Ziwei Ba

Shailpik Roy (Teammate)

CS598JGE- Computational Topology

November 2, 2017

Final Project Proposal

**General Idea**

We are aiming to make a web app using some existing libraries to visualize algorithms for graphs and curves that we have learned in class. Features of our app will include live animation of algorithms, custom data input to generate the curve, and an explanation of each algorithm used. We’re not looking to make a graph theory library from scratch- rather, utilize existing tools to create our app to visualize some definitions and algorithms we learned in class.

**Motivation**

A lot of things related to graphs are difficult to conceptualize until you work out an example by hand. When I watch the lecture videos, I have to pause every time a new topic is discussed to work out a concrete example, and apply whatever theorem or algorithm we just discussed. As a result, I usually take a day or two to catch up on the past week’s lectures. A lot of this time could be avoided with a program or an app that could do the visualization for me, so I decided to create one. This would help students learn about these algorithms, and also help non-graphing people become more interested in graphs with a fun visualization app.

**Existing Technologies**

Inspiration for this project came from tree visualization apps that I discovered when I was looking for tools to help teach my students in CS225 AVL trees.

Tree Visualization

<https://www.cs.usfca.edu/~galles/visualization/>

Currently only btrees and avl trees work here, but Professor Galles from University of San Francisco made some neat interactive tree visualization apps with the Java Swing library. Users can add nodes, delete nodes, and most importantly increase or decrease animation speed. This really helped my 225 students grasp trees a lot better. Our app will be similar to this in that we focus on a few data structures, but we will accompany each visualization with a simple explanation of the algorithm or definition.

VisuAlgo

<https://visualgo.net/en>

VisuAlgo is a database of algorithms visuals- trees, graphs, MSTs, etc. The interface is more code-like than the tree visualization app, where user can input arguments to functions. As the animation plays, there is a little popup window on the side displaying the current line of code that is executing. The distinguishing feature of VisuAlgo is the large number of algorithms its database contains. We will be focusing on a small number of graph definitions and structures that are helpful to visualize, such as curve and path definitions, and homotopy definitions for different structures.

**Implementation Ideas**

Java Swing Library

Galles (from the USFCA page) has a helpful tutorial to add more algorithms in Java Swing. I haven’t looked into this option much, but his library seems pretty comprehensive. Java Swing is a pain to deal with though, so I would rather hold off on this option.

Cytoscape  
 Cytoscape is a JavaScript graph visualization library and our most likely option at this point. It has an intuitive API and many options to customize colors and graph layout. I haven’t looked into animation with Cytoscape yet, but so far it looks like a good implementation option.

Dracula  
 Dracula looks a lot more lightweight and easy to use than Cytoscape. Currently there seems not to be an option to animate a graph, so we may have to modify the source code for that ourselves.