Daniel Tolosa

Ph.D. Candidate | Graduate Data Science Researcher
Purdue University, West Lafayette, IN 47907

dtolosav@purdue.edu
www.linkedin.com/in/daniel-tolosa
website: danieltolosa.com

Interests

Algebraic Topology, Topological Data Analysis, Complex Systems, Mathematical Biology, Data Analysis in Medicine and Biology.

Education

Ph.D. in Mathematics — Exp. May 2024
Purdue University (*Advisor: Manuel Rivera)* — West Lafayette, Indiana USA

B.S. in Mathematics — 2017
National University of Colombia — Bogotá, Colombia

Academic Positions

Graduate Data Science Researcher — Jan 2023 – Present
The Data Mine, Purdue University — West Lafayette, Indiana USA

Graduate Teaching Assistant — Aug 2018 – Present
Purdue University — West Lafayette, Indiana USA

Academic Tutor — 2012 – 2013
SLEG (Smart Learning Educational Group) — Bogotá, Colombia

Undergraduate Teaching Assistant — 2011 – 2017
National University of Colombia — Bogotá, Colombia

Research

- **Algebraic Topology:** developing a version of cyclic homology that provides an algebraic model of the free loopspace as an S^1-space.
- **Mathematical Biology:** applying topological data analysis for complex systems coming from biology. Using topological methods to give a quantitative analysis of patterns on the skin of zebrafish as they change in time.
- **Clinical Diagnosis/Data Science:** developing a clinical-grade machine learning classifier for Alzheimer's Disease from cf-mRNA data, in collaboration with a corporate partner: Molecular Stethoscope.

Publications in Preparation:

- **D. Tolosa** *Cyclic homology of categorical coalgebras and the free loop space* (Ph.D. Thesis).
- **D. Tolosa**, A. Volkening *Quantifying biological pattern formation: a time-dynamic persistent homology approach.*
- D. Debnath, K. Fruehauf, P. Joshi, F. Krastev, N. Ram, G. Rickus, **D. Tolosa**, S. Vaddadi, J. Sninsky, J. Braun *Modeling of Measurement Uncertainty of a high dimensional RNA-Seq classifier of cell-free mRNA for Alzheimer's Disease.*

Presentations and Posters

Upcoming Talks

- *Title TBD* AMS Spring Southeastern Sectional Meeting, Special Session in Diversity in Mathematical Biology, Florida State University, 2024.
- *Title TBD* Joint Mathematical Meetings, Special Session in Equivariant techniques in stable homotopy theory, San Francisco, CA, 2024.
- *Quantifying biological pattern formation: a time-dynamic persistent homology approach*, Topology Data Analysis Seminar, Michigan State University, 2023.
- *Cyclic homology of categorical coalgebras and the free loop space*, Topology Seminar, Michigan State University, 2023.
- *Cyclic homology of categorical coalgebras and the free loop space*, Topology Seminar, University of Minnesota, 2023.

Invited Talks

- *An algebraic model for the free loop space as an S^1-space*, Topology Seminar, Indiana University, 2023.
- *An algebraic model for the free loop space as an S^1-space*, Topology Seminar, Purdue University, 2023.
- *Quantifying biological pattern formation: a time-dynamic persistent homology approach*, Applied Geometry and Topology Seminar (Online), Potsdam University, Germany, 2023.
- *An algebraic model for the free loop space as an S1 space*, Algebra and Geometry Seminar, University of Genova, Italy, 2023.
- *Topological techniques to quantify biological pattern formation*, AMS Spring Sectional Meeting, University of Cincinnati, 2023.
- *Whitehead's theorem for Model Categories*, Student Topology Seminar, Purdue University, 2021.
- *An introduction to persistent homology using zebrafish-skin patterns*, Student Topology Seminar, Purdue University, 2021.
- *Goppa Codes in PQ-Crypto* Code Theory Seminar, Universidad de los Andes, Colombia, 2017.

Contributed Talks

- *Future directions in the intersection of Cyclic Homology Theory, Equivariant Homology Theory, and Topological Data Analysis*, Student Topology Seminar, Purdue University, 2023.
- *An algebraic model for the free loop space as an S^1 space*, Midwest Topology Seminar, UIUC, 2023.
- *Quantifying biological pattern formation in time*, Synergies between TDA and Life Sciences Workshop (Online), Heidelberg University, Germany, 2023.
- *An algebraic model for the S^1-homology of the free loop space* Graduate Research Day, Purdue University, 2022.
- *Time dynamics in Topological Data Analysis of Zebrafish Patterns* Student Colloquium, Purdue University, 2022.
- *Goppa and McEliece codes* Post-Quantum Cryptography Seminar, Universidad del Rosario, Colombia, 2017.
- *Finite fields in code-based cryptography* Post-Quantum Cryptography Seminar, Universidad del Rosario, Colombia, 2017.
- *Gröbner Bases, Stillman's Conjecture and F5 algorithms* UREP-C Symposium, Purdue University, 2016.
- *Bridges between Algebra and Geometry* Next Generation Researchers, Lafayette, IN, 2016.
- *Recent developments on Cerny's Conjecture* CS and Discrete Mathematics Seminar, National University of Colombia, 2016.

