

# Computational topology - group project

## Mapper

December 3, 2020

The goal of this project is to use the Mapper algorithm to analyze the shape of the 3D object given as a cloud of points in 3D space. You will have to implement your own version of the Mapper algorithm, use it on different datasets, compute homology for the resulting complex and compare them.

The datasets can be obtained from the internet (for instance from source 1, source 2, source 3. . .) or you can draw your own shape in a 3D program. Make sure the end result is a 3D point-cloud that can be analyzed by your Mapper implementation (if dataset is too large, take a subsample).

Run a 3D version of the Mapper algorithm on each point cloud  $X$  using measurement function  $f : X \rightarrow I$  and a partition  $U$  of  $I$ . Experiment with different measurement functions ( $z$ -coordinate, distance from a certain point. . .), partitions, clustering schemes (you can use existing clustering implementation) and make sure to make nice pictures.

For every run the output of the Mapper algorithm is a simplicial complex. Compute its persistent homology (you can implement your own algorithm or use existing ones on the internet) and compare the resulting persistent diagrams. How are the diagrams connected to the original shapes?