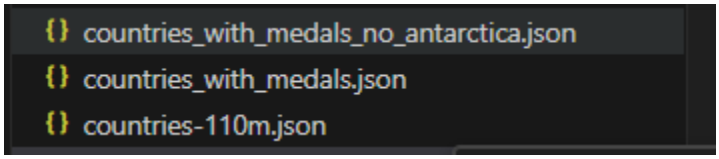
Group member: Zhuohui Wu, Jin Tian, Zulin Luo

Data Description

Our group decided to use data from the 2024 Olympics data to create a visualization comparing medals and GDP per capita (2024 Olympics: Medals vs GDP). For the map, we utilized topographic map data from GitHub. Initially, we only had the 110m JSON, which included Antarctica on the map(which had no country). To refine this, we used Python to filter out Antarctica and merged the map data with the CSV file containing country-specific data. We filtered out Antarctica because, initially, we included it in our map but later realized that, since Antarctica does not have any countries, it would have no impact on the visualization. Including it only adds unnecessary data with no relevant information.

This process allowed us to have a JSON file that integrates information on medals, GDP per capita, and population. Now, when we click on one country, we will have the county's medals, GDP per capita, and population information below, which we use three small bar charts to represent. We did not make any changes to the CSV file, as the data was already complete and accurate. It only contained 2024 data, including only countries that participated in the Olympics and won medals, separate medal counts into gold, silver, and bronze but also have total counts, and did not contain any null values.

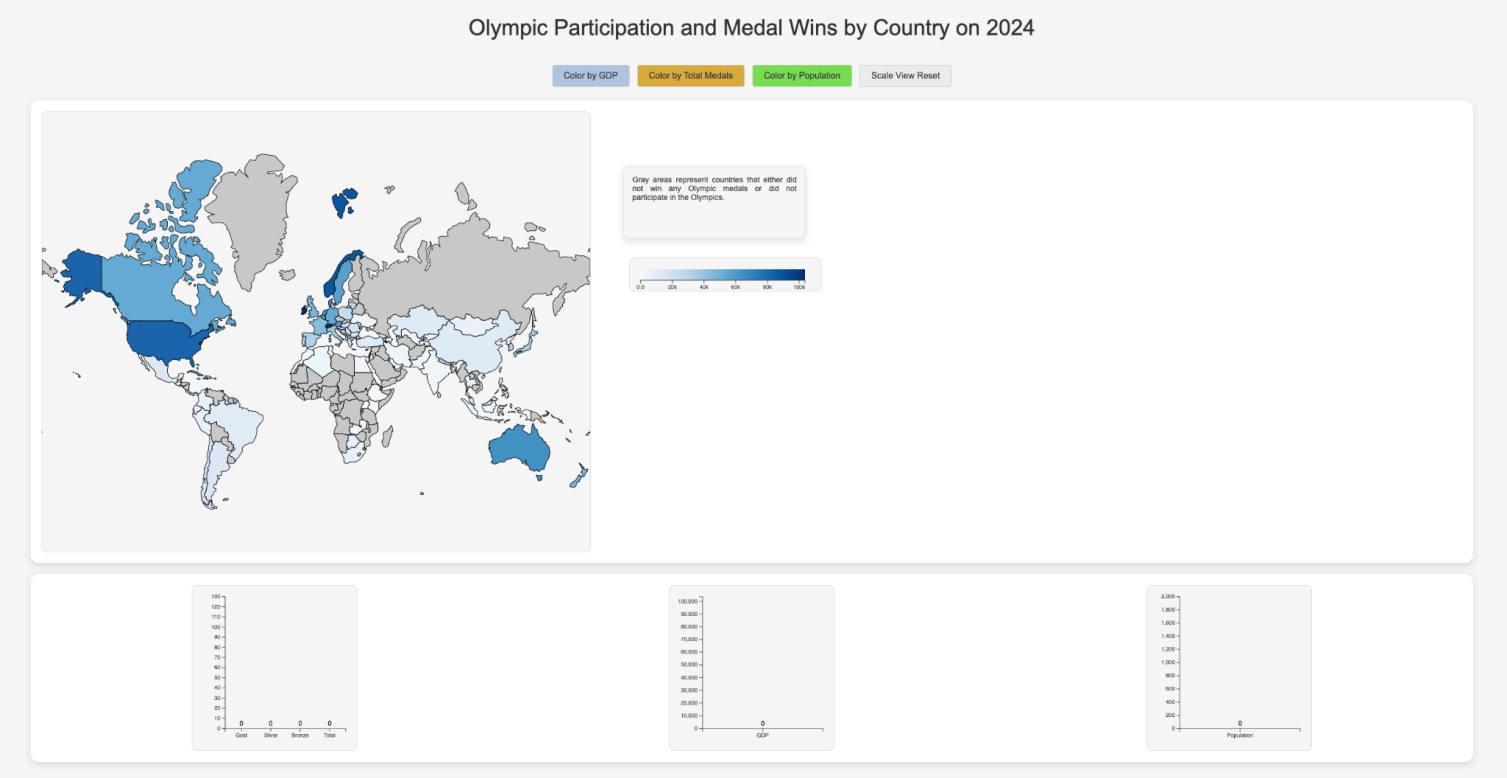



```
1  country,country_code,region,gold,silver,bronze,total,gdp,gdp_year,population
```