- *The Euler Characteristic: development through history and complexity* (CIMPA Summer School) Geometric, Algebraic and Topological Methods for Quantum Field Theory, Villa de Leyva, Colombia, 2015.

Poster Sessions

- *Quantifying biological pattern formation in time*, 3rd workshop on Computational Persistence (ComPer), Purdue University, 2023.
- *Quantifying biological patterns using persistent homology* PULSe Orientation Faculty Poster Session, Purdue University, 2023.
- *Uncertainty analysis of Alzheimer's Disease cell-free mRNA assay classifier* The Data Mine Symposium, Purdue University, 2023.
- *Cerny's Conjecture and the method of extension* Graduation Poster Session Class of 2017, National University of Colombia, 2017.
- *Gröbner Bases Computation* C-SAP Academic Event, Purdue University, 2016.

Academic Activities and Service

- **Panelist,** *Graduate students speak to potential mathematicians*, Purdue University 2023
- **Panelist,** *Basic Skills Workshop*, Purdue University 2023
- **Panelist,** *Ask a mathematician, Math Summer Camp*, Purdue University 2023
- **Poster Session Judge,** *SURF Symposium*, Purdue University 2023
- **Co-Organizer,** *Topology Student Seminar*, Purdue University . . . . . 2022 – Present
- **Poster Session Judge,** *Fall Undergraduate Research Expo*, Purdue University 2022
- **Participant** *Math challenges in biology contest*, NSF-Simons Center for Quantitative Biology 2022
- **Member,** *Anti-racist reading group*, Purdue University . . . . . 2019 – Present
- **Member,** *Post-quantum cryptography research group*, Rosario University, Colombia 2017
- **Visiting Scholar,** *Undergraduate Research Experience*, Purdue University . Summer & Fall 2016
- **Visiting Scholar,** *Undergraduate Research Experience*, University of Bologna, Italy . . Fall 2013

Teaching and Mentoring Experience

Instructor of Record

- *Applied Calculus 2* (2 Sections), Purdue University . . . . . Spring 2022
- *Applied Calculus 1* (2 Sections), Purdue University . . . . . Fall 2021

Teaching Assistant (Recitation)

- *Multivariate Calculus* (3 Sections), Purdue University . . . Fall 2019, Summer 2021, Spring 2022
- *Linear algebra and differential equations* (2 sections), Purdue University . . . . . Fall 2020
- *Discrete mathematics and applications* (2 sections), Purdue University . . . . . Summer 2020
- *Calculus 2* (2 sections), Purdue University . . . . . Fall 2018 and Spring 2019
- *ODEs and Linear Algebra* (1 section), National University of Colombia . . . . . Spring 2016
- *Fundamentals of mathematics* (1 section), National University of Colombia . . . . . Fall 2015

Mentor

- *UREP-C: Mentoring a visiting scholar*, Mateo Matijasevick, Purdue University . . . Spring 2021

Awards and Honors

- Excellence in Teaching Award 2023
- Summer research grant awarded by Purdue University. . . . . Summer 2023
- Summer research assistantship supported by NSF grant. . . . . Summer 2022

Relevant Courses and Certifications

- *Algebraic Methods for Biochemical Reaction Networks*, MSRI Summer School at Max Planck Institute, Germany 2023
- CS 59000 (*Data Eng. 1*), Purdue University, USA 2020
- CS 50024 (*Data Eng. 2*), Purdue University, USA 2020
- *Fundamentals of Biochemistry*, National University of Colombia 2018
- *Scientific Programming with Python*, Konrad Lorenz University, Colombia 2017

Language Skills

- **English:** Bilingual Proficiency (C2 Level).
- **Spanish:** Native Language.
- **Italian:** Bilingual Proficiency (C2 Level).
- **French:** Intermediate (B2 Level).

Programming Skills

- **Languages:** Python, Matlab, Macaulay2, LaTeX, SQL, noSQL.
- **Specializations:** Scientific Computing, Topological Data Analysis, Abstract Algebra, Scientific Writing, statistical analysis of RNAseq data.