DAV Project Report:

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Project Report: Interactive Data Visualization Dashboard for TB Using D3

1. Introduction

This project focuses on developing an **Interactive Data Visualization Dashboard** to analyze Tuberculosis (TB) data. The primary objective is to create a dynamic, user-friendly dashboard that offers insights into the global and regional dynamics of TB by visualizing various aspects of the disease over time. The dashboard integrates data from **TB Portals Data Sharing** and **TB-DIAH Data Hub**, and includes a range of visualizations such as **Force-Directed Graphs**, **Geographic Maps**, **Sunburst Charts**, **Hierarchical Tree Maps**, and **Line Animations**.

The visualizations focus on key TB metrics such as the number of new incidences, population, life expectancy, and the relationship between regions and countries in terms of TB data.

2. Project Objective

The goal of this project is to develop an interactive dashboard using **D3.js** to allow the user to explore and analyze TB-related data across different **countries** and **regions**. The visualizations include both **static** and **dynamic elements**, enabling users to filter, zoom, and interact with the data. Key features of the dashboard include:

- **Interactive and Dynamic Visualizations**: The dashboard will feature a variety of visualizations that represent data in engaging and user-friendly formats.
- **Data Filtering**: Users can filter the visualizations by countries, regions, and different metrics (such as TB cases, population, or life expectancy).
- **Animation**: Some visualizations will feature animations, where the data evolves over time.
- **Cross-Visualization Interaction**: Selections in one visualization will dynamically update the data presented in other visualizations.
- **Tooltips**: Hovering over specific points or segments will provide additional insights into the data.

3. Data

The data for this project is sourced from two main repositories:

- **TB Portals Data Sharing**
- **TB-DIAH Data Hub**

These datasets contain a variety of data attributes, including:

- **Year**: The year the data was recorded.

- **Population**: The population of each country.
- **New Incidence**: The number of new TB cases reported.
- **Region and Country Names**: Geographic identifiers.
- **Relationship Type**: The type of relationship between entities (collaboration, conflict, etc.).

The data was cleaned and preprocessed to ensure that missing values were handled, and the format was optimized for D3.js integration. Specifically, the following steps were taken:

- **Handling Missing Data**: Missing values were filled using median (for numerical data) or mode (for categorical data).
- **Removing Columns with Excessive NULL Values**: Columns with more than 50% NULL values were dropped.
- **Merging Datasets**: Data was merged based on **Country** and **Year**.

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4. Visualization Components

A. Force-Directed Graph

The Force-Directed Graph is used to visualize relationships between **countries** and **regions** based on their TB data.

- **Data**: The graph uses the `graph_data_cleaned.json` file, which includes relationships between countries and regions.
- **Features**:
    - **Nodes**: Represent countries or regions.
    - **Links**: Represent the relationship between two nodes (countries or regions).
    - **Dynamic Filtering**: Users can filter the graph based on **regions** using a dropdown.
    - **Drag-and-Drop**: Users can drag nodes to explore the network.
    - **Color Coding**: Regions are color-coded for better identification.
    - **Tooltips**: Display details such as country name and relationships on hover.

B. Geographic Map Chart

The Geographic Map Chart visualizes the global map and places **interactive pins** on countries based on their geographical coordinates.

- **Data**: The `graph_data_for_mapchart.json` file provides **latitude** and **longitude** for countries.
- **Features**:
    - **Mercator Projection**: Used to map countries in a 2D space.
    - **Zoom and Pan**: Users can zoom in and out and pan across the map.
    - **Interactive Pins**: Pins are displayed for each country, and their size changes when hovered.
    - **Tooltips**: Hovering over pins shows country-specific information.

The Sunburst Chart is used to visualize hierarchical relationships in the data, representing regions, countries, and TB cases over time.

