DUC TOAN NGUYEN

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EDUCATION

TEXAS CHRISTIAN UNIVERSITY — Fort Worth, Texas
College of Science and Engineering, John V. Roach Honors College — August 2021-May 2025
Bachelor of Science in Mathematics — Current GPA: 4.0/4.0
Bachelor of Science in Computer Science

Relevant Coursework:

- **Mathematics Courses**: Applied Linear Algebra, Differential Geometry, Geometric PDEs, Statistics, Real Analysis I & II, Multivariable Analysis, Topology, Numerical Analysis, Abstract Algebra I
- **Computer Science Courses**: Analysis of Algorithms, Artificial Intelligence, Deep Learning, Data Mining and Visualizations, Database Systems, UNIX/Linux Admin, Computer Organizations

RESEARCH EXPERIENCE

Independent Research — Fort Worth, Texas
Variance-Reduced Shuffling Stochastic Optimization Project — April 2024-Present
Advisor: Dr. Lam M. Nguyen, Dr. Trang H. Tran

- Propose a novel variance-reduced optimization method by applying shuffling paradigms to SARAH
- Prove a faster convergence rate of the proposed method than convergence rates of similar algorithms
- Develop an inexact version for the expectation minimization (EM) problems with proofs of comparable complexities to the state-of-the-art algorithms

Texas Christian University, Department of Computer Science — Fort Worth, Texas
Research Assistant for GO2AI project — January 2023-Present
Advisors: Dr. Liran Ma, Dr. Ze-li Dou

- Implement Monte Carlo Tree Search and CNNs into the policy of AI agents playing the game Go
- Optimize the performance of AI agents by improving the training process using distributed learning
- Implement Grad-CAM to explain how AI learns and evolves through many iterations

Texas Christian University, Department of Mathematics — Fort Worth, Texas
Honor Research Program — September 2022-Present
Advisor: Dr. Ken Richardson

- Develop the first algorithm to construct approximate Steiner Trees with an arbitrary number of points by adding Fermat points heuristically, reducing total length by 2% compared to the Minimum Spanning Tree
- Prove the condition for the existence of the Fermat point in a triangle on a general 2-D surface

Rice University, Department of Statistics — Houston, Texas
Research Experiences for Undergraduate (REU) STAT-DATASCI — May 2023-July 2023
Advisor: Dr. Eric C. Chi

- Investigated the dependence of optimal tuning parameters on the noise level of an existing NMF method
- Proposed a new algorithm called Square-Root Min-Vol NMF and proved the convergence guarantee
- Tested the algorithm with large datasets of hyperspectral images and got better errors than recent methods

ACADEMIC PUBLICATION

- **Nguyen, Duc Toan**, and Eric C. Chi. "Towards tuning-free minimum-volume nonnegative matrix factorization," *Proceedings of the 2024 SIAM International Conference on Data Mining (SDM24).*
- **Nguyen, Duc Toan**. "Anti-Steiner Point Revisited." *Mathematical Reflections,* Vol. 2020 and 2021.
- **Nguyen, Duc Toan**. "On the existence of a balanced vertex in geodesic nets with three boundary vertices." (preprint)

HONORS/AWARDS

- Top 300 in the 85th William Lowell Putnam Mathematical Competition 2024
- Pi Mu Epsilon (PME) Student Travel Funding for the 2025 Joint Mathematics Meetings (JMM25)
- Student Travel Award for the 2024 SIAM International Conference on Data Mining (SDM24)
- Outstanding Session Presentation, Computational Mathematics and Operations Research, GCURS 2023
- Best Undergraduate Poster Presentation Finalist of TCU Student Research Symposium 2023
- Top 500 in the 83rd William Lowell Putnam Mathematical Competition 2022
- First prize in TCU Math Department Calculus Bee 2022, 2023, and 2024
- Third prize in the Russian Sharygin Geometry Olympiad 2019
- Third prize in the Vietnam Mathematical Olympiad 2019
- Pi Mu Epsilon - TCU Texas Alpha chapter
- Upsilon Pi Epsilon - TCU chapter
- TCU Scholar (GPA 4.0)

POSTERS/PRESENTATION

- **Nguyen, Duc Toan** and Eric C. Chi. "Towards Tuning-Free Minimum-Volume Nonnegative Matrix Factorization." *AMS Contributed Papers Session, Numerical analysis I, JMM,* January 2025. (accepted)
- **Nguyen, Duc Toan**. "On the existence of a balanced vertex in geodesic nets with three boundary vertices." *AMS - PME Undergraduate Student Poster Session, JMM,* January 2025. (accepted)
- **Nguyen, Duc Toan** and Eric C. Chi. "Towards Tuning-Free Minimum-Volume Nonnegative Matrix Factorization." *SIAM Conference on Mathematics of Data Science (MDS24),* October 2024. (poster)
- **Nguyen, Duc Toan** and Eric C. Chi. "Towards Tuning-Free Minimum-Volume Nonnegative Matrix Factorization." *SIAM International Conference on Data Mining (SDM24),* April 2024.
- **Nguyen, Duc Toan**. "A Majorization-Minimization Variant For Minimum-Volume Nonnegative Matrix Factorization." *National Collegiate Research Conference (NCRC), Harvard University,* January 2024.
- **Nguyen, Duc Toan**. "Towards Tuning-Free Minimum-Volume Nonnegative Matrix Factorization." *Gulf Coast Undergraduate Research Symposium (GCURS), Rice University,* October 2023.
- **Nguyen, Duc Toan**. "Searching for networks of minimum length." *Research and Creative Activities Week, Texas Christian University,* September 2023 (poster).
- Leath, Harrison, Blake Good, Shawn Fahimi, **Duc Toan Nguyen**, Liran Ma, and Ze-li Dou. "The Sybil in AI: The Many Personalities of a Go Playing Model." *Research and Creative Activities Week, Texas Christian University,* September 2023 (poster).

WORK EXPERIENCE

TRIO Program - TCU College of Education Fort Worth, Texas

SSS Peer Tutor January 2022-Present

- Support lower-income and first-generation students under a federally funded program
- Teach 10 students to think critically and perform better in elective Math and Computer Science courses
- Tutor 2 graduate Math courses including Real Analysis I and Real Analysis II

TCU Department of Mathematics Fort Worth, Texas

Math Grader/Teaching Assistant January 2022-Present

- Grade student's homework assignments and give them detailed feedback
- Discuss with Professors some problems in grading and other mathematical topics

TECHNICAL SKILLS

- **Programming Languages:** Python, Java, MATLAB, R, MySQL, C, C++, HTML, JS, PHP
- **Machine Learning:** Pytorch, Scikit-learn, NetworkX, Numpy, Pandas, Captum
- **Operating Systems:** Linux, MacOS, Windows