

Duc Toan Nguyen

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EDUCATION

Aug 2025 - Present **Ph.D. in Electrical and Computer Engineering (ECE)**

Rice University, Houston, TX

George R. Brown School of Engineering and Computing

May 2025

Bachelor of Science in Mathematics

Bachelor of Science in Computer Science

Texas Christian University (TCU), Fort Worth, TX

College of Science and Engineering, John V. Roach Honors College

RESEARCH EXPERIENCE

Rice University, Dept. of Electrical and Computer Engineering

Aug 2025 - Present

- **Role:** Graduate Researcher (Network Regression with Bures-Wasserstein Metric)
- **Advisor:** Dr. Cesar Uribe
- Leveraging the intrinsic **Riemannian geometry** of the Bures-Wasserstein metric to design efficient optimization algorithms for network regression on graph Laplacians.
- Deriving rigorous **bottleneck conditions** characterizing stationary points of the Fréchet mean optimization problem with Wasserstein metric.
- Applying network regression methods on real-world datasets, specifically modeling **aging brain networks** using **fMRI data** to advance computational methods in **Neuroscience**.

Independent Research (Collaboration with IBM/Lehigh)

Apr 2024 - May 2025

- **Role:** Researcher (Variance-Reduced Shuffling Stochastic Optimization)
- **Advisors:** Dr. Lam M. Nguyen (IBM Research), Dr. Trang H. Tran (Lehigh University)
- Proposing a novel variance-reduced optimization method by applying shuffling paradigms to SARAH, creating a protocol that is practically efficient for **large-scale machine learning** workloads.
- Proving a **faster convergence rate** for the proposed method compared to existing state-of-the-art algorithms, directly addressing **AI computational efficiency**.
- Developing an inexact version for Expectation Maximization (EM) problems with rigorous proofs of complexity comparable to leading stochastic methods.

Texas Christian University, Dept. of Computer Science

Jan 2023 - May 2025

- **Role:** Research Assistant (GO2AI Project)
- **Advisors:** Dr. Liran Ma, Dr. Ze-li Dou
- Implementing Monte Carlo Tree Search (MCTS) and Convolutional Neural Networks (CNNs) into the policy architecture of autonomous **AI agents** (Go).
- Optimizing **reinforcement learning** algorithms by enhancing the training pipeline through distributed learning techniques.
- Implementing **Grad-CAM (Explainable AI/XAI)** to visualize and interpret black-box learning processes, evolving the transparency of AI decision-making.

- **Role:** Honors Research Scholar (Network Architecture)
- **Advisor:** Dr. Ken Richardson
- Developing a first-of-its-kind heuristic algorithm to construct approximate Steiner Trees for arbitrary point sets, reducing total network length by 2% compared to Minimum Spanning Trees.
- Applying the algorithm to optimize network architecture designs, with direct implications for efficient **communication infrastructures** and **genetic network analysis**.
- Proving theoretical conditions for the existence of Fermat points in triangles on general 2-D surfaces.

Rice University, Dept. of Statistics (REU)

May 2023 - July 2023

- **Role:** Undergraduate Researcher (STAT-DATASCI REU 2023)
- **Advisor:** Dr. Eric C. Chi
- Investigating the sensitivity of optimal tuning parameters to noise levels in Nonnegative Matrix Factorization (NMF), a critical technique for **dimensional reduction**.
- Spearheading the development of a novel algorithm, “Square-Root Min-Vol NMF,” and establishing its rigorous convergence guarantees.
- Validating the algorithm on large-scale datasets of **hyperspectral images**, demonstrating superior error reduction compared to recent methods, with applications in **biomedical imaging**.

ACADEMIC PUBLICATIONS

- **Nguyen, D. T.**, Tran, T. H., & Nguyen, L. M. “Adjusted Shuffling SARAH: Advancing complexity analysis via dynamic gradient weighting.” (*In Revision for Journal of Optimization Theory and Applications - JOTA*).
- **Nguyen, D. T.**, & Chi, E. C. “Towards tuning-free minimum-volume nonnegative matrix factorization.” *Proceedings of the 2024 SIAM International Conference on Data Mining (SDM24)*.
- **Nguyen, D. T.** “On the existence of a balanced vertex in geodesic nets with three boundary vertices.” *Journal of Geometry*, 116.3 (2025): 36.
- **Nguyen, D. T.** “Geodesic Nets - Construction and Existence.” (*Outstanding Honors Thesis*).
- **Nguyen, D. T.** “Anti-Steiner Point Revisited.” *Mathematical Reflections*. Vol. 2020 and 2021, 30 Sep. 2022, pp. 568–608. (*Book Chapter*).