- **Data**: The `sunburst_chart_data.json` file provides hierarchical data by region, country, and year.
- **Features**:
    - o **Interactive Breadcrumb Navigation**: Clicking on a segment will navigate the user deeper into the hierarchy.
    - o **Hover Effects**: Hovering over segments shows details.
    - o **Hierarchical Structure**: The chart is divided into levels representing different layers of the hierarchy (e.g., region → country → year).

D. Hierarchical Tree Map

The Hierarchical Tree Map displays regions and countries as **nested rectangles**.

- **Data**: The `hierarchical_tree_map.json` file provides hierarchical data for regions and countries.
- **Features**:
    - o **Color-Coding**: Regions are color-coded to distinguish them easily.
    - o **Tooltip**: Hovering over rectangles displays additional information (e.g., number of new TB incidences).
    - o **Legend**: A legend provides color codes for each region.

E. Dynamic Line Chart

The Dynamic Line Chart visualizes TB metrics (e.g., **population** and **new TB incidences**) over time for selected countries.

- **Data**: The `bubble_chart_data.json` file contains time-series data for countries.
- **Features**:
    - o **Yearly Animation**: The line chart animates over time, showing how TB metrics change.
    - o **Play/Pause/Reset Buttons**: These control the animation.
    - o **Dropdown**: Users can select different countries to visualize.
    - o **Tooltips**: Hovering over the line shows specific data points (year and TB values).

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5. Interactivity Features

The dashboard implements several advanced interactivity features, ensuring a seamless and engaging user experience:

- **Focus-Plus-Context**: Allows users to zoom into specific visualizations while keeping the broader context in view.

- **Cross-Visualization Interaction**: Selections made in one visualization automatically update other visualizations.
- **Dynamic Filtering**: Filters allow users to focus on specific data points, such as selecting particular regions or countries.
- **Hover and Tooltip Details**: When hovering over data points or segments, additional details are provided.

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6. Implementation

The **D3.js** library was used for implementing all visualizations. The following steps were followed for each visualization:

1. **Data Preprocessing**: Ensured the data was in the correct format and cleaned it.
2. **D3 Integration**: Used D3's built-in functions for scaling, axis creation, and path generation.
3. **Interactivity**: Implemented interactions such as **drag-and-drop**, **zooming**, **filtering**, and **tooltip displays**.

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7. Bonus Features

To enhance the user experience, the following bonus features were added:

