MATH 583B: TOPOLOGICAL DATA ANALYSIS
PRESENTATIONS

Students enrolled in Math 583B will give a 15-minute presentation during one of the final four class meetings (Wednesday May 15, Monday May 20, Wednesday May 22, or Wednesday May 29). The presentation will cover a topic of your choosing, and could be a report on a topic from TDA not covered in class or a topological analysis of real or synthetic data. Students need to turn in slides or a short paper to accompany their presentation, and should also provide a link to a Github repository if their presentation includes code. These materials will be made available to the whole class both for reference and for peer feedback. In particular, everyone is expected to attend peer presentations, and there will be a formal (and required) mechanism for providing feedback.

In order to schedule presentations and avoid duplication of topics, students need to submit a brief presentation proposal by May 1. This will involve filling out a Google Form (to appear soon) with fields for a one-paragraph description of your topic and references you intend to use.

Following is an extended list of potential presentation topics that veers heavily towards theory. Students are welcome — even encouraged — to propose alternative topics as well.

- → topological methods for signal analysis,
- → persistent homology of point clouds generated by discrete-time dynamical systems,
- → applications of persistent homology to symplectic topology,
- → dimensionality reduction with Eilenberg-MacLane coordinates (following [PST23]),
- → decorated merge trees (following [CHM+22]),
- → density-scaled Vietoris–Rips complexes (following [Hic21]),
- → zigzag persistence modules as constructible cosheaves on $\mathbb{R}$ (following [GS23]),
- → applications of TDA to evolution or genomics (drawn from [RB19]),
- → algorithmic aspects of TDA (*e.g.*, discrete Morse theory for fast homology computations).

References

[CHM+22] Justin Curry, Haibin Hang, Washington Mio, Tom Needham, and Osman Berat Okutan. Decorated merge trees for persistent topology. *J. Appl. Comput. Topol.*, 6(3):371–428, 2022.

[GS23] Ryan Grady and Anna Schenfisch. Zig-zag modules: cosheaves and K-theory. *Homology Homotopy Appl.*, 25(2):243–274, 2023.

[Hic21] Abigail Hickok. A family of density-scaled filtered complexes. arXiv:2112.03334, 2021.

[PST23] Jose A. Perea, Luis Scoccola, and Christopher J. Tralie. Dreimac: Dimensionality reduction with eilenberg-maclane coordinates. *Journal of Open Source Software*, 8(91):5791, 2023.

[RB19] Raul Rabadan and Andrew J. Blumberg. *Topological Data Analysis for Genomics and Evolution: Topology in Biology*. Cambridge University Press, Cambridge, 2019.