

## Detecting topological conjugacy of dynamical systems via TDA

Justyna Signerska-Rynkowska<sup>1</sup>

<sup>1</sup>*Gdańsk University of Technology*

In the talk I will show how to bring TDA type invariants to dynamical data. In particular, I will present topology-based statistical tests for verifying (semi-)conjugacy of discrete dynamical systems, which provide a framework to study equivalence of dynamics under noise and embedding transformations. The tests work directly on sampled trajectories and therefore no explicit model reconstruction is needed. The methods are exemplified on synthetic benchmark data generated by a rotation map on the Klein bottle, the Lorenz system, tent and logistic maps. However, potential applications include detecting equivalence of biological, physical, or financial systems from time series as well as model validation for reconstructed or data-driven dynamical systems.

I will also mention a recently developed tool based on Euler Characteristic Profiles for detecting conjugacy of continuous dynamical systems which opens a new way for investigating biological and physical data in the form of vector fields (such as gene migration data or ocean currents).

- [1] P. Dłotko, M. Lipiński, J. Signerska-Rynkowska. Testing topological conjugacy of time series. *SIAM Journal on Applied Dynamical Systems* **23** (2024), 2939–2982. <https://doi.org/10.1137/23M1594728>
- [2] P. Dłotko, M. Marszewska, J. Signerska-Rynkowska. Topological characteristics of dynamics: New stable characteristics on discrete and continuous dynamical systems. (in preparation) (2025)