Connecting persistent homology to geometry

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Abstract

Persistent homology is obtained by applying a homology functor to a filtration, i.e., to a sequence of inclusions of simplicial complexes. When the filtration consists of Vietoris-Rips complexes, the resulting persistent homology is expected to contain information on geometry of the space, such as the size of holes, length of homology generators, etc.

In this talk we will provide an overview of some of the geometric properties that induce algebraic elements in persistent homology. Amongst other results, we will explain how certain closed geodesics can generate persistent homology classes in dimensions one, two, and three.