CSE306 Assignment 2

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1 Introduction

This report will describe the content covered in Labs 6-9. Lab 5, on the other hand, is in the separate folder in the same repository.

To begin, I developed the Polygon class. This class formed the foundation for the implementation of various polygon-related operations and algorithms. One key algorithm that I integrated into the project was the polygon clipping algorithm. This algorithm is widely used for efficiently computing the intersection of two polygons by clipping one against the edges of the other. By implementing the Sutherland-Hodgman algorithm for clipping, I was able to accurately determine the resulting polygon after the intersection operation, which was crucial for achieving the desired visual effects in the simulation.

Throughout the project, I discussed the implementation of the diagram evaluation using L-BFGS with my colleague, Matea Gjika, after the lab sessions, and we might have influenced each other in our implementations of L-BFGS evaluation during these lab sessions.

Returning to the development process, after integrating the Sutherland-Hodgman algorithm and various other functionalities, I proceeded to create the classes responsible for computing the Voronoi diagram and evaluating it. The Voronoi diagram is a geometric structure that partitions the simulation space into regions based on the proximity to a set of input points. This diagram played a crucial role in visualizing the relationships between the elements in the simulation, adding depth and complexity to the overall visual representation.

Finally, I concluded the project by making necessary modifications to previous functions to enable fluid motion. Based on a boolean flag that can be set in thee main function, the program will either output the frames of the Vornoi Diagram without the fluid motion, or with the fluid motion incorporated. Fluid motion refers to the smooth and continuous movement of objects in the simulation. By enhancing the existing functions, I achieved a more natural and visually appealing motion effect.

Although the project yielded promising results, I am aware that there is still ample room for improvement. Code clarity, documentation, and expanding the functionality to accommodate different types of motion are areas that require attention.

Furthermore, I enjoyed this project because, although very challenging at times, making progress throughout this project was gratifying and enjoyable. Following the lecture notes and lab sessions closely was very helpful. I am happy with the quality of the course, especially because of the way the content has been presented: giving enough information in a gradual way and making the steps clear, but also leaving room for creativity and requiring resourcefulness and thinking to achieve the concepts from the lectures with code.

The GIFs I created comprise a total of 200 frames, using used $\epsilon = 0.004$, $dt = 0.002$, and each particle has a mass of 200. Generating the frames for the final result was very time-consuming, taking around an hour, even with the utilization of the pragma OMP library. This was probably the most challenging aspect of the project, because I couldn't afford to test the code after every change I made, which lead to bugs in the later frames I haven't noticed initially. Fortunately I was able to debug these errors and get the desired result.

Since I wasn't able to include the GIFs in this PDF, I included the final result representing fluid motion in the folder of my CSE306 Assignment 2.