

ABSTRACT

AlgoViz: Real-Time Algorithm Visualization and Learning

Introduction:

AlgoViz: Real-Time Algorithm Visualization and Learning is an interactive, web-based tool designed to help users understand and visualize the working of various sorting algorithms and fundamental data structures. The platform allows real-time algorithm visualizations, enabling users to grasp the mechanics of algorithms and data structures through dynamic, step-by-step animations. This tool is aimed at students, educators, and developers who seek a hands-on approach to learning algorithms.

Key Features:

- Sorting Algorithms Visualization: Real-time animations of Bubble Sort, Selection Sort, and Insertion Sort.
- Data Structure Visualizations: Dynamic views of Queue, Stack, and Linked List.
- Binary Tree Traversals: Supports in-order, post-order, and pre-order tree traversals.
- Graph Visualizations: Includes Dijkstra's Algorithm for shortest path finding.
- Algorithm Comparisons: Allows side-by-side comparisons of different sorting algorithms.
- Time and Space Complexity Analysis: Provides complexity metrics for all visualized algorithms.
- Code Snippets: Displays the algorithm code alongside its visualization for better understanding.
- Problem-Solving Questions: Includes algorithm-related questions for students to solve, encouraging practical learning.

Technology Stack:

1. Frontend: HTML, CSS, JavaScript
2. Libraries: D3.js (for dynamic visualizations), Bootstrap (for UI components)
3. Storage: Local Storage (for saving user data and settings)

Future Enhancements:

- Add more quizzes to test user understanding
- Provide certificate for completed models
- Integrate an AI assistant for guidance and support
- Enable downloading of algorithm visualizations
- Implement automatic code generation for algorithms

Outcomes:

The project aims to improve understanding of algorithmic concepts, provide an interactive learning experience, and serve as a reliable tool for students and educators. By offering clear visual representations, the tool enhances comprehension of algorithm behaviour, time complexity, and real-world applications.

Conclusion:

AlgoViz brings algorithms to life through real-time visualizations, making learning more interactive and accessible. This tool is ideal for anyone looking to understand algorithms and data structures, whether they are students just starting out or developers looking to sharpen their skills.