Group member: Zhuohui Wu, Jin Tian, Zulin Luo

Design Rationale

- **Map**



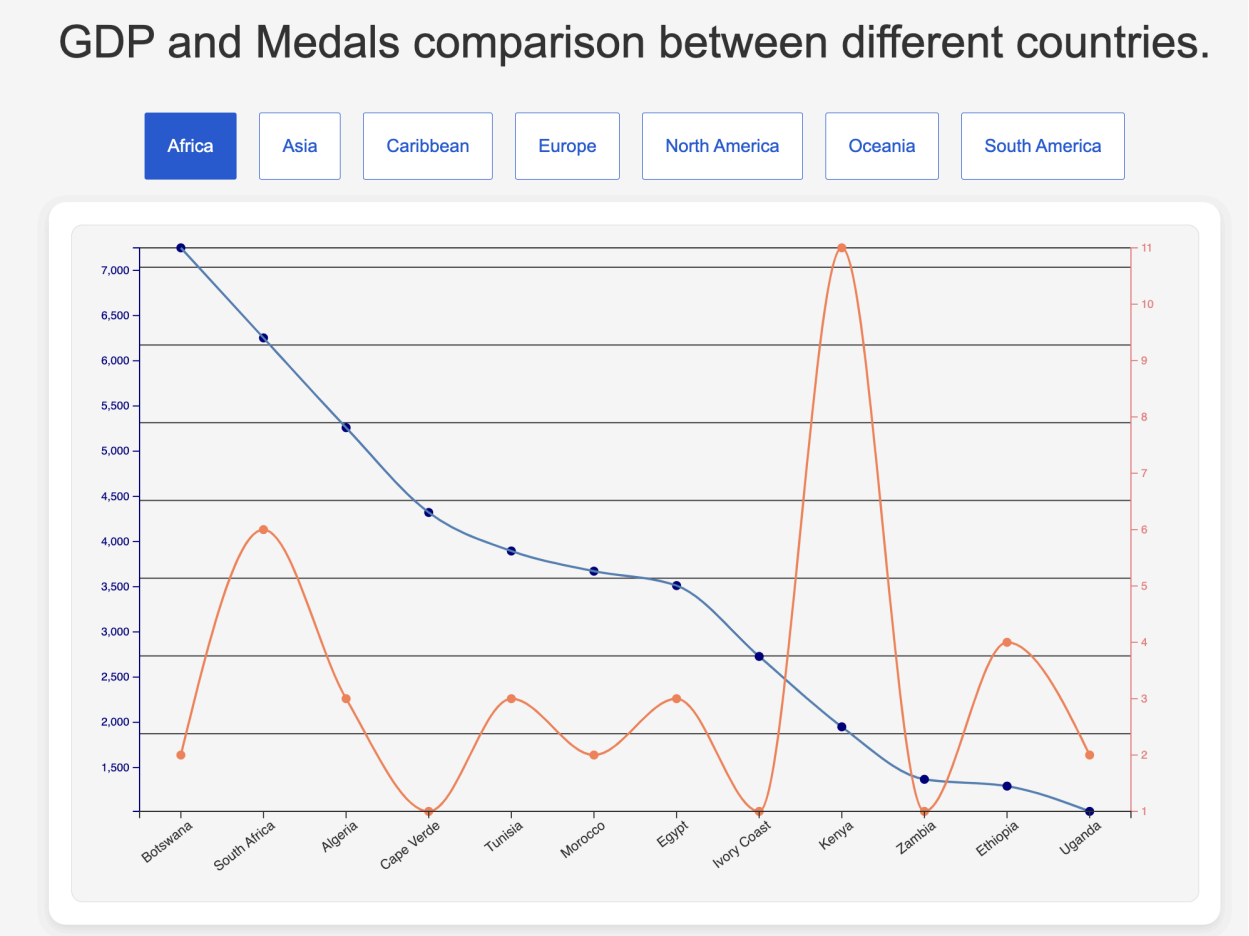
  - **Colors**: For the color palette, we used three main schemes to make one map with three visualizations(we used three buttons to switch modes). Besides the three color schemes, we also use gray areas to indicate countries that either did not participate in the Olympics or did not win any medals.
    i. GDP: We use a Blue palette, where lighter shades represent countries with lower GDP per capita, and darker shades indicate countries with higher GDP per capita.
    ii. Total Medals: For this visualization, we used an orange palette, where countries with fewer medals are shown in lighter orange, and countries with more medals are shown in darker shades.
    iii. Population: We use a green palette to represent the population, where countries with smaller populations are shaded in light green and those with larger populations in darker green.

