# Tuyen Pham

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## Education

**PhD in Mathematics** 2021 - Present

University of Florida, Gainesville Graduation: Spring 2026

Dissertation: "Efficient tools for the geometric and topological analysis of machine learning models"

Advisor: Hubert Wagner

**BSc in Applied Mathematics, Minor in Statistics; MS in Mathematics** 2016; 2020

California Polytechnic State University, San Luis Obispo

## Experience

**Skills:** Algorithm design, applied and theoretical research, Git, Linux/Unix command-line tooling

**Languages :** Python, C++ **Packages :** NumPy, SciPy, Matplotlib, Scikit-learn, Keras, PyTorch, Cython

**Algorithms for Topological Analysis of Neural Networks**
**2022 Google Research Scholar Program: Algorithms and Optimization** Jan 2023 - Present

- Researched methodology for extending geometric and topological algorithms and data structures to Bregman divergences to analyze the structure of neural networks.
- Developed C++ and Python software translating theoretical results to practical applications.
- Presented technical concepts to non-experts through clear presentations and documentation.
- Principal Investigator: Dr. Hubert Wagner

**Fast Kd-trees for the Kullback–Leibler divergence and other Decomposable Bregman divergences** Jan 2023 - Aug 2025

- Proved Kd-trees work with a class of Bregman divergences used in machine learning.
- Implemented efficient C++ library and Python package for public use for nearest neighbour searches and computing Bregman–Hausdorff divergences.
- Improved computation times by up to 100× compared to other public implementations.
- ***Presented and published*** results at The Algorithms and Data Structures Symposium, August 2025.

**Bregman–Hausdorff Divergence: Strengthening the Connections Between Computational Geometry and Machine Learning** Aug 2024 – May 2025

- Defined the Bregman–Hausdorff divergence, a measurement between sets of vectors in machine learning.
- Designed and implemented algorithms to compute the Bregman–Hausdorff divergence, which are up to 750× faster than the simplistic algorithms in high dimensions.
- ***Published*** in Machine Learning and Knowledge Extraction, May 2025.

**Compute Representatives of Persistent Homology Generators with Cohomology** Jan 2023 - Aug 2023

- Designed an algorithm to compute persistent homology generators using cohomology.
- Improved computation time a factor of 200 compared to existing algorithms.
- Developed testing framework in Python for comparisons.
- ***Presented and published*** results at Canadian Conference on Computational Geometry 2023.

**Topological Generative Adversarial Network** Sep 2023 - Dec 2023

- Implemented a Generative Adversarial Network incorporating topological information.

**Topological analysis of time series | Master's Thesis** Fall 2019 - Spring 2020

- Implemented sliding window and persistent homology algorithm for Python to extract periodicity in time series data.

## Teaching and Leadership

**Graduate student | University of Florida** Aug 2021 – Present

- Assistant lecturer for 'Linear Algebra for Data Science'. Gave lectures on pseudoinverses, SVD decompositions, and random projections.
- Teaching assistant for 'Computational Mathematics', 'Computational Linear Algebra', 'Calculus 1', and 'Online Calculus 3'.

**Topological data analysis seminar leader** Aug 2024 – Dec 2024

- Led the University of Florida TDA Seminar, inviting speakers internationally.
- Shifted the seminar focus to applications of TDA and algorithms design.

**Middle school and high school teacher | SLO Classical Academy** Sep 2020 – Aug 2021

- Taught Algebra 1 and Computer Science as hybrid courses.
- Created videos to supplement class work to adapt to COVID remote learning restrictions.
- Led a committee to redesign Algebra I curriculum by adjusting pacing and order for teaching higher order polynomials.

## Certifications

**Coursera | DeepLearning.AI**

- Machine learning specialization Jul 17, 2023
- Generative Adversarial Networks (GANs) Nov 5, 2023