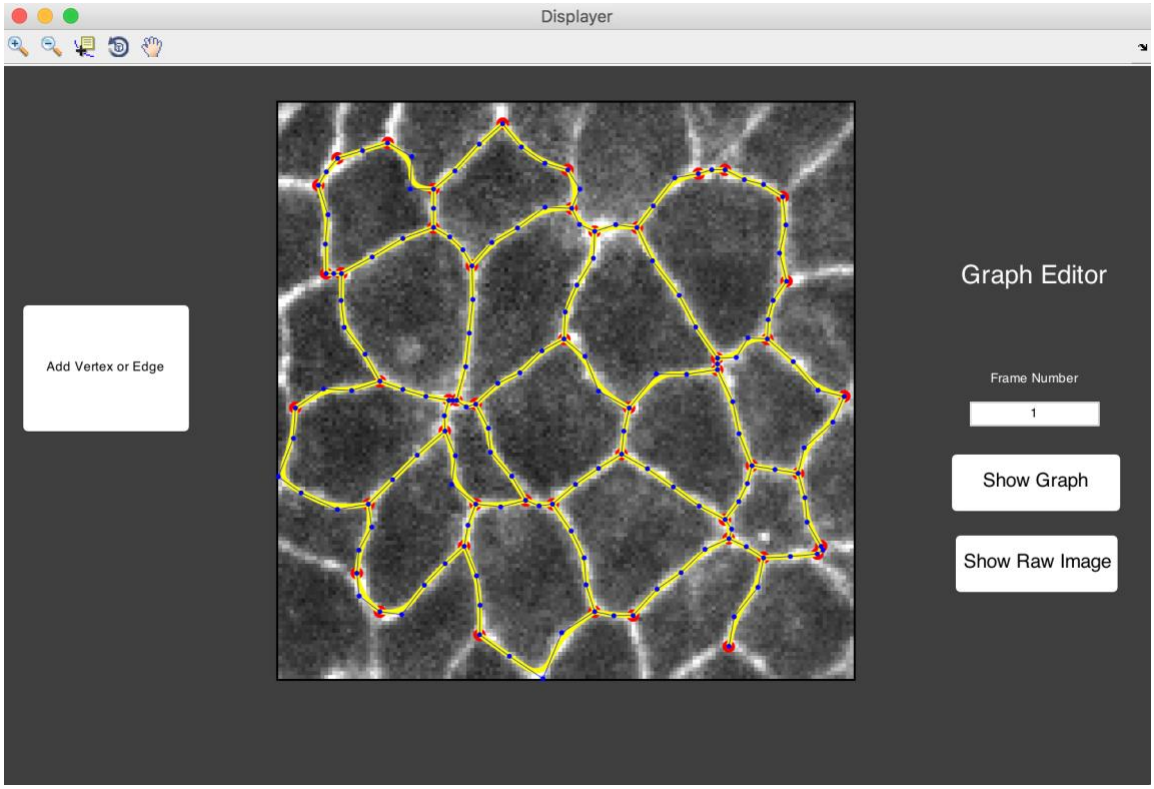
Graph Editing GUI Design



Cases:

- Move Vertex:

User will click and drag the vertex, will change color when being moved. The edges attached to the vertex will move (only its part most close to the vertex) along with the vertex. In case the edge might cross some other edge while moving the vertex, the edge will automatically detour to avoid the crossing. If the vertex is moved to a location that the edges attached to it must cross other edges, the status will turn red and give an error.