- **Responsive Design**: The dashboard automatically adjusts its layout for different screen sizes.
- **Smooth Transitions**: Animated transitions for zooming and data updates.
- **Exportable Views**: Users can export visualizations as images.
- **State Persistence**: The dashboard remembers user settings, such as filters and zoom levels, even after a page reload.
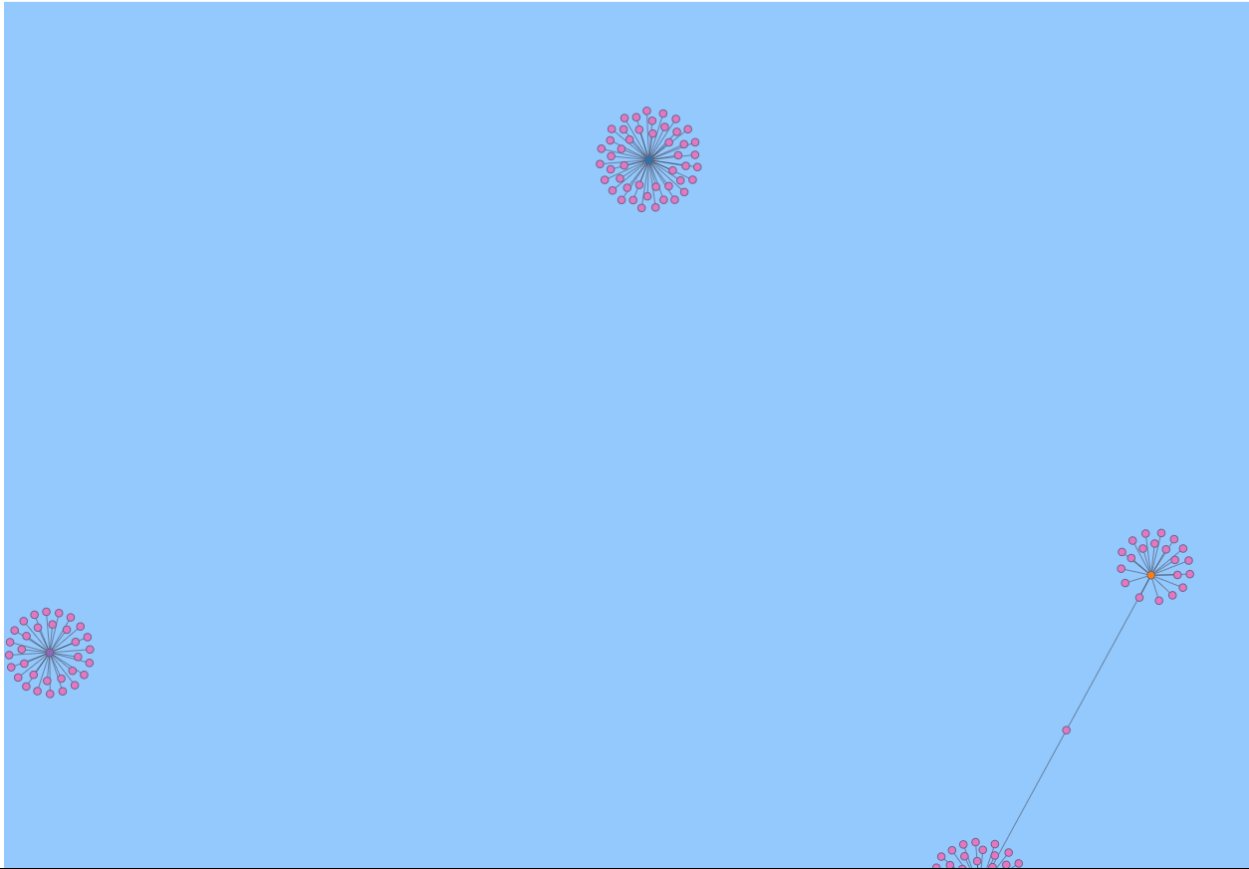
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8. Conclusion

