

PERSISTENT HOMOLOGY OF KDE FILTRATION ON RIPS COMPLEX

JISU KIM

ABSTRACT. When we observe a point cloud in the Euclidean space, the persistent homology of the upper level sets filtration of the density is one of the most important tools to understand topological features of the data generating distribution. The persistent homology of KDEs (kernel density estimators) for the density function is a natural way to estimate the target quantity. In practice, however, calculating the persistent homology of KDEs on d -dimensional Euclidean spaces requires to approximate the ambient space to a grid, which could be computationally inefficient when the dimension of the ambient space is high or topological features are in different scales. In this paper, we consider the persistent homologies of KDE filtrations on Rips complexes as alternative estimators. We show consistency results for both the persistent homology of the upper level sets filtration of the density and its simplified version. We also describe a novel methodology to construct an asymptotic confidence set based on the bootstrap procedure. Unlike existing procedures, our method does not heavily rely on grid-approximations, scales to higher dimensions, and is adaptive to heterogeneous topological features.

(Jisu Kim) INRIA SACLAY

E-mail address: jisuk1@andrew.cmu.edu