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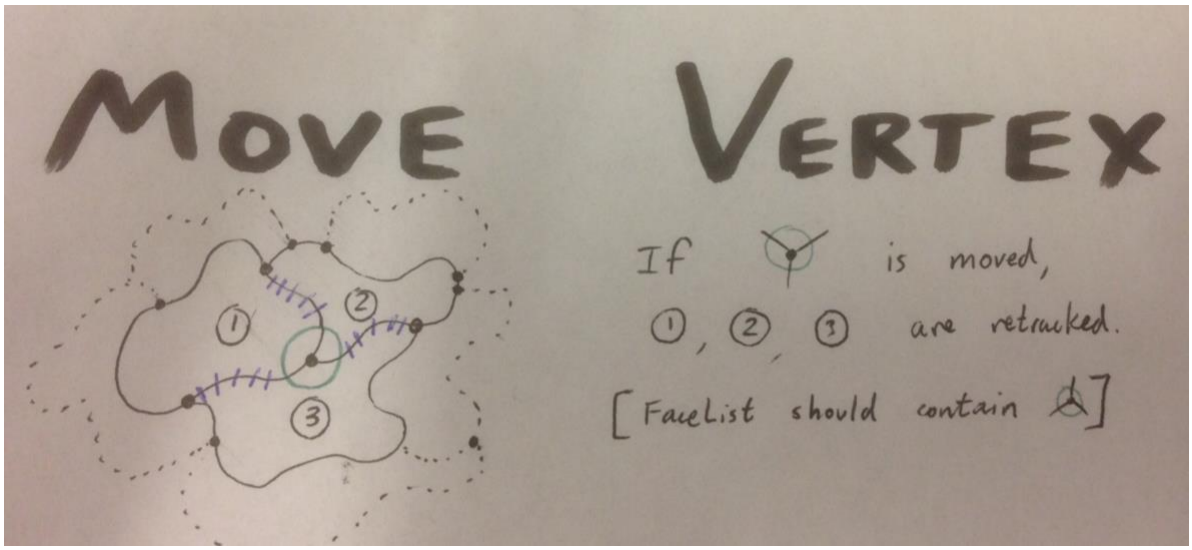
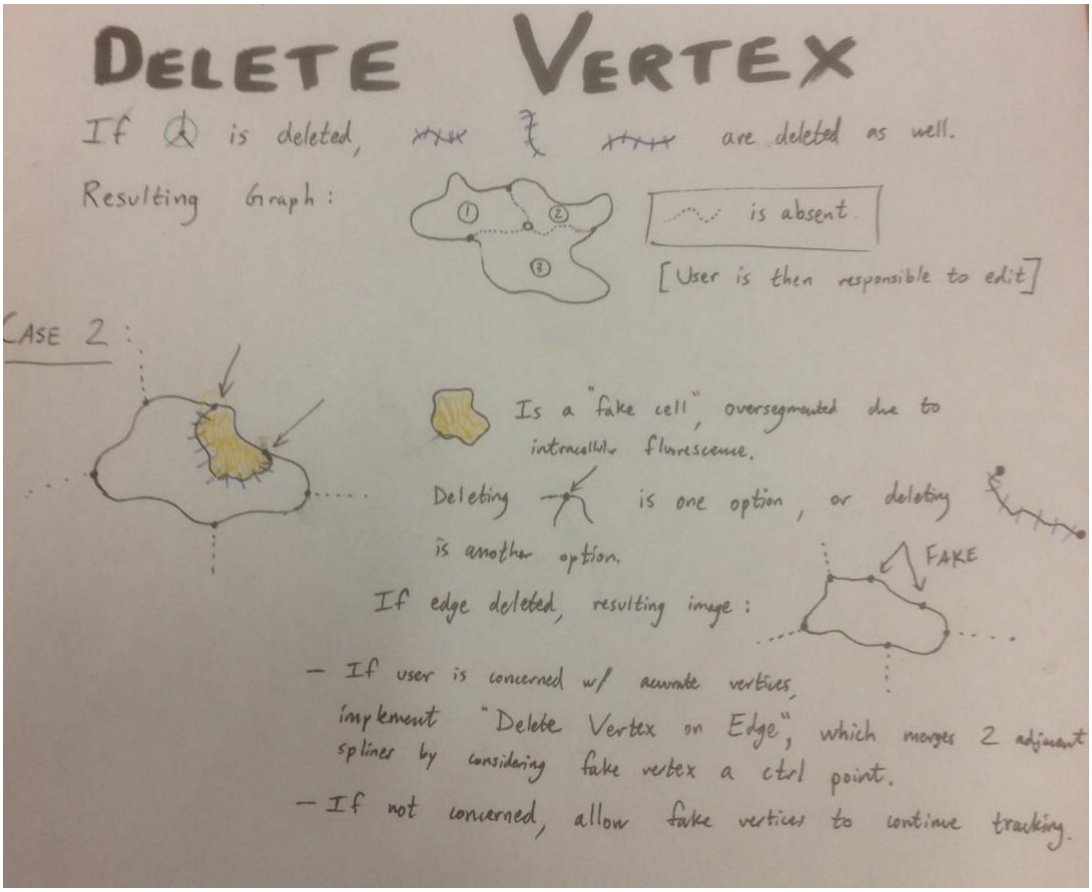


