ECS 277 - Homework # 3

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June 3, 2018

We employed webGL to develop a dashboard for studying Voronoi Diagrams and Delauney triangulation for multiple surfaces. This method adds new datapoints based on an error metric that approximately selects the best points to add at each step.

Running the Application

If running in a Chrome or Safari browser, cross-origin requests need to be enabled. The simplest way to do this is to run

```
python -m SimpleHTTPServer
```

while inside the directory containing `Index.html`. Then the app will be at `http://0.0.0.0:8000/`.

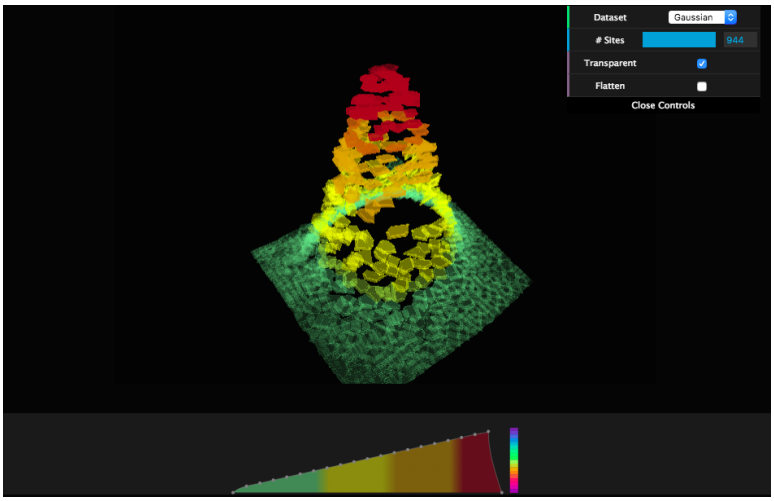

Figure 1: The dashboard for the Voronoi Interpolation. Here the user can select from a multitude of different controls for each visualization. Moreover, they display both 2D and 3D triangulations of a function.

Voronoi Diagrams

This visualization utilizes Voronoi diagrams to triangulate over a surface. These construct polygons surrounding scattered datapoints that form bisectors between a point and it's neighbors. Once these diagrams are constructed, we can use Sibson's interpolation to estimate the value of a point. In this visualization, we use Sibson's interpolation to select the next point we plan to insert into the plot.

Deciding on the next point to add starts by computing the error between the Sibson's interpolation of a given point with the value of the that point. This error is given by

$$E(x) = \left| \hat{f}(x) - f(x) \right|$$

where we measure the distance between the interpolation and the actual value. After doing this with every point that has yet to be added to the diagram, we select the point with the most error to be added. This is our approximation to which point produces the minimum error on the new set of points. In general, the points that were added are the points with largest gradients in the original function (See Figure 2). This is expected as a larger gradient implies more difference between a point and it's neighbors; thus making the interpolation less accurate.

Flatten

One feature that was added to the visualization is the ability to go from the 2 Dimensional Voronoi graph to the 3D triangulation. This is done using the "Flatten" gui control check box. Figure 2 shows both the the 2D and 3D triangulations for different amounts of points for a Gaussian curve.

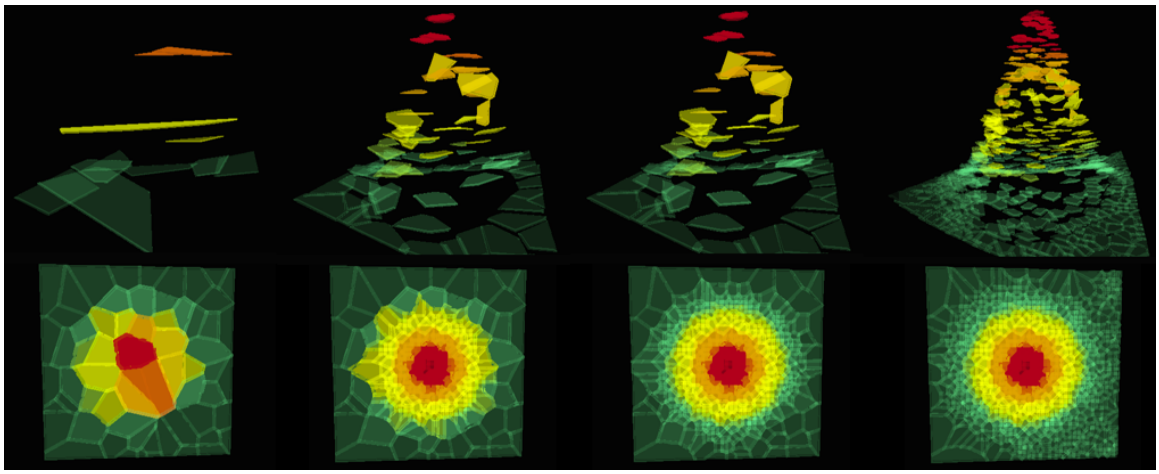

Figure 2: Demonstrating the 2D and 3D triangulations for a Gaussian curve.