Data Visualization - World Development Data (2023)

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Assignment 3
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1 Introduction

This report details the implementations for a complex visualization of a compact World Development Data from 2023 [1], consisting of various socioeconomic metrics for countries across the globe. I implemented multiple interactive visualizations that allow the user to explore and compare key metrics such as GDP, urban population, life expectancy, etc on a sleek dashboard design [7].

A demonstration of this project can be seen at: `https://youtu.be/QIQl_V5_hR4`

2 Tools Used for Visualization

To process and visualize the dataset, several tools and technologies were used:

- **Python**: This is the primary language used for creating the interactive dashboard.
- **Plotly**: I used this versatile library for creating vibrant, interactive visualizations, including sunburst, choropleth, spider, and bubble charts.
- **Dash**: This framework [7] was used to create a local app to host a visually coherent dashboard.

3 Dataset Description

The dataset World Development Data (2023) [1] includes a broad set of economic, health, and social indicators across several countries worldwide. While this dataset is extremely

detailed, I have also created a derived attribute via a dictionary map which serves to map the global regions on the basis of each country name.
Key attributes of the dataset include:

- **Categorical Attributes**: Country, Abbreviation, Capital or Largest City, Latitude/Longitude, Calling Code, and Currency Code.
- **Quantitative Continuous Variables**: Population, Urban Population, GDP, Density (P/Km^2), Agricultural Land (%), Land Area (Km^2), Armed Forces Size, Birth Rate, CO_2 Emissions, CPI, CPI Change (%), Fertility Rate, Forested Area (%), Gasoline Price, Gross Primary and Tertiary Education Enrolment (%), Infant Mortality, Life Expectancy, Maternal Mortality Ratio, Minimum Wage, Out-of-Pocket Health Expenditure, Physicians per Thousand, Labor Force Participation (%), Tax Revenue (%), Total Tax Rate, Unemployment Rate.

4 Tasks to Support with Visualization

The visualizations in this project aim to support multiple tasks:

- To enable viewers to look up and compare trends in a complex dataset across different regions.
- To allow users to understand the comparative position of multiple countries on a broader social development index.

5 Encoding Channels and Idioms

5.1 Sunburst Chart

This chart [2] hierarchically depicts the world's population, showing countries' associations with regions through radial, positional encoding. Sector size and hue encodings together depict differences in population.

5.2 Spider Chart

A space-efficient chart [3] for comparing several metrics using the same radial axis. Colour encoding distinguishes countries, and a combination of orientational and positional encodings shows the metric values.

5.3 Bar Chart

This simple chart [4] displays the top 10 countries globally (or regionally) sorted by GDP. Bar length (size encoding) represents GDP, while colour encoding distinguishes countries.

5.4 Scatter Plots

- **Dynamic Chart**: Viewers can select metrics of interest for this chart [5]. Data can be localized to specific regions, with colour encoding for countries and size encoding for metric intensity.

- **Static Chart**: Shows the relationship between child mortality, country GDP and privatized healthcare levels. Colour encoding distinguishes countries, and size encoding represents child mortality values.

5.5 Choropleth Plot

A geographic map [6] that uses positional encoding. Metrics are expressed through a hue-encoding in purple, chosen interactively from a drop-down menu.

6 Novelty of Visualization and Implementation Complexity

This dashboard [7][9] includes highly interactive charts requiring multi-level filtering [8]. The dataset's complexity necessitated pre-processing to fix improperly formatted data and blend multiple encoding channels for clarity.

The dashboard enables high user engagement and control over what data they wish to view and explore. Challenges included extensive cleaning and handling data with missing values.

7 Strengths and Weaknesses of the Visualization

Strengths

- Intuitive and interactive dashboard enabling focus on specific metrics or an overarching overview.
- Multiple chart types blend effectively to represent complex data across countries.

Weaknesses

- The dashboard might present a learning curve for beginner users.
- Rows removed during preprocessing with incomplete data might limit geographic coverage.
- Bubble and spider charts may appear cluttered when too many countries overlay.