This project successfully implements an interactive and dynamic dashboard for visualizing **Tuberculosis (TB)** data. The dashboard uses advanced **D3.js** features to create visually engaging and informative charts. Users can interact with the data, filter by various dimensions, and analyze trends and relationships over time.
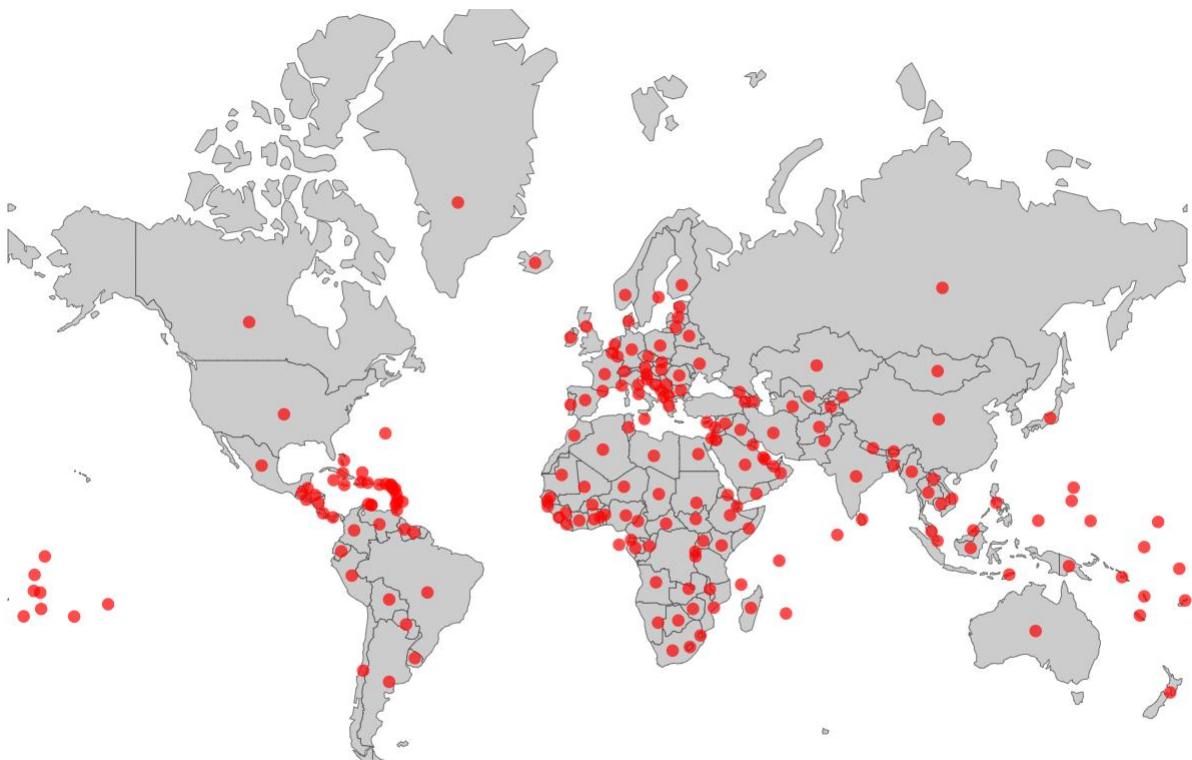
The dashboard enhances data accessibility and provides insights into