Contour Tree & Morse-Smale

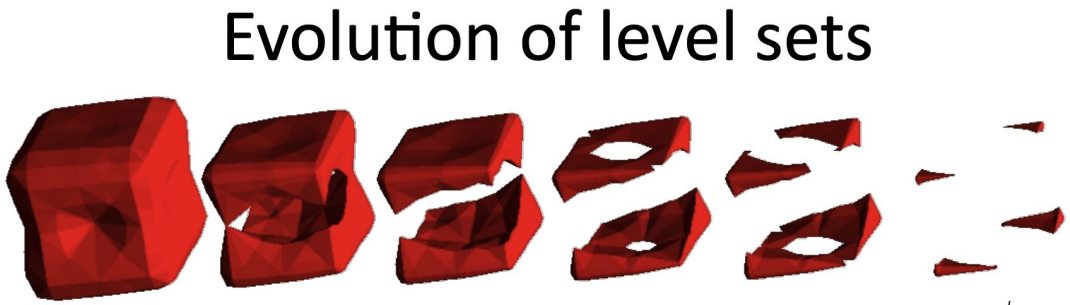
Yihong Liu & Ziyu Xiong

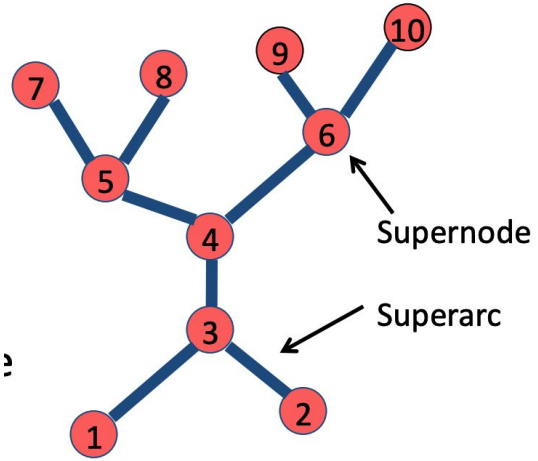
Introduction

- What is your project about?
  - Our idea on this final term project is based on the research paper “Visualizing 2D Scalar Fields with Hierarchical Topology” [Wu and Zhang 2015]
  - We are mainly introduce Contour Tree (CT) and Morse-Smale (MS) complex scalar fields to visualize our dataset
- What is your team planning to accomplish by the end of Finals week?
  - Contour Tree is the main goal to achieve in this project and we will also have some discuss and attempts on Morse-Smale complex scalar fields
- What datasets are being used?
  - As for the dataset for this project, we think that data given by first two assignments can be used in contour tree algorithms
- Division of tasks for each team member
  - We mostly work on the project together, in order to make sure both of us at the same page.

Contour Tree

- Definition: Contour Tree is a graph-based representation to illustrate how the topology of level set changes with the scalar values.





Contour Tree (Cont.)

Implementation:

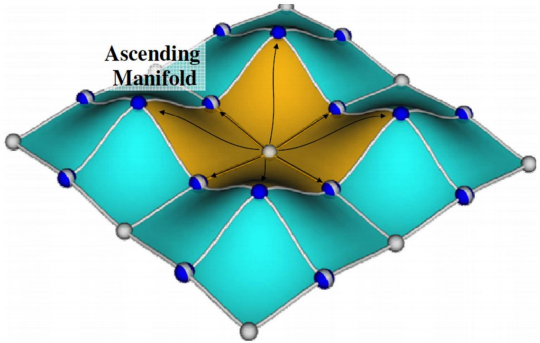
- Sort the scalar values at all the vertices and store into an event queue
- Scan the contour value (isovalue) from max. to min. values in the domain
- Track cells that are active - the range of cells contains the current scalar value
- Assign cells into one of the current components

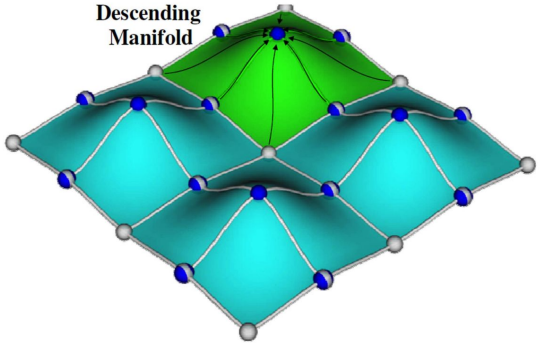
Contour Tree (Cont.)

- Local Maximum:
  - A new component is born and creating a new supernode and superarc
  - Every cell incident to the local maximum vertex become active
  - Those cells will point to the new superarc
- Local Minimum:
  - An existing component is destroyed
  - A super node is created
  - The end of superarc and the cells incident to the local minimum are no longer active
- Saddle:
  - Two or more components merge into one / One component splits into two or more
  - A new supernode is created and make superarc incidents to the supernode / vice versa

Morse-Smale (optional)

- Morse-Smale is aiming at investigating the topology of a surface by looking at critical points of a function on surface
- A Morse-Smale Complex can be obtained by superimposing the descending and ascending manifolds of f
  - The ascending manifold of p (critical) is the set of points belonging to integral lines whose origin is p
  - The descending manifold of p is the set of points belonging to integral lines whose destination is p





Q&A