential Equations, Differential Geometry, Probability, Machine Learning and Data Science

EDUCATION

Michigan State University, Honors College, East Lansing, Michigan — 09-2021 — 05-2025
Bachelor of Arts in Advanced Mathematics, Minor in Computer Science — Major GPA: 3.93/4.0

RESEARCH EXPERIENCE

Caltech Computing + Mathematical Sciences — Pasadena, California
Advisors: Professor Franca Hoffmann, Dr. Ricardo Baptista and Dr. Benjamin Zhang — 6-2024 — Present

- Summer Undergraduate Research Fellow (SURF) working on optimal transport theory
- Mathematically proved qualitative estimates for obtaining Knothe maps via a free-target version of optimal trasnport
- Introduced a non-parametric estimator for estimating triangular vector fields used for conditional sampling tasks
- Implemented numerical simulations to validate theory
- Paper presented at "Optimal Transport and Applications" in Pisa by Franca Hoffmann (http://www.crm.sns.it/course/7100/)

MSU Mathematics Department — East Lansing, Michigan
Advisor: Professor Jun Kitagawa — 1-2024 — Present

- Research assistant through NSF DMS-2246606 researching gradient flows
- Studied optimal transport in a reading course centered around Alessio Figalli's book "An invitation to optimal transport;" Gave weekly presentations on material in book

Advisor: Dr. Son Tu — 1-2024 — Present

- Studied the first two chapter of Prof. Hung Tran's Hamilton-Jacobi book in a reading course and gave weekly presentations on each section
- Authored an expository report on Hamilton-Jacobi equations and state-constraint solutions to Hamilton-Jacobi equations
- Delivered weekly presentations as well as presentation at MSU Student Math Conference

MSU Signals, Learning and Imaging Group — East Lansing, Michigan
Advisor: Professor Sai Ravishankar — 09-2022 — 03-2024

- Developed deep learning based MRI reconstruction algorithms that are robust to adversarial attacks
- Independently proved theorems on rate of convergence for proposed algorithm and verified theorems with experimental results; Under review at Journal on Selected Topics in Signal Processing

PUBLICATIONS (= denotes alphabetical ordering)

=[2] R. Baptista, F. Hoffmann, **M.V. Nguyen**, B. Zhang, "Knothe-Rosenblatt maps via soft-constraint optimal transport", *in progress*

[1] S. Liang*, **M.V. Nguyen***, J. Jia, I. Alkhouri, S, Liu, S. Ravishankar, "Robust MRI Reconstruction by Smoothed Unrolling (SMUG)", *Submitted to Journal of Selected Topics in Signal Processing* (2024)

TALKS

8. *Knothe-Rosenblatt maps via soft-constrained optimal transport*, Presented by Franca Hoffmann, Optimal Transport and Applications, Pisa, Italy, 12-2024
7. *Knothe-Rosenblatt maps via soft-constrained optimal transport*, UT Austin DSML, 10-2024 *(online)*
6. *From Benamou-Brenier optimal transport to triangular velocity fields*, Caltech Student-Faculty Programs Summer Seminar, 08-2024
5. *Rate of convergence of vanishing viscosity procedure for static problems, via a doubling variable method*, 21th MSU Student Mathematics Conference, 04-2024 **(Best Presentation Award)**

4. *Gaussian Smoothed Optimal Transport*, UT Austin Data Science and Machine Learning (DSML) Lab's Optimal Transport reading group, 03-2024 *(online)*

3. *Rate of convergence of Smoothed Unrolling for MRI reconstruction*, 3rd MSU Data Science Confernce 09-2023 **(Best Poster Award)**

2. *Rate of convergence of Smoothed Unrolling for MRI reconstruction*, Signals, Learning and Imaging Group Meeting, 09-2023

1. *Randomized smoothing for robustness training*, Signals, Learning and Imaging Group Meeting, 01-2023

SELECTED MATH COURSES

- PhD Quals Measure Theory — Real Analysis, Folland
- PhD Quals Econometrics — Statistical Inference, Casella and Berger
- PhD Quals Partial Differential Equations — Partial Differential Equations, Evans
- PhD Quals Differential Geometry — Introduction to Smooth Manifolds, Lee
- PhD Quals Functional Analysis — A Course in Functional Analysis, Conway
- Honors Real Analysis 1 & 2 — Course notes: Net based approached to analysis
- Honors Abstract Algebra 1 & 2 — *Group theory*: Algebra, Artin. *Galois theory*: Topics in Algebra, Herstein
- Point Set Topology — Munkres, Topology

AWARDS

- **Larry Fowler Research Award** 05-2024
  Awarded $4000 to work on Hamilton Jacobi theory with Dr. Son Tu, via MSU's College of Natural Science
- **21st Annual MSU Student Math Conference** 04-2024
  Best Presentation Award
- **ULA Award for Excellence in Teaching** 04-2024
  For excellence in teaching as an undergraduate learning assistant in Mathematics
- **Best Conference Poster** 10-2023
  MSU's 3rd Data Science Conference
- **RE Phillips Award** 05-2023
  Awarded $1250 merit award in the Department of Mathematics, MSU
- **SpartaHack 8, Winner** 01-2023
  Winner of Best AI Project in MSU's premier hackathon (400+ attendants)
- **Wielenga Research Scholar** 08-2023
  Awarded $4000 through MSU's Honors College to work as a Professorial Assistant with Prof. Sai Ravishankar
- **MSU Provost Undergraduate Research Initiatve** 05-2022
  Awarded $2000 for research in applied economics
- **Econ Scholar, Michigan State University** 05-2022
  Top 3% of Economics Undergraduates

TEACHING EXPERIENCE

- **Undergraduate Learning Assistant**: Honors Calculus 3, Honors Linear Algebra, Calculus 2, Macroeconomics
- **Recitation Leader**: Honors Calculus 3, Calculus 2

SERVICE

- Student Representative, Undergraduate Studies Committee: Department of Mathematics, 2024-25 Academic Year
- Math Learning Center Supervisor, MSU
- Organizer: MSU 2nd Data Science Conference, Oct. 2022
- Residential Assistant: Michigan State University