

# Intrinsic Hierarchical Clustering Behavior Recovers Higher Dimensional Shape Information

Paul Samuel Ignacio

## Abstract

We show that specific higher dimensional shape information of point cloud data can be recovered by observing lower dimensional hierarchical clustering dynamics. We generate multiple point samples from point clouds and perform hierarchical clustering within each sample to produce dendrograms. From these dendrograms, we take cluster evolution and merging data that capture clustering behavior to construct simplified diagrams that record the lifetime of clusters akin to what zero dimensional persistence diagrams do in topological data analysis. We compare differences between these diagrams using the bottleneck metric, and examine the resulting distribution. Finally, we show that statistical features drawn from these bottleneck distance distributions detect artefacts of, and can be tapped to recover higher dimensional shape characteristics.