the global and regional TB landscape. Future enhancements could include integrating additional data sources or adding more visualization types for deeper exploration.
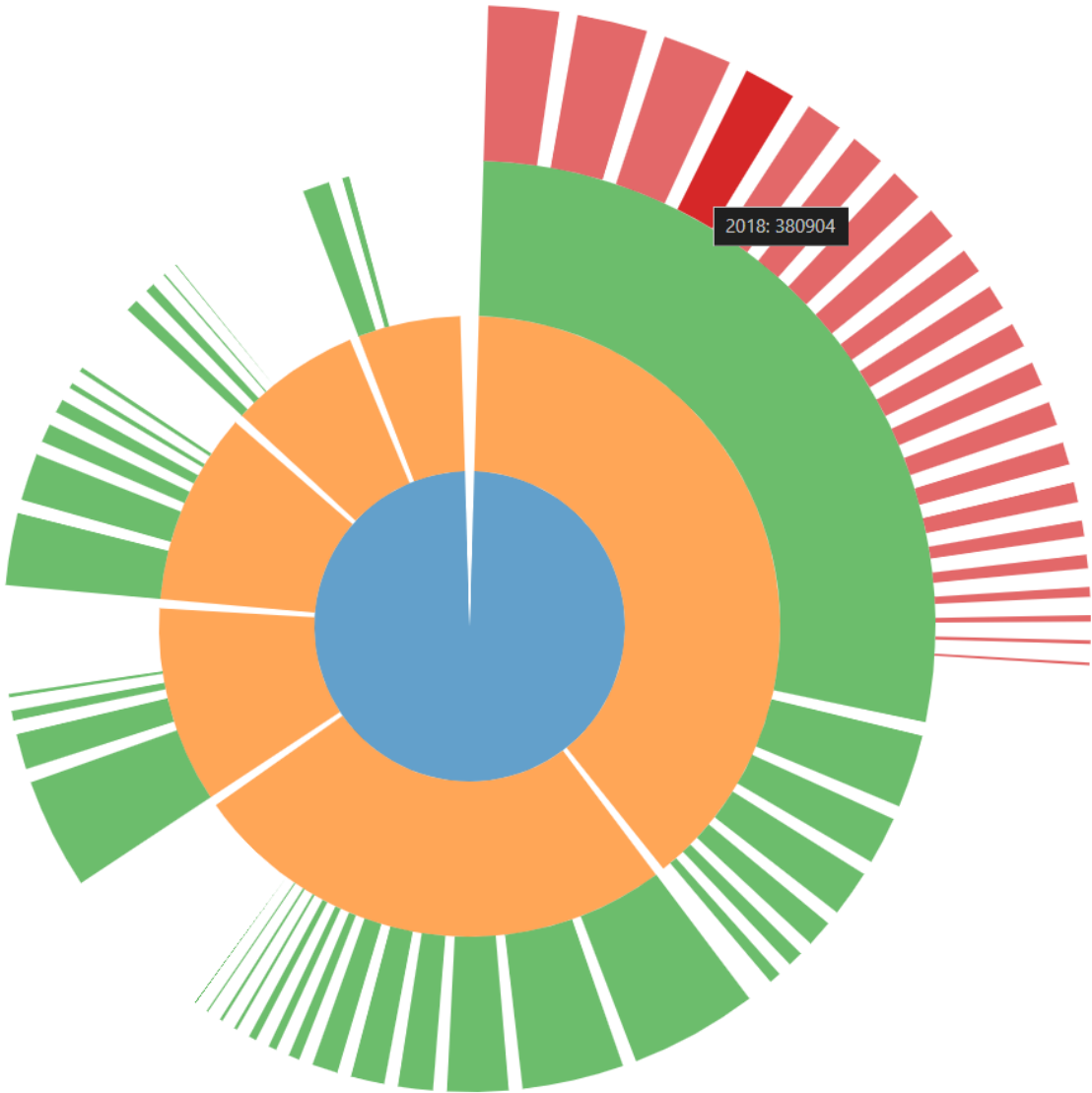
FORCE DIRECTED GRAPH
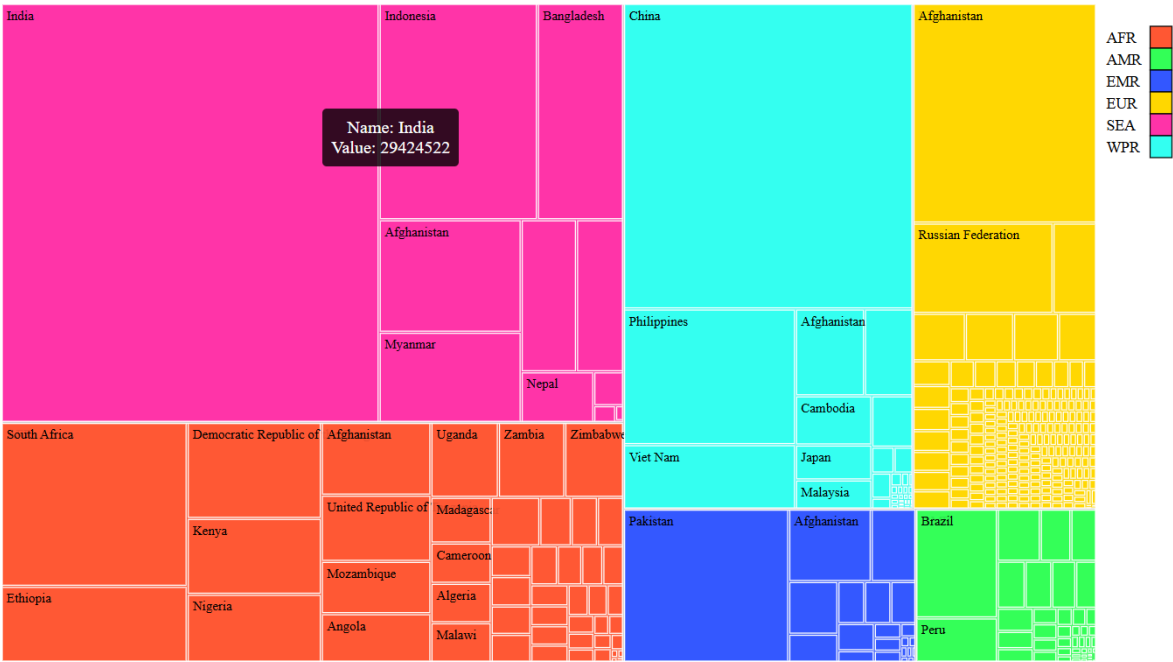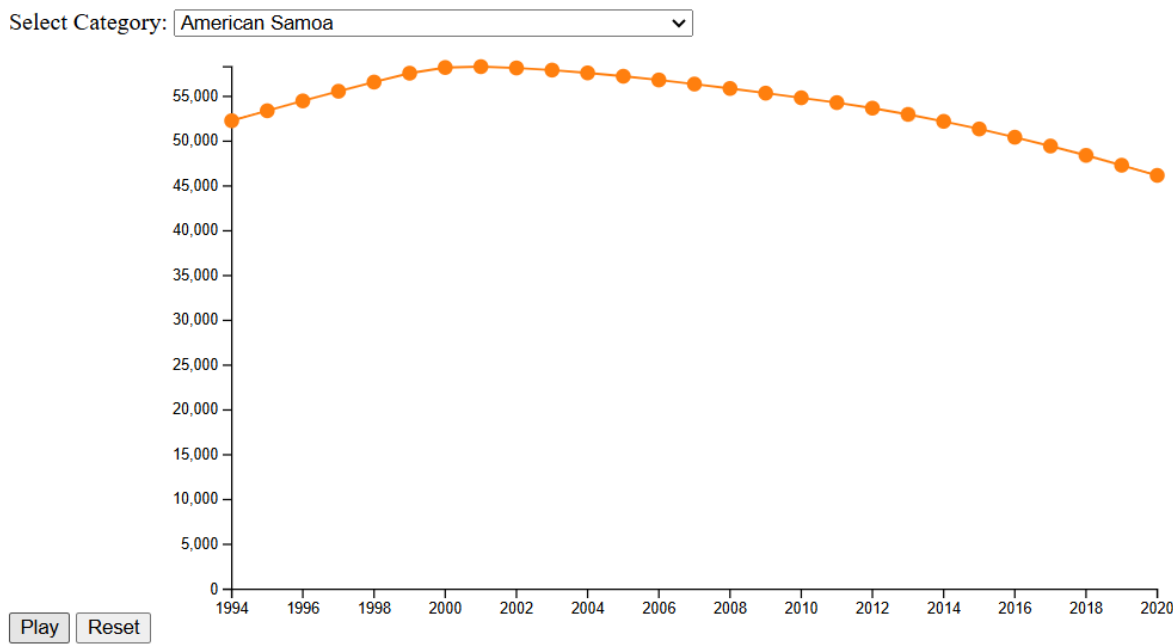
Filter by Region: [All ▾]
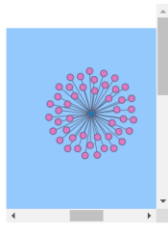
MAP CHART

SUNBURST CHART

2018: 380904

TREEMAP

DYNAMIC LINE CHART/ BUBBLE CHART

Select Category: American Samoa

Play   Reset

DASHBOARD

Force Directed Graph

Bubble Graph

Select Category: United Arab Emirates

Pause Reset
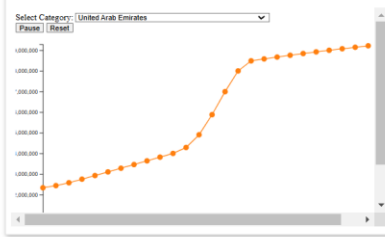
Geographic Map Chart

Tree Map

Afghanistan
Myanmar
Nepal
South Africa
Democratic Republic of
Afghanistan
Uganda
Zambia
Zimbabwe
Russian Federation
Philippines
Afghanistan
Cambodia
Viet Nam
Japan
Malaysia

Sunburst Chart

World: 20625089