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Topological Data Analysis for Collider Events

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We introduce a novel framework to capture the inherent topological structure of collider events. Using persistence homology, the evolution of various topological features across scales is recorded graphically in a persistence diagram, and further encoded as scalars and vectors amenable to machine learning classifiers, showing excellent performance on both jet tagging and event classification tasks. We further propose a way to metricize the space of persistence diagrams by means of linearized optimal transport, which offers a new representation especially suited for topologically more challenging datasets. These topological taggers are inherently invariant to certain transformations of the underlying datasets, thus eliminating the need to preprocess jets and events in an *ad hoc* fashion. This constitutes another major advantage of the Topological Data Analysis framework applied to collider physics.

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