Bradley Vigil

Applied and Computational Topology | Data Science | Mathematical Neuroscience

Research Overview

My interdisciplinary research develops theory and models to understand the mathematical properties and structure of complex systems.

I am particularly interested in interdisciplinary questions regarding biological processes expressing both continuous and network features. My research praxis fuses mathematical modeling, differential equations, computational topology, data science and interdisciplinary collaboration to target challenging problems from epilepsy and neurodegenerative disease to climate change and biodiversity.

Awards and Notoriety

2024-2025 ***Quad Fellow (By IIE)*: *TTU Article***

2023-2025 **Charles S. Peirce Fellow**

2023-2024 **Hildebrand Fellow**

2023-2023 **ICERM Travel Grant** *$1,145.82*

2019-2023 **Texas Presidential Scholar**

2019-2023 **Texas Merit Scholar**

Professional Affiliations

AMA American Mathematical Association

AMS American Mathematical Society

NAM Natl Assoc of Mathematicians

SIAM Soc of Appl and Industrial Mathematics

Contact

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Personal Website

Texas Tech University
Dept. of Mathematics and Statistics
1108 Memorial Circle
Lubbock, Texas. 79409

Education

2022-Present — **Ph.D. Mathematics** — Lubbock, Texas
Texas Tech University
Quad Fellow,
Hildebrand Graduate Fellow,
Peirce Graduate Fellow, Presidential Scholar

2021-2022 — **M.Sc. Mathematics** — Lubbock, Texas
Texas Tech University
Presidential Scholar, Merit Scholar

2019-2021 — **B.Sc. Mathematics** — Lubbock, Texas
Texas Tech University
Presidential Scholar, Merit Scholar
Minor in Economics

Academic Appointments

2021-Present — **Distinguished Grad. Res. Asst.** — Lubbock, Texas
Texas Tech Graduate College
Dept. of Mathematics and Statistics
→ Applied and Computational Topology,
→ Data-driven Mathematical Modeling,
→ Mathematical Neuroscience

2021-Present — **Grad. Instructor** — Lubbock, Texas
Dept. of Mathematics and Statistics
→ Instructor of record: Calculus II; Ordinary Diff. Eqn.
→ Offline and online multimodal curriculum
→ Large lecture leadership experience

Publications

1. Travis B. Thompson, **Bradley Z. Vigil**, Robert S. Young. *Alzheimer's disease and the mathematical mind.* Brain Multiphysics, 2024, doi.org/10.1016/j.brain.2024.100094

2. **Bradley Z. Vigil**, Travis B. Thompson, Robert S. Young. *NPC and GPC reveal hidden structure in the persistent homology of propagation.* (In preparation).

3. **Bradley Z. Vigil**, Travis B. Thompson, Robert S. Young. *Topological data analysis is a choice (function).* (In preparation).

4. Robert Young, Naresh Sah, **Bradley Vigil**, Komoraiah Palle, Sharilyn Almodovar, Yifan Wang, Amanda Laubmeier and Travis Thompson. *Decoding Cancer's Defenses: Employing data-driven mathematical modeling to decipher cancer resistance.*. (In preparation).

5. Travis B. Thompson, Boris Decourt, J. Josh Lawrence, Amanda Laubmeier, Yifan Wang, **Bradley Vigil**, Robert Young, Eleni Keith, Irkan Khan, Andrew Shin, Vijay Hegde, and Naima Moustaïd-Moussa. *Mouth to Mind: Diet, obesity and mathematical opportunity in Alzheimer's disease research.* (In preparation).

Extracurricular Activity

Dream Center (Lubbock, TX)
→ Initiated the development of cooking classes for low economic families designed to provide key insights into how diet is tied to Alzheimer's disease
→ Collaborated with horticulturists to develop lists of healthy and affordable foods that can grow in the climate of the Texas panhandle

Math Circle (Texas Tech Univ.)
→ For middle and high school math students
→ Provides challenging problems
→ Encourages excitement for mathematics

Math Club (Texas Tech Univ.)
→ Discuss grad school applications with undergrads
→ Discuss grad school life with undergrads

Topological Data Analysis Workshops
→ Hosted workshops for faculty and grad students for an introduction to the theory and computational tools for topological data analysis
→ Jupyter notebook available *here*

ASPCA
→ Aided at the animal shelter by cleaning animal kennels and caring for the animals

Academic Presentations

October, 2024	**Institute for Studies in Pragmaticism** Lubbock, Texas *Understanding the Importance of Academic Outreach Across Societies and Cultures. Insights from a young scholar on networking with scientists, technologists, and politicians* Texas Tech University (invited)
October, 2024	**SIAM TX-LA** Waco, Texas *Organizer for mini-symposium Title of talk: Making a Complex Choice* Baylor University (invited)
November, 2023	**SIAM TX-LA** Lafayette, Louisiana *Organizer for mini-symposium Title of talk: Networks, Topology, Data and Pathology* University of Louisiana at Lafayette (invited)
April, 2022	**Professional Development Seminar** Lubbock, Texas *Vertex Algebras: An introduction to Vertex Operator Algebras* Texas Tech University (invited)
March, 2023	**Groups and Dynamics Conference** Austin, Texas *Dynamics, Dysfunction and Degeneration: The mathematics of Alzheimer's disease* The University of Texas at Austin (accepted)

Academic Workshops

October, 2024	**The Quad Summit** Washington, D.C. *Institute of International Education: website* (invited)
April, 2024	**Python: Topological Data Analysis II** Lubbock, Texas *Institute for Studies in Pragmaticism* Texas Tech University (organized)
March, 2024	**Python: Topological Data Analysis I** Lubbock, Texas *Institute for Studies in Pragmaticism: flyer* Texas Tech University (organized)
October, 2023	**Topology and Geometry in Neuroscience** Providence, Rhode Island *Institute for Computational and Experimental Research in Mathematics (ICERM): website* Brown University (accepted)

Scientific and Research Computing

Data Science, Machine Learning	**Python**: *Proficient* **GUDHI**: *Journeyman* **Tensorflow**: *Apprentice*
Modeling and Simulation	**Python** : *Proficient* **Matlab**: *Proficient* **C/C++**: *Journeyman* **Mathematica**: *Journeyman*
Academic Writing	**Latex** : *Proficient*