8 Conclusion

This project uses a high-level programming language and libraries to successfully create an intuitive and interactive visualization dashboard. The visualizations allow exploration of complex global socioeconomic data, balancing functionality and readability.

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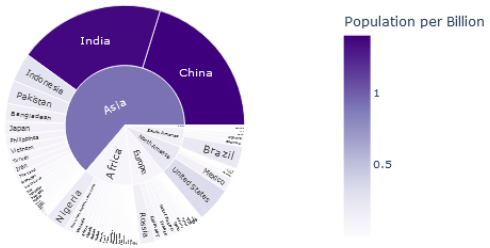
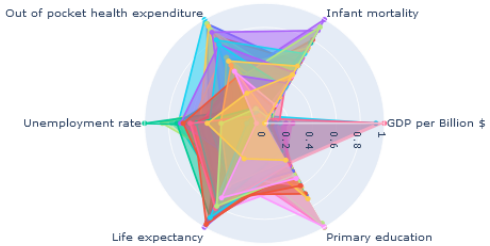
All Regions

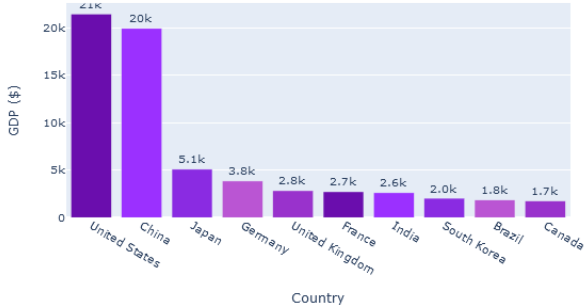
Population by Region and Country (All)



Comparing Countries Across Multiple Metrics (All)



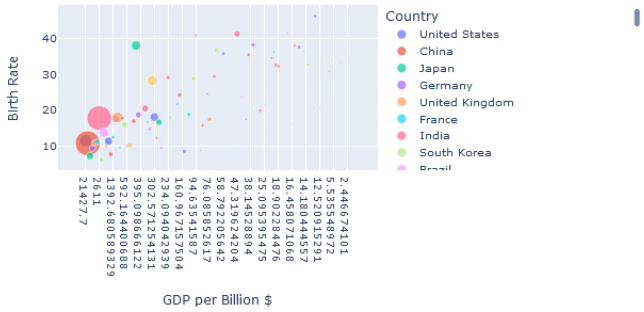
Top 10 Countries by GDP (All)



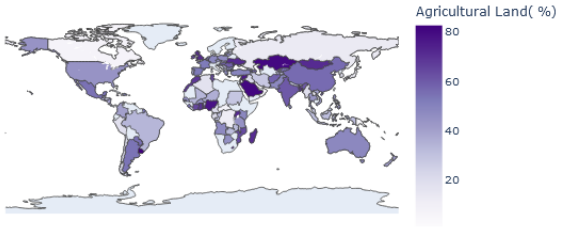
Birth Rate

Agricultural Land(%)

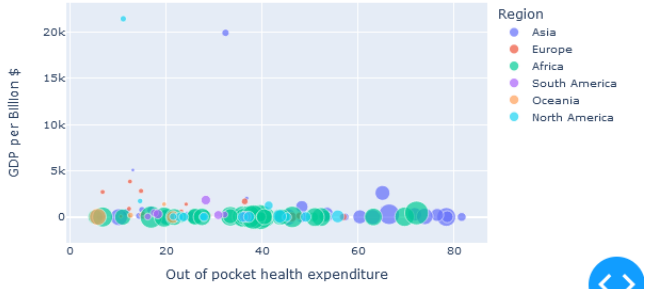
(Birth Rate) vs GDP per Billion $ (All)



(Agricultural Land(%)) in (All)



Child Mortality Rate vs Out-of-Pocket Healthcare Spending



References

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