Proposal For Graphics And Visualization Project

Rohit Prasad, Lakhan Malviya, Ichchhit Baranwal (Team-9)

1 Problem Statement

Feature identification and matching through persistence diagram and overview visualization of the time step data set.

2 List of Features/Algorithms

1. Forming persistence diagram for every time step by finding critical points. We'll be using TTK(Topology Tool Kit) and ParaView for computation of persistence diagrams.
2. For every cross product of persistence pairs between 2 persistence diagrams of the consecutive time steps we compute a distance. The distance metric we are going to use is Waaserstein's distance d(p_i, p_{i+1}).
3. We'll be finding the matching pairs of 2 consecutive persistence diagrams using Kuhn Munkres algorithm. It finds the optimal matching function for a persistence pair by minimizing the total distance $\sum_i d(p_i, M(p_i))$ where p_i is the pair for the persistence diagram for the i^{th} step and M(p_i) is matching for it.

References

[1] J. Ahrens, B. Geveci, and C. Law, "Paraview: An end-user tool for large data visualization," *Visualization Handbook*, 01 2005.

[2] International CFD Database, http://cfd.cineca.it/. [Online]. Available: http://cfd.cineca.it/

[3] J. Munkres, "Algorithms for the assignment and transportation problems," *Journal of the Society of Industrial and Applied Mathematics*, vol. 5, no. 1, pp. 32–38, March 1957.

[4] M. Soler, M. Plainchault, B. Conche, and J. Tierny, "Lifted wasserstein matcher for fast and robust topology tracking," *CoRR*, vol. abs/1808.05870, 2018. [Online]. Available: http://arxiv.org/abs/1808.05870

[5] J. Tierny, G. Favelier, J. A. Levine, C. Gueunet, and M. Michaux, "The Topology ToolKit," *IEEE Transactions on Visualization and Computer Graphics (Proc. of IEEE VIS)*, 2017, https://topology-tool-kit.github.io/.