Median of Medians (MoM) and P-Center Visualizer

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Objective:

This project provides an interactive visualization of two algorithms:

1. **Median of Medians (MoM) Algorithm**: A selection algorithm to find the kth smallest element in an unsorted array with linear time complexity. The visualization demonstrates each step of the algorithm, highlighting sublists, medians, and the
2. partitioning process.
3. **P-Center Problem**: A facility location optimization algorithm that identifies the placement of a fixed number of facilities (p) to minimize the maximum distance between demand points and their nearest facility.

The tool is designed for educational purposes, helping users understand these complex algorithms through step-by-step visualizations.

Features:

1. **Median of Medians (MoM) Visualizer**:
    - Interactive visualization of sublist creation, median selection, and array partitioning.
    - A bar chart view dynamically demonstrates the algorithm's steps in real-time.
    - Allows users to input a list of numbers and specify the value of k.
2. **P-Center Problem Visualizer**:
    - Users can click on the canvas to mark demand points and candidate facility locations.
    - Interactive selection of demand points and candidate facilities.
    - Highlights the optimal placement of p facilities.

3. **Dynamic Controls**:
    - Next/Previous buttons to navigate through each step manually.
    - Play button for automated visualization.
4. **Customizable Inputs**:
    - Users can enter lists manually or interact with the canvas to place demand points and facilities visually.
5. **Accessible Online**: The project is hosted online and can be accessed directly at:

    https://ankitkumaratg6041.github.io/mom-pcenter-visualizer/

Installation Instructions:

1. **Prerequisites**:
    - Ensure **Node.js** and **npm** are installed on your system.
2. **Clone the Repository**:

    git clone git@github.com:ankitkumaratg6041/mom-pcenter-visualizer.git

    cd mom-pcenter-visualizer

3. **Install Dependencies**: Run the following command to install all required packages:

    npm install

4. **Run the Application Locally**: Start the development server:

    npm run dev

    Open the app in your browser at the provided URL (*e.g., link will look something like this http://localhost:3000*).

How to Use the Tool:

1. **Median of Medians Visualizer**:
    - Enter an array of numbers and the value of k in the input fields.
    - Click **Submit** to start the visualization.
    - Use the **Next** and **Previous** buttons to step through the process, or click **Play** for automated visualization.
2. **P-Center Visualizer**:
    - Click the **Demand Points** button to place demand points on the canvas by clicking locations.
    - Click the **Candidate Facilities** button to place potential facility locations.
    - Specify the number of facilities (p) and click **Run Visualization** to see the optimal placement.

Sample Inputs and Outputs

Median of Medians:

1. **Input**:
    - Array: [3, 2, 1, 5, 4, 7, 6, 9, 8]
    - k = 5
    - **Output**: 5
2. **Input**:
    - Array: [10, 20, 30, 40, 50]
    - k = 3
    - **Output**: 30

3. **Input**:

    - Array: [15, 10, 25, 35, 20, 5]
    - k = 4
    - **Output**: 20

P-Center Problem:

1. **Input**:

    - Demand Points: [(100, 100), (200, 200), (300, 300)]
    - Candidate Facilities: [(150, 150), (250, 250), (350, 350)]
    - p = 2
    - **Output**: Facilities placed at (150, 150) and (250, 250).
2. **Input**:

    - Demand Points: [(0, 0), (50, 50), (100, 100)]
    - Candidate Facilities: [(25, 25), (75, 75), (125, 125)]
    - p = 1
    - **Output**: Facility placed at (75, 75).
3. **Input**:

    - Demand Points: [(10, 10), (30, 30), (70, 70), (90, 90)]
    - Candidate Facilities: [(20, 20), (60, 60), (100, 100)]
    - p = 2
    - **Output**: Facilities placed at (20, 20) and (60, 60).

Conclusion:

The MoM and P-Center Visualizer successfully demonstrates the step-by-step process of two complex algorithms in an interactive and educational format.

The project is live and can be accessed at: https://ankitkumaratg6041.github.io/mom-pcenter-visualizer/