Geometric Algorithms: Implementation and Visualization

Your Name

Abstract

In this project, various geometric algorithms, including line segment intersection and convex hull solutions, were implemented and visualized. The algorithms included Graham Scan, Jarvis March, Brute Force, Quickhull, and Monotone Chain.

1 Introduction

This project focuses on line segment intersection and convex hull construction algorithms. The chosen algorithms are known for their efficiency and versatility.

2 Your Programming Design

The program is designed in Python, providing an interactive user interface through Tkinter. Users can draw line segments on the canvas

3 Experimental Setup

User interaction involves clicking on the canvas to add points for line segments. Visualization functions for each algorithm allow users to observe step-by-step constructions of convex hulls.

4 Results and Discussion

4.1 Line Segment Intersection Visualization

The Bentley-Ottmann algorithm efficiently visualizes line segment intersections. User input is visually represented, and intersections are marked with red dots.

4.2 Convex Hull Visualization

4.2.1 Graham Scan

Visualization showcases the convex hull construction using the Graham Scan algorithm. Execution time and complexity are discussed, highlighting the algorithm's efficiency.

4.2.2 Jarvis March

Step-by-step construction of the convex hull using the Jarvis March algorithm. Comparison with other algorithms emphasizes its simplicity and ease of implementation.

4.2.3 Brute Force

Visualizations demonstrate the brute-force convex hull algorithm. Trade-offs and limitations are discussed, providing insights into practical use.

4.2.4 Quickhull

Efficient construction of the convex hull using the Quickhull algorithm. Comparison with other algorithms emphasizes its speed and practicality.

4.2.5 Monotone Chain

Visualization of the convex hull using the Monotone Chain algorithm. Advantages and use cases in specific scenarios are discussed.

5 Conclusion

The project successfully implemented and visualized various geometric algorithms. Key findings include the efficiency and trade-offs of each convex hull algorithm and the accuracy of the Bentley-Ottmann algorithm in visualizing line segment intersections. Challenges were faced and overcome during implementation, paving the way for future improvements.

6 References

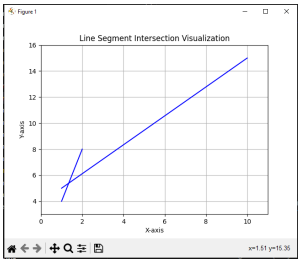

Figure 1: Line Segment Intersection Visualization

Figure 2: Line Segment Intersection Visualization

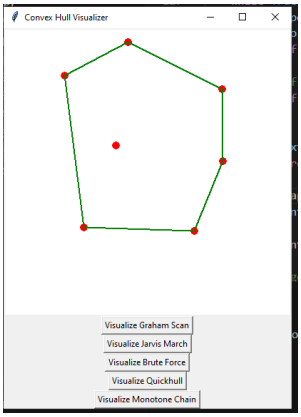

Figure 3: Grham scan

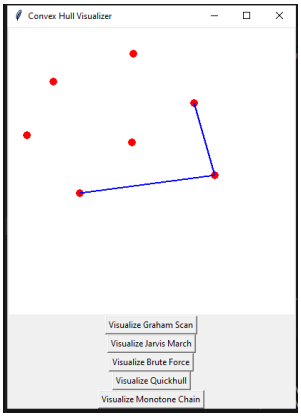

Figure 4: jarvis march

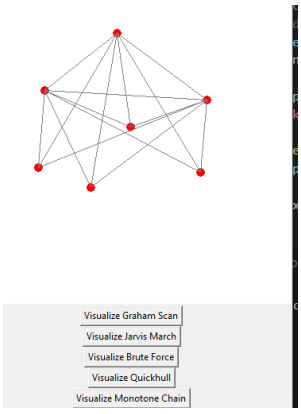

Figure 5: brute force

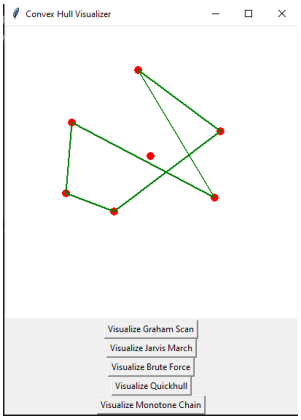

Figure 6: brute force

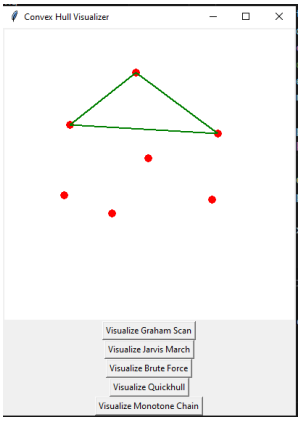

Figure 7: quickhull

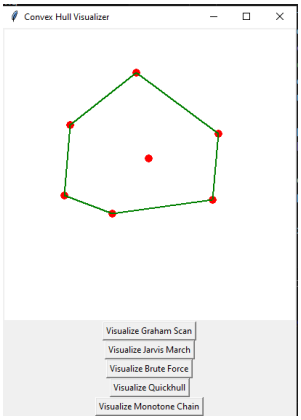

Figure 8: monotonechain