TDA in theoretical mathematics: the shape of knot invariants

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Topological Data Analysis (TDA) offers a powerful framework for uncovering structure in complex data by analyzing its underlying shape. This talk presents recent advances in visualizing maps between high-dimensional spaces to reveal correlations across datasets, as well as novel adaptations of TDA to settings where representative sampling is infeasible. These developments include the integration of TDA with machine learning techniques to effectively analyze infinite or unstructured data domains and to enhance the interpretability of machine learning results.

A central focus is the application of these tools to knot theory, where the exponential growth in knot complexity positions the space of knots and their invariants as a natural case study in mathematical big data.