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Using Topological Data Analysis to Disentangle Complex Data Sets

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A recent new branch of the, currently called AI, is the Topological Data Analysis (TDA). TDA was born as an extension of algebraic topology to discrete data and, therefore, is a combination of algebraic topology, geometry, statistics and computational methods. According to E. Munch TDA comprises "a collection of powerful tools that can quantify shape and structure in data in order to answer questions from the data's domain."The key idea of TDA is that "data has shape and shape has meaning", the shape can be quantified via topological signatures. Topological signatures lead to topological invariants, and such invariants enable greater understanding of the relationships
in—and transformations of—real data.
There are three main streams in TDA: (1) persistent homology and its extension; (2) Mapper; (3) Morse-Smale complex analysis. We will focus on Mapper as one of the most effective and computationally efficient tools in the realm of TDA. Mapper could be seen as an extension of cluster analysis and, due to its flexibility can be adapted to a number of different applications. An introduction to Mapper with some practical real world application is the main topic of our presentation.

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