- **Marks**: This map uses the shape of each country to represent the data, while the bar charts underneath use bars. We use black boundary strokes to distinguish different countries on the map. Those strokes can ensure that each country is visually separated, making ur easy for users to identify and interact with different regions.
- **Buttons**: For this map, we have four buttons in total to enhance user functionality, the first three buttons are used for users to switch the data shown on the map to GDP per capita, medal, or population. The last button is used for users to reset the scale view.
- **Legends**: This map includes a color legend to help users interpret the visualization effectively. Each visualization mode (GDP per capita, Total Medals, and Population) has its own color gradient (blue, orange, green). Each mode's color gradient is combined by a numerical scale (visible in the legend), helping users understand the range of values represented by the colors. We also added a small info box beside the map, explaining to users why there are some country is gray.
- **Bar Charts**: Every time when a user clicks one country on the map, the three little bar charts below will update based on user interactions.
    i. The left chart displays the total number of Gold, Silver, Bronze, and Total Medals won by the selected country. The y-axis of the left chart is the medal counts.
    ii. The middle chart shows the GDP per capita of the selected country. Y represents the value of each country's GDP per capita.
    iii. The right bar represents the population of each court. Y is the population count. When no country is selected or the user selects the gray country, the charts remain blank to reduce bias.
    iv. Once a colored country is clicked on the map, the charts populate with the relevant data, providing a clear and immediate visual summary. Besides, each bar chart is styled with distinct colors for better differentiation, helping users quickly locate and interpret the information.

- **Trade-offs**
  i. We use color gradients for GDP per capita, medals, and population to enhance the map's aesthetic and convey information effectively. However, users with color vision deficiencies may find it harder to distinguish between gradients. We did consider adding more textures or patterns to the legend, but we finally decided to prioritize simplicity and consistency rather than including those features.
  ii. The zoom-in and zoom-out functionality provides a detailed view of selected countries, but it temporarily makes users unable to see the global information. So we add a scale view reset button to help users return to the default view easily.

