

Duc Toan Nguyen

 [ductoanng.github.io](https://github.com/ductoanng) |  duc.toan.nguyen@rice.edu |  Houston, TX

EDUCATION

- Aug 2025 – Present **Ph.D. in Electrical and Computer Engineering (ECE)**
Rice University, Houston, TX
- 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

INDUSTRY EXPERIENCE

- KLA Corporation, Ann Arbor** May 2026 – Aug 2026
- **Role:** Algorithm Engineer Intern
 - **Project title:** Topological and Geometric Representation for Robust Alignment and Reticle Inspection
 - Proposed a **novel** anomaly-score heat map to localize scarce misalignment regions in tiny artifacts on **semiconductor** optical reticle images, supporting **semiconductor manufacturing** quality control
 - Built an efficient **deep learning** model to classify misalignment accurately under strict speed and memory constraints for real-time **reticle inspection**
 - Conducted experiments evaluating **state-of-the-art** image-processing methods, including **Persistent Homology** and **Morse-Smale representation**, for robust **semiconductor** defect detection

RESEARCH EXPERIENCE

- Rice University, Dept. of Electrical and Computer Engineering** Feb 2026 – Present
- **Role:** Graduate Researcher (Decentralized Optimization on Riemannian Manifolds)
 - **Advisor:** Dr. César A. Uribe
 - Developed **the first intrinsic decentralized Riemannian optimization framework** achieving **exact convergence** in both consensus and objective error, matching the convergence rates of Euclidean decentralized optimization for smooth convex, nonconvex, deterministic, and stochastic settings.
 - Developed **intrinsic** consensus analysis and geometric contraction techniques without relying on ambient Euclidean embeddings.
 - Demonstrated the framework on Hadamard, sphere, Grassmann, and Bures–Wasserstein manifolds with applications to Fréchet mean, Fréchet median, and related manifold optimization problems.
- Rice University, Dept. of Electrical and Computer Engineering** Aug 2025 – Present
- **Role:** Graduate Researcher (Fréchet Regression on the Bures-Wasserstein Manifold)
 - **Advisor:** Dr. César A. Uribe
 - Leverage the intrinsic Riemannian geometry of the **Bures-Wasserstein metric** to design efficient optimization algorithms for **network regression** on graph Laplacians.
 - Derive rigorous **bottleneck conditions** characterizing stationary points of the **Fréchet mean** optimization problem with Wasserstein metric.
 - Apply network regression methods to real-world datasets, specifically modeling **diffusion tensor MRI**, to advance computational methods in **neuroscience**.

Independent Research

Apr 2024 – May 2025

- **Role:** Researcher (Variance-Reduced Shuffling Stochastic Optimization)
- **Advisors:** Dr. Lam M. Nguyen (IBM Research), Dr. Trang H. Tran (Emory University)
- Propose 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.
- Prove a **faster convergence rate** for the proposed method compared to existing state-of-the-art algorithms, directly addressing **AI computational efficiency**.
- Develop 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
- Implement Monte Carlo Tree Search (MCTS) and Convolutional Neural Networks (CNNs) into the policy architecture of distributed **AI agents** (Go).
- Optimize **reinforcement learning** algorithms by enhancing the training pipeline through distributed learning techniques.
- Implement **Grad-CAM (Explainable AI/XAI)** to visualize and interpret black-box learning processes, evolving the transparency of AI decision-making.

Texas Christian University, Dept. of Mathematics

Sep 2022 – May 2025

- **Role:** Honors Research Scholar (Geodesic Nets - Construction and Existence)
- **Advisor:** Dr. Ken Richardson
- Develop 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.
- Apply the algorithm to optimize network architecture designs, with direct implications for efficient **communication infrastructures** and **genetic network analysis**.
- Prove theoretical conditions for the existence of Fermat points in triangles on general 2-D surfaces.

Rice University, Dept. of Statistics (REU)

May 2023 – Jul 2023

- **Role:** Undergraduate Researcher (STAT-DATASCI REU 2023)
- **Advisor:** Dr. Eric C. Chi
- Investigate the sensitivity of optimal tuning parameters to noise levels in Nonnegative Matrix Factorization (NMF), a critical technique for **dimensional reduction**.
- Spearhead the development of a **novel algorithm**, “**Square-Root Min-Vol NMF**,” and establish its **rigorous convergence guarantees**.
- Validate 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.**, & Uribe, C. A. “Fréchet Regression on the Bures-Wasserstein Manifold.” (*Accepted for the Conference on Neural Information Processing Systems (NeurIPS) 2026*).
- **Nguyen, D. T.**, & Uribe, C. A. “Intrinsic Decentralized Stochastic Riemannian Optimization on Manifolds with Bounded Sectional Curvature”. *IEEE Control Systems Letters* (2026). Invited for presentation at the *IEEE Conference on Decision and Control (CDC 2026)*.
- **Nguyen, D. T.**, Tran, T. H., & Nguyen, L. M. “Adjusted Shuffling SARAH: Advancing Complexity Analysis via Dynamic Gradient Weighting”. *Journal of Optimization Theory and Applications*, 210(1), (2026): 12.

- **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*).

HONORS & AWARDS

- 2026 **Pi Mu Epsilon Outstanding Speaker Award** – Joint Mathematics Meetings (JMM)
- 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
- 2025 Member, **Pi Mu Epsilon** (TCU Texas Alpha chapter)
- 2025 Member, **Upsilon Pi Epsilon** (TCU chapter)
- 2024 **Top 300** (of 3,988 students) – 85th William Lowell Putnam Mathematical Competition
- 2024 **SIAM Student Travel Award** – SIAM Int. Conference on Data Mining (SDM24)
- 2023 **Outstanding Session Presentation** – Comp. Math & Operations Research, GCURS
- 2022 **Top 500** (of 3,415 students) – 83rd William Lowell Putnam Mathematical Competition

PROFESSIONAL ACTIVITIES

- **Reviewer**, *The Conference on Neural Information Processing Systems (NeurIPS) 2026* - Top-tier conference in Machine Learning.
- **Reviewer**, *Journal of Machine Learning Research (JMLR)* - Top-tier journal in Machine Learning.
- **Reviewer**, *International Conference on Learning Representations (ICLR) 2026* - Top-tier conference in Machine Learning.
- **Reviewer**, *Journal of Optimization Theory and Applications (JOTA)* - Top-tier journal in Mathematical Optimization.
- **Reviewer**, *Statistica Sinica* - Top-tier journal in Statistics.
- **Reviewer**, *IEEE Transactions on Signal and Information Processing over Networks* - Q1 journal in Signal Processing.

POSTERS & PRESENTATIONS

- **Nguyen, D. T.**, & Uribe, C. A. “Fréchet Regression on the Bures-Wasserstein Manifolds.” *SIAM Conference on Optimization*, Jun 2026.
- **Nguyen, D. T.**, & Uribe, C. A. “Fréchet Regression on the Bures-Wasserstein Manifolds.” *INFORMS Conference on Optimization*, Mar 2026.
- **Nguyen, D. T.** “Geodesic Nets - Construction and Existence.” *PME Contributed Session on Research by Undergraduates*, JMM, Jan 2026.
- **Nguyen, D. T.**, & Chi, E. C. “Towards Tuning-Free Minimum-Volume Nonnegative Matrix Factorization.” *AMS Contributed Papers Session, Numerical Analysis I*, JMM, Jan 2025.
- **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, Jul 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, Apr 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