COM-480 - Milestone 2

Math Olympiviz

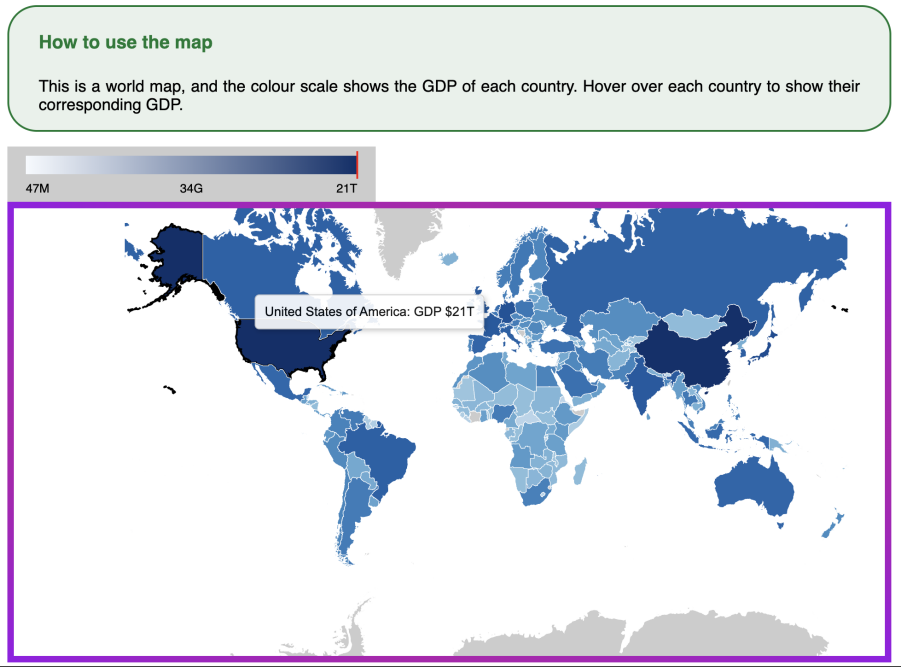
April 26^{th} 2024

1 Project Goal

Our aim for this project is to analyse the International Math Olympiad dataset, which consists of historical data over the years of all the participants, their scores, the country they represent and how well their country performed every year. We want to display and visualize how countries rank and more particularly measure how well countries perform based on GDP. In fact, countries with higher GDPs tend to rank highest (e.g., U.S, China, Korea) but how well do countries with lower GDP perform?

2 Sketches and Ideas

The main visualization of our project will be an interactive world map which will allow visualization according to several characteristics already mentioned. It will also be possible to choose the desired country(ies), and a time axis will allow you to choose the desired year(s), with manual progress or by letting the program scroll the years. The following is a sketch of our idea, where we have already set data with GDP, but we still need to embed some other data in the map.



The other visualizations will allow us to give another point of view of the data, such as a visualization in the form of a "race" between countries according to different parameters such as GDP or the number of medals, to highlight the variations and possible correlations between the parameters. Our idea is to plot the evolution of some metrics such as number of medals, or rank over the year. We will design several plots using D3.js and the following are 2 sketched out examples:

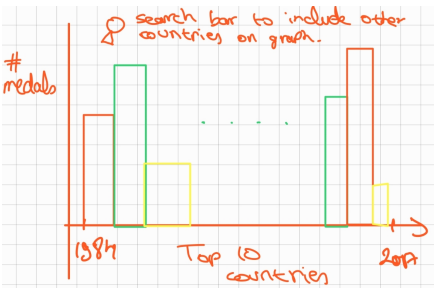


Figure 1: Number of medals of selected countries over the years

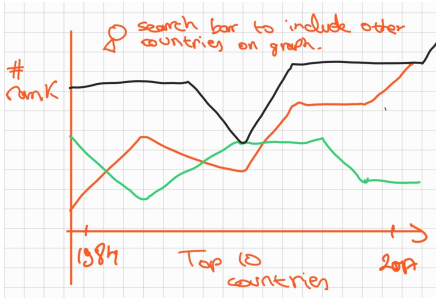


Figure 2: Rank evolution over the years of the selected countries

Next, we will analyse a metric as a function of the GDP in order to observe some interesting results regarding high performers based on GDP. One metric

we could observe is for example $M = -\frac{Rank}{\log(GDP)}$ and observe countries with the highest ratio. In fact, countries with the highest rank, with lower GDP will have the highest ratio. For example, we expect to see countries such as Vietnam, or Tajikistan, which were awarded honorable mentions throughout the years even though we would not expect these countries to be in the top performers. One other measure of this, based on GDP, is to perform some regression analysis by countries and their ranks, and find some outliers from there. The following is a very simple sketch, which we will improve in style and make it interactive and visually appealing.

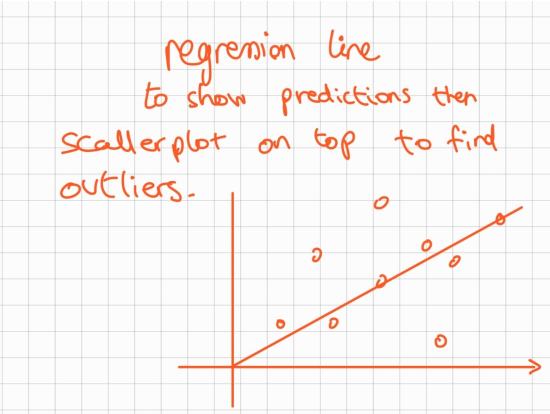


Figure 3: Regression visualization

Finally, we aim to include a gif or animation which can be paused of the best performing people in the history of the math olympiads, who were lated awarded some prestigious mathematics prize, such as the Fields Medal or others.

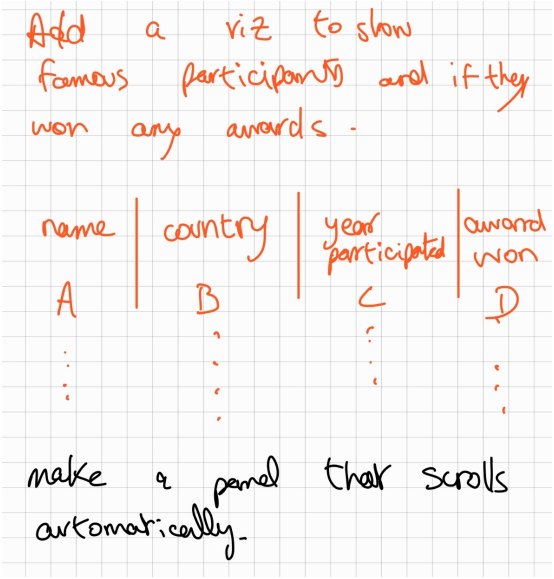


Figure 4: Panel visualization

3 Tools

We will use

- D3.js
- AmCharts or D3.js for the map
- Tailwind CSS and Node.js for a stylish website
- *Lectures Needed*: Data, Interactions, Designing Viz, Maps

4 Pieces to Implement

- Implementing the website
- Data Analysis with D3 to perform the said analysis and produce the plots
- Embed data into the map
- Search for participants who were later awarded some prestigious prizes
- Extra Ideas
  - Make the website more stylish with Tailwind CSS
  - Do some additional analysis on gender for example
  - Have the best participants in the Olympics (the hall of fame) with their score and their progress over the years as on the IMO sites
  - Include other prestigious mathematical competitions by country
  - Include visualization of other international Olympiads