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# 1. Introduction

## **Project Overview:**

The project analyzes Olympic performance trends over time, focusing on athlete evolution, country dominance, and medal distribution. It uses interactive visualizations to provide a historical perspective on the Olympics, highlighting the significant changes in countries, sports, and athletes since their inception, driven by growing interest in data-driven sports analytics.

## **Target Audience:**

Sports enthusiasts interested in Olympic history. Data analysts and researchers exploring long-term trends in sports. General audiences who are curious about how sports and athletes have evolved. Journalists looking for historical insights on Olympic performances.

**Motivation:** we want to provide historical perspective on the Olympics through data-driven visualizations.

# 2. Design and Development

## A) Website layout

The website is designed with a clean and intuitive structure that prioritizes user experience. A responsive Bootstrap layout serves as the foundation, incorporating a navigation bar that includes sections such as About, Explore, and Team. From the start, the goal has been to make the interface as straightforward and seamless as possible, ensuring that users of all backgrounds, whether casual sports fans or data enthusiasts can browse the content with ease. The visual theme takes inspiration from the official Olympic colors, primarily using shades of blue (#0066B3) and yellow (#FFCC00) to create a cohesive aesthetic. Functional enhancements, such as a scrolling navbar that adjusts its appearance dynamically and fullscreen toggles for certain visualizations, were implemented to make exploration more engaging and immersive.

## B) Storytelling

The project adopts a data-driven storytelling approach that emphasizes exploration, curiosity, and historical context. Rather than overwhelming users with raw data, the website guides them through Olympic history with progressively revealed insights, letting them interact with the information at their own pace. This layered design encourages deeper engagement by offering high-level overviews as well as country-specific and event-specific deep dives.

One of the central storytelling techniques used is **geographic anchoring**—the data is tied closely to the interactive world map and 3D globe, allowing users to begin with a visual overview and then drill down into specific countries or time periods. For example, clicking on a country on the 3D globe highlights its Olympic performance with contextual statistics such as medal counts and top sports. The color of each country on the globe doubles as a heatmap, making it easy to

identify high-performing nations and regional patterns at a glance. This adds a powerful visual storytelling layer that communicates performance density without requiring users to read complex graphs.

Additionally, **progressive disclosure** is used across the interface. Data dashboards are organized into accordion sections, fun Olympic facts are sprinkled throughout, and visual hierarchy highlights the most relevant insights first. These techniques make the experience feel informative but not overwhelming, especially for users unfamiliar with data visualization.

The combination of historical statistics, interactive maps, and visual design choices all contribute to a narrative that invites users to explore—not just what happened in Olympic history, but **how** and **why** those patterns emerged. From gender evolution to geopolitical dominance, the site uses interactivity as a storytelling tool, turning data into a journey through Olympic time and space.

## C) Visualisations

The visualization components are central to how this project delivers insight and storytelling. Each one was carefully chosen to address a specific aspect of Olympic history, whether it's understanding general trends, exploring the evolution of sports, or investigating how nations have performed over time. Interactivity and clarity were prioritized across all elements to support a wide range of users, from casual browsers to data enthusiasts. Below is a breakdown of the main visualizations, each with its conceptual rationale, tools, design choices, and the practical challenges involved in development.

### Key Statistics Dashboard

The Key Statistics Dashboard acts as a foundational entry point for users to explore important figures and trends in Olympic history. The goal was to make complex data approachable by allowing users to visualize and interact with distributions and comparisons easily. This section includes charts that depict gender participation over time, the most represented sports, medal distributions, and changes in athlete physique (height, weight, age). These visual elements help highlight broad social and athletic transformations—like the growing inclusion of women, or how physical expectations have shifted in various disciplines. With interactive tooltips, dropdowns, and brief facts embedded in each section, users are encouraged not just to view data but to engage with it and reflect on its historical context.

- **Tools:** Implemented using Chart.js with bar, doughnut, and pie charts.
- **Design Decisions:**
  - Color-coded visuals aligned with Olympic color themes.
  - Accordion layout to reduce clutter and prevent overload.
  - Tooltips and legends for interactivity and better comprehension.
  - "Did You Know?" facts to make the content more engaging.
- **Challenges:**

- Proper