- Add Vertex:

To add a vertex, the user will first click the “Add Element” button. The user will then click a location on the graph where there is not already a vertex to add a new one. If the vertex is not placed on an edge, the GUI will not form connections between the new vertex and existing vertices. In this case, the GUI status indicator will display a yellow warning, indicating that further action is recommended from the user before tracking. If the vertex is placed on or sufficiently close to an edge, the GUI will split the edge into two edges by incorporating the vertex as a mutual endpoint of the split edges. In this case, the GUI status indicator will display a yellow warning as well.

    - Cells to Track: No additional cells need to be tracked until another operation is performed (e.g. drawing splines)

- Delete Vertex:
  To delete a vertex, the user must click on a vertex and then press the delete key on the keyboard. That vertex and any edges connected to the vertex will then be removed from the graph.
    - Cells to Track: Merge cells? Delete more edges?



- Move Ctrl Points:

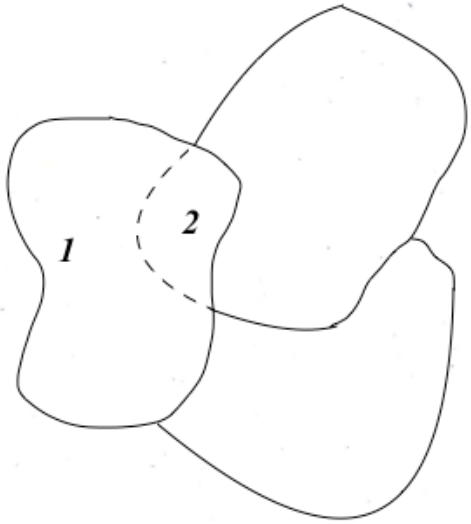
To move control points, the user can click on an edge and then that edge will change colors and the control points will appear. Then the user, can click and drag any control point to edit the spline in real-time. There will also be the functionality to add control points that will be added in later.

    - Cells to Track: Any cell in FaceList that contains that edge

- Add Edge:

To add an edge, the user will need to click on the “Add Vertex or Edge Button”, and then click on two existing vertices. A line will then be drawn with no control points, and then control points can be added or moved in order to fit the spline to the membrane.

    - Cells to Track: The cells in that contain the new edge
        - Look for the cell(s) in FaceList that contain the two existing vertices, and update the FaceList by adding a new index taking the newly drawn spline into account. Each of the newly formed cells should be retracked.



- If the dotted line is the new edge added, then only cells 1 and 2 will be tracked

Delete Edge
The user clicks edge, will change color, when the user hits the delete key, the edge will be removed. If an edge has a vertex that is connected only to this edge, when this edge is removed, this vertex is also removed.

implementation

Removing an edge removes the spline stored in the program. when removing, program will check both vertex connected to this edge to see if a vertex has only one spline connected to it and delete this vertex.
After the removal of an edge, the programs automatically deleted all the dangling vertices and edges. the Facelist will change, all the edges and vertices deleted will be deleted in the following frames, nothing will be retracted.

- Before Running Algorithm, Check:

After every edit, the GUI will check for properties of the graph that require or suggest further editing from the user. The user will be notified of these errors through a simple hint notification and a color change in the GUI status indicator. A green status signifies that the graph is ready to be tracked, a yellow status signifies that the graph has incomplete components that will be removed if tracking were to be initiated, and a red status signifies that further action is required from the user to initiate tracking. In the case that tracking is initiated under a yellow status, the incomplete graph components will be automatically deleted. Graph properties that result in each of these states are in the table below.

    - If vertex connects to no edges, delete automatically
    - If vertex connects to only 1 edge, delete edge and the vertex automatically
    - Graph needs to be connected, no isolated parts, otherwise ERROR

<u>Additional Features:</u>

If the user is running the tracking algorithm on a new image stack, a ground truth segmentation step will precede initial graph editing. Should the ground truth segmentation produce an initial graph with many errors, a “Back Button” will allow the user to reattempt segmentation with new threshold parameters.

Although the GUI allows for graph editing with the use of a mouse and keyboard shortcuts, a menu bar will be included that contains a small button for each operation. This will aid when demonstrating the algorithm.