

## **PROJECT PROPOSAL**

In my final project I decided to implement a faster way to compute Vietoris-Rips Complex. I will use the paper that I will propose next week ("Fast Construction of the Vietoris-Rips Complex") to implement my final project. My goal for this project is to create a filter in TTK, that is faster than the one that we created in Assignment 2.

In paper that I chose, as the title suggested the author presents a fast algorithm for constructing the Vietoris-Rips complex of a point set. This complex is fairly used in topological data analysis, and its construction can be hard to implement efficiently. The paper formulates a two-phase approach so my filter will be composed by two phases: one geometric and one topological. In fact, the first part, I will be building my neighborhood graph and the second part, I will be building Vietoris-Rips complex from the neighborhood graph previously built. In paper they proposed three ways to approach the first phase, but I will implement just the more efficient way: Landmarking or Randomized (in paper they have a comparable performance). For the second part I will be implementing the Incremental Algorithm, which seems to have the best performance.

Deliverables for this project will be:

- Implement landmarking for the first phase of the Vietoris-Rips Complex
- Implement Incremental Algorithm for the second part of the Vietoris-Rips Complex
- Create a correct TTK filter
- A Faster TTK filter than the one that we previously implemented
- Comparison analysis in performance between the new Vietoris-Rips Complex filter and the old Vietoris-Rips Complex filter
- Test the filter with large data set to prove its speed

The filter will be set up in the same as the one created. It will have a slider to choose the actual size of the radius. Additional controls will be added to the filter to have a more flexible filter.

I will not use any particular dataset, but mostly I will use big data set so that it will be easier to see the differences between the filter that I will be implementing and the filter that we already implemented in class. Some experimentation will be conducted with smaller data set to see difference in performance between the two filters.