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Machine learnings on persistence diagrams and materials structural analysis.

Persistence diagrams have been widely recognized as a compact descriptor for characterizing multiscale topological features in data. When many datasets are available, statistical features embedded in those persistence diagrams can be extracted by applying machine learnings. In particular, the ability for explicitly analyzing the inverse in the original data space from those statistical features of persistence diagrams is significantly important for practical applications. In this talk, we propose a unified method for the inverse analysis by combining linear machine learning models with persistence images. We study RIDGE and LASSO on persistence diagrams, and introduce a useful concept called "sparse persistence diagram", which explicitly connects learning results to geometric structures. This method is first applied to point clouds and cubical sets, showing the ability of the statistical inverse analysis and its advantages. Then, I explain our recent activity of topological data analysis on materials science based on the this method. (Received September 12, 2017)