School of Electrical, Computer and Energy Engineering

M.S. Final Oral Defense
Perturbation Robust Grassmann Representations of Persistence Diagrams
by
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Abstract
This thesis aims to develop a topological data analytical framework that is robust to
topological noise in the data. Persistent homology as a tool for data analysis has been gaining
steady popularity in the recent years. Persistence Diagrams, which summarize topological
features of the data elegantly, are not robust to significant noise in input data. We propose a
novel method to overcome this problem. We achieve this by artificially yet carefully
perturbing the points in the Persistence Diagram thus, trying to capture all probable noise
variations that can distort the input data. We efficiently summarize these persistent diagrams
as a point on the Grassmann manifold. We establish the superiority of this approach by
conducting experiments on a synthetic dataset and show that the proposed method is indeed
stable with respect to a significant amount of noise in the input data. Comprehensive
experiments on 3D shape retrieval, action recognition from motion capture data and multi-
view action recognition from IXMAS datasets, indicate the performance of the proposed
method in comparison to other baseline methods. The proposed method is general, i.e., it can
be applied to data from different domains and is invariant to the method of computing
persistent diagrams be it Vietoris Rips Complex or sublevel set filtration.