Group member: Zhuohui Wu, Jin Tian, Zulin Luo

- **Line Chart**



  - **Scales**: The graph uses GDP per capita (left) and medals (right) as y-axes and country name as the x-axis. We use linear scales for both y-axes to ensure accurate proportional representation, and we use scalePoint to handle categorical data of the x-axis.
    i. The two y-axes are set to change their domain corresponding to each region selected. For example, the left axis will range from the max GDP per capita among all African countries to the lowest one, while the right axis will range from the highest total medal counts among all African countries to the lowest one. In contrast to using the same axes domain for all regions, the changing axes allow each graph to show a more spread out and clear visualization with the most fitted domain.

ii. The x-axis sorts countries by GDP per capita to create an ordered structure to help users quickly identify high and low values. The country name on the x-axis is set to rotate about 40 degrees so that all names in regions that have more countries can be shown without overlapping. This is to enhance the readability of the graph.

- **Gridlines**: We choose a shared gridline for both the GDP per capita and Medal Count axes to create a unified reference. The gridlines are based on the shared extent of the GDP and medal scales to make sure they align with both metrics. This ensures users to visually compare these metrics with a consistent reference. It helps users perceive both metrics within the same visual space and reduces cognitive load.
- **Marks**: The circles are marks that show the exact data point with x positions corresponding to country names and y positions corresponding to either the GDP per capita or Medal Count. The lines are employed to show the trends of GDP and total medals across countries to ensure easier comparisons of the separate lines for each metric.
- **Colors**: We use two different colors to distinguish the two metrics. The contrast between the cool blue and warm coral ensures a clear differentiation between the two scales, even for users with limited color perception.
    i. The GDP per capita scale and marks are styled in navy. We think this color is rather professional and suitable to reflect economic data.
    ii. The total medal count scale and marks are styled in light coral, which is an energetic color that suits the dynamic nature of the Olympics.
- **Buttons**: At the top of the graph, there are seven buttons that correspond to seven different regions. We include these buttons to allow users to filter the data based on regions (e.g., Asia, Europe) and see the data points and trends of countries within each region.
- **Legend**: We include a legend on the side of the line graph to indicate the corresponding color of each scale and line. The rectangle shows the navy and light coral color of the GDP per capita and medal counts. With this legend, the user can track each line more easily and understand the graph better.

- **Trade-offs**:
  i. Gridline: We only use one shared gridline for both y-axes. While adding different gridlines for each axis could improve precision, it will make the chart visually overwhelming. The current balance ensures enough gridlines for readability without overcrowding.
  ii. Display by region: The line graph shows data within each region and only allows for comparison between countries in the same region. This might hinder users from directly comparing two countries in different regions. However, a line graph that contains all countries from the world is too crowded and hard to read. It is reasonable to put countries by region since they mostly share similar cultures, ethnicities, and economics, which ensures a more fair comparison than comparing a developed country with an underdeveloped country. It also ensures that the graph is not too skewed toward a country that might hinder readability.
  iii. Dual y-axes: Having two y-axes on the same graph can confuse users who are unfamiliar with this approach. However, we think it can help users better visually compare the two metrics simultaneously without requiring separate graphs. This side-by-side representation can better show trends and relationships (e.g. how economic performance correlates with medal counts) that might otherwise be harder to determine. Since we acknowledge that this can be confusing, the design includes clear labels and contrasting colors to minimize misinterpretation.

Group member: Zhuohui Wu, Jin Tian, Zulin Luo

Interactive Elements

Map

Zoom In, Out, and Pan Effect:

The map supports zooming and panning for an intuitive exploration experience. Users can zoom in or out with scroll gestures or touch gestures to inspect regions in more detail or gain a global overview. The panning feature enables users to drag the map when zoomed in, allowing seamless navigation across countries.

Hover Shadow Effect:

When users hover over a country, a subtle glow effect is applied, highlighting the hovered region with a visual cue. This glow effect, combined with a tooltip displaying the country's name, improves interactivity by clarifying which country the user is focusing on.

Clickable Effect:

Clicking on a country zooms in and centers the map on that region. The action dynamically updates the charts below the map to show the selected country's medal counts, GDP per capita, and population. For gray-colored countries, which represent non-participants or those without medals, the charts remain blank to maintain unbiased visuals.

Button Interactions:

The map includes color adjustment buttons that allow users to switch the map's color scheme based on GDP, total medals, or population. Each button applies a distinct color gradient to represent the selected data type. Additionally, the "Scale View Reset" button restores the map's original zoom and color view, helping users reorient easily.