HONORS & AWARDS

- 2024 **Top 300** (of 3,988 students) – 85th William Lowell Putnam Mathematical Competition
- 2024 **Honors College Heritage Scholarship** – TCU
(*Most prestigious annual scholarship; awarded to 1 student out of >1000 honors students*)
- 2025 **Senior Scholar** – Department of Mathematics, TCU
- 2025 **Best Undergraduate Poster** – TCU Student Research Symposium
- 2025 **Finalist**, Best Honors Thesis Presentation (Boller Competition) – TCU
- 2025 **Student Travel Funding** – Pi Mu Epsilon (PME) for JMM 2025
- 2024 **SIAM Student Travel Award** – SIAM Int. Conference on Data Mining (SDM24)
- 2023 **Outstanding Session Presentation** – Comp. Math & Operations Research, GCURS
- 2023 **Finalist**, Best Undergraduate Poster Presentation – TCU Student Research Symposium
- 2022 **Top 500** (of 3,415 students) – 83rd William Lowell Putnam Mathematical Competition
- 2025 Member, **Pi Mu Epsilon** (TCU Texas Alpha chapter)
- 2025 Member, **Upsilon Pi Epsilon** (TCU chapter)

PROFESSIONAL ACTIVITIES

- **Reviewer**, *Journal of Machine Learning Research (JMLR)* - Top-tier journal in Machine Learning.
- **Reviewer**, *International Conference on Learning Representations (ICLR) 2025* - Top-tier conference in Machine Learning.

POSTERS & PRESENTATIONS

- **Nguyen, D. T.** & Chi, E. C. “Towards Tuning-Free Minimum-Volume Nonnegative Matrix Factorization.” *AMS Contributed Papers Session, Numerical Analysis I, JMM*, Jan 2025. (Accepted).
- **Nguyen, D. T.** “On the existence of a balanced vertex in geodesic nets with three boundary vertices.” *AMS - PME Undergraduate Student Poster Session, JMM*, Jan 2025.
- **Nguyen, D. T.** & Chi, E. C. “Towards Tuning-Free Minimum-Volume Nonnegative Matrix Factorization.” *SIAM Conference on Mathematics of Data Science (MDS24)*, Oct 2024. (Poster).
- **Nguyen, D. T.** “Towards Tuning-Free Minimum-Volume Nonnegative Matrix Factorization.” *Summer school on Bayesian learning and network analysis, VIASM, Hanoi*, July 2024. (Poster).
- **Nguyen, D. T.** & Chi, E. C. “Towards Tuning-Free Minimum-Volume Nonnegative Matrix Factorization.” *SIAM International Conference on Data Mining (SDM24)*, Apr 2024. (Slides/Poster).
- **Nguyen, D. T.** “A Majorization-Minimization Variant For Minimum-Volume Nonnegative Matrix Factorization.” *National Collegiate Research Conference (NCRC)*, Harvard University, Jan 2024.
- **Nguyen, D. T.** “Towards Tuning-Free Minimum-Volume Nonnegative Matrix Factorization.” *Gulf Coast Undergraduate Research Symposium (GCURS)*, Rice University, Oct 2023.
- **Nguyen, D. T.** “Searching for networks of minimum length.” *Research and Creative Activities Week*, TCU, Sep 2023. (Poster).
- Leath, H., Good, B., Fahimi, S., **Nguyen, D. T.**, Ma, L., & Dou, Z. “The Sybil in AI: The Many Personalities of a Go Playing Model.” *Research and Creative Activities Week*, TCU, Sep 2023. (Poster).
- **Nguyen, D. T.** “Geodesic Nets construction using Genetic Algorithm.” *Student Research Symposium (SRS)*, TCU, April 2023. (Poster).

TECHNICAL SKILLS

Languages	Python, Java, MATLAB, R, MySQL, C, C++, HTML, JS, PHP
AI/ML	PyTorch, Scikit-learn, NetworkX, NumPy, Pandas, Captum, TensorFlow
Systems	Linux, MacOS, Windows, Distributed Computing