CSC 3S006 EP - Computer Graphics : Report 2

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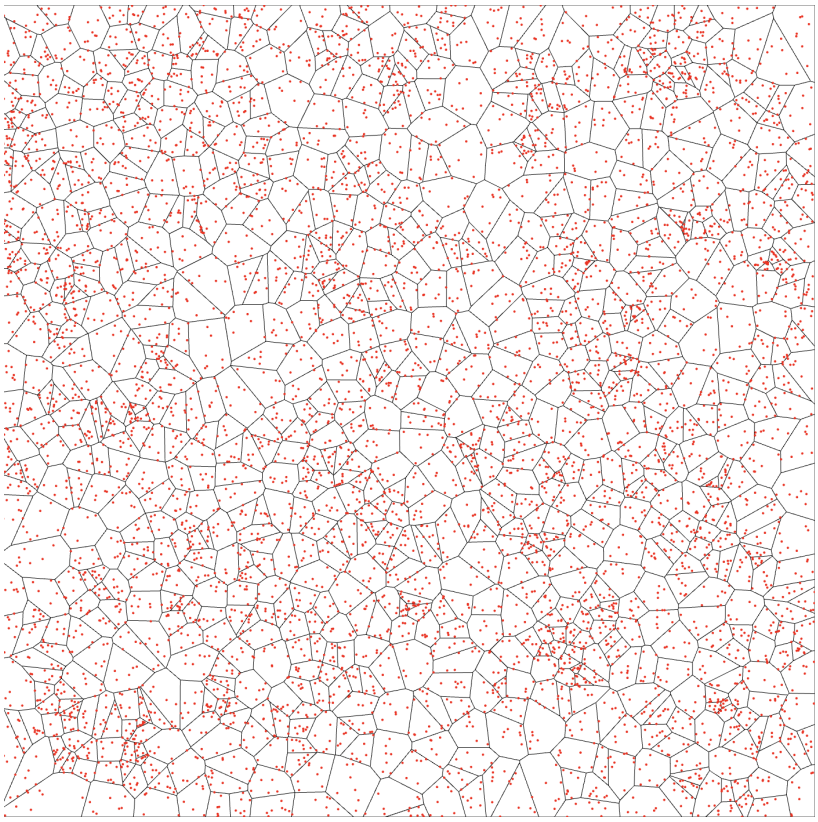
In this report, we used Voronoi and Laguerre diagrams to simulate fluid behavior in two dimensions. We first built the diagrams and clipped them to a square domain. Then, we optimized the cells so that each had the right area and was centered around its generating point. Finally, we used this setup to make particles fall and behave like fluid, by combining optimal transport with gravity. The result is a simple and visually realistic fluid simulation.

1 Lab 6

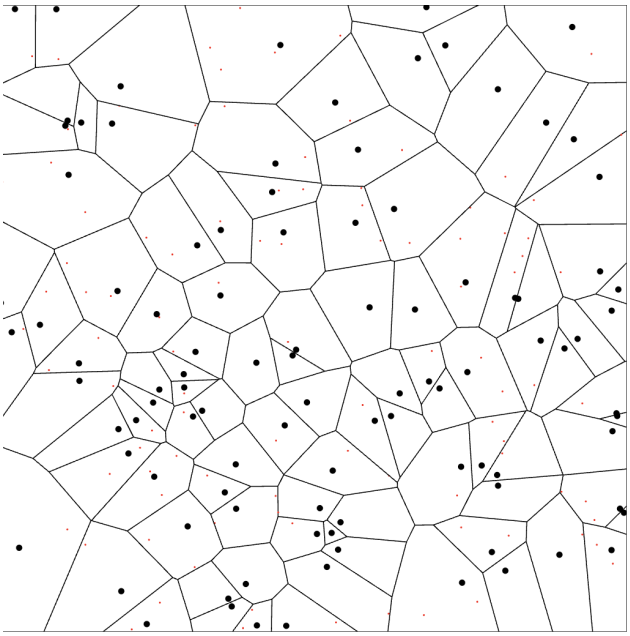
In Lab 6, we started by dividing space into Voronoi cells: each cell contains the area closest to one point (called a site). We clipped these cells to fit inside a square. Then, we generalized them into Power diagrams (also called Laguerre diagrams), where each site has a weight that changes the shape of its cell.



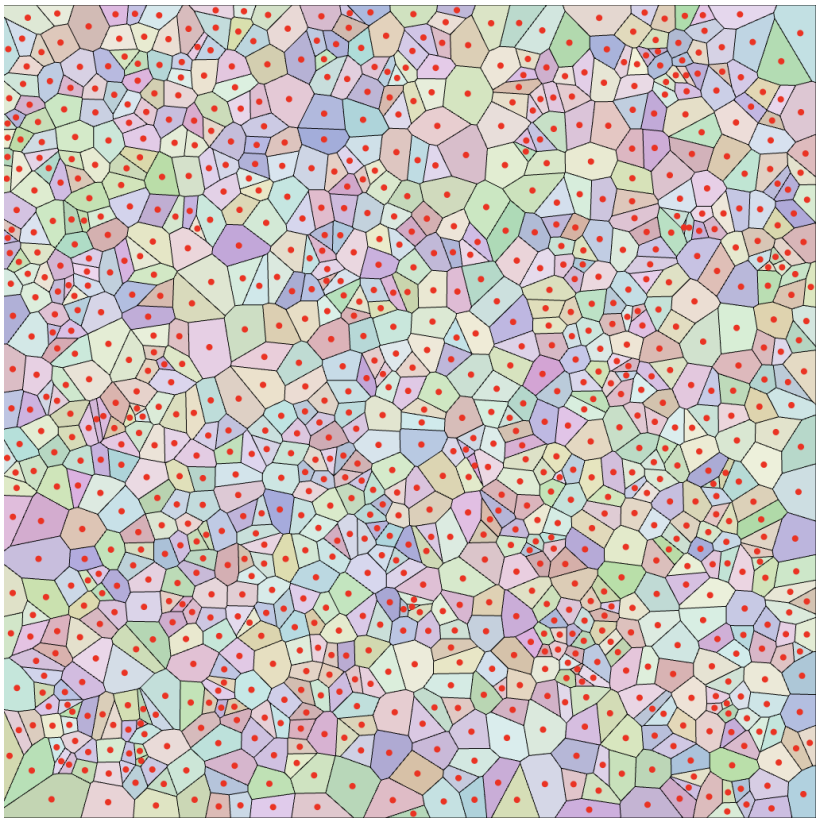
You can see how the space is split into many small polygons, and each site has several red sample points inside its cell. These points help us later when we want to estimate areas and integrals.

2 Lab 7

Here, we made the cells more balanced. You can see black points (sites) and tiny red dots (samples). When the centroids and sites are well aligned, the black points move to the center of their polygons. The diagram becomes more regular and balanced.



For a more interesting visualisation:



3 Lab 8

We used the Laguerre diagrams from Lab 7 to simulate fluid motion.

Each site was treated as a fluid particle, and its associated cell represented a portion of the fluid. At every step, particles were pulled toward the centroids of their cells and also influenced by gravity.

We updated their velocities and positions accordingly, while applying damping for a better fluid viscosity. As a result, the droplets fell and gradually settled at the bottom of the domain, behaving like fluid.

[Video included in the repo]