

# Boğaziçi Math Seminar

## Density, geometry, data: What is the moduli space of the world?

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### Abstract:

Real-world data often lives in high-dimensional spaces, but instead of filling the full space, observed samples tend to concentrate on much lower-dimensional, 'intrinsic' subspaces shaped by the underlying data-generating processes. Techniques of nonlinear dimensionality reduction aim to find faithful low-dimensional representations, which is often done by seeking maps that preserve some geometric proxy for the relevant structure of data such as distance. In this talk, after giving an introduction to the problem of dimensionality reduction, we will propose a density-based method, prove its feasibility by using a theorem from differential geometry, describe a density estimation technique for submanifolds, and finally, formulate a convex optimization problem that allows a practical implementation of the theoretical ideas mentioned.

**Date :** Wednesday, April 16, 2025

**Time:** 13:30

**Place:** TB 130, Boğaziçi University