Group member: Zhuohui Wu, Jin Tian, Zulin Luo

Line Graph

Mouse Over Effect:

The line graph features an interactive mouse-over function that aids in exploring data points. As users hover over the graph, a vertical focus line highlights the corresponding data point, while a tooltip appears with detailed information about the selected country, including its GDP per capita and total medal count. This feature enhances usability by providing precise and dynamic feedback.

Button Interactions:

The graph includes a set of buttons corresponding to geographic regions, such as Asia, Europe, and Africa. Clicking a region button filters the graph to display only the data for countries within that region. This interaction allows users to focus on specific areas and compare trends within those regions. A consistent layout and responsive scaling ensure the filtered data remains readable and visually effective.

Visualization Story

- **Map**

Our map visualization shows the connections between a country's economic power, population size, and performance in the 2024 Olympics. One of the primary insights is the relation between GDP per capita and medal counts. Wealthier countries (higher GDP per capita) often perform better in medal counts. Possibly because of the higher GDP per capita countries assign more economic resources to develop athletic programs, like USA, Canada, and Australia. But that is not absolutely correct, some countries with relatively lower GDP per capita also perform great, which might be because there are other influences that exist such as population, government priorities, or cultural focus on sports (like China).

The regional patterns revealed by the visualization are also striking. Certain regions consistently outperform others in overall medal counts or GDP per capita. For example, North America and Western Europe tend to dominate both economically and in medal counts. Asia, particularly countries like China and Japan, also stands out with strong performances, driven by significant investments in athletics and large populations.

Meanwhile, gray-colored countries, those that didn't win medals or participate, highlight disparities in global representation.

- **Line Graph**

For most of the region, countries with higher GDP per capita earned higher total counts of medals. This trend is particularly consistent in regions like the Caribbean, North America, and Oceania. This suggests that wealthier countries may have better training, sports infrastructure, and athlete development resources, so they may win more medals. In these regions, economic wealth seems to be correlated with athletic success.

However, we were surprised by the existence of some special cases - countries that showed opposite performance to the general trend described above. For example, despite having one of the lowest GDP per capita among African countries participating in the Olympics, Kenya has the highest total Olympic medals in the region. This may be related to Kenya's tradition and excellence in long-distance running. Since long-distance running relies less on expensive infrastructure than other sports but rather on cultural factors and talent, the lack of superior GDP per capita does not hinder their success. Similarly, China has a medium GDP per capita in Asia, but it ranks first in Asia in terms of total medals. This may be due to the social norm that the Chinese value physical exercise from a young age, make large investments in sports, and have a long history of dominating many Olympic fields (e.g., table tennis, diving, and badminton).

While GDP per capita might be a strong indicator of Olympic success in many regions, it is not the only determining factor. Countries such as Kenya, China, and several European countries like the United Kingdom and France show that other factors such as government investment in sports, the presence of a sporting tradition, and cultural factors can also contribute significantly to Olympic success. On the other hand, countries with very high GDP per capita such as Qatar, Singapore, and Ireland perform poorly in terms of medal counts. This could be

due to the lack of a deep-rooted sporting culture or a relatively limited population size, which could affect the number of potential athletes. This suggests that economic wealth alone is not enough to ensure Olympic success.

Therefore, after analyzing the line graph, we can tell that the factors that lead to good Olympic performance are complex. Economic wealth is only one piece of the puzzle. The interplay of various aspects discussed above should also be considered regarding their influence on the medal counts.

Team contributions

Tian Jin: Actively discussing data use with teammates. I downloaded data and imported it to GitHub, set up GitHub, coded the basic structure of the Map graph, and added topics and UI parts in both graphs. Adding the explanation box to the map. Generating data descriptions, map design rationales, and map visualization stories.

Zulin Luo: Designed and created the line graph, added filtering options and styled buttons, and modified the graph UI. Wrote the line graph design rationales and the line graph visualization stories. Iterated graph designs and UI choices. Engaged with team discussions and fixed coding bugs.

Zhuohui Wu: I designed and implemented the map section, including its interactive features and UI enhancements. My work focused on ensuring the map was both functional and visually appealing, aligning with the overall project goals.