Inverse problems in Topological Data Analysis

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While the Topological Data Analysis (TDA) pipeline is known to yield provably stable descriptors for data, its discrimination power and potential invertibility have remained mostly unexplored to date. Simple examples show that, in general, significantly different data sets can have the same persistence diagram. However, what happens when only small perturbations of the data are considered? Or when a single persistence diagram is replaced by a collection thereof? Hiraoka and co-authors [1] on the one hand, Turner et al. [2] on the other hand, have started paving the way in these two directions. The common thread among these contributions is that they consider data equipped with an extrinsic metric. In this talk I will focus on intrinsic metric spaces, and as a starter, I will restrict the focus to metric graphs, for which fairly precise injectivity statements can be made.

Joint work with: Elchanan (Isaac) Solomon

References

[1] M. Gameiro, Y. Hiraoka, I. Obayashi. Continuation of Point Clouds via Persistence Diagrams. *Physica D: Nonlinear Phenomena*, 344:118–132, 2016.

[2] K. Turner and S. Mukherjee and D. Boyer. Persistent homology transform for modeling shapes and surfaces. *Information and Inference: A Journal of the IMA*, 3(4):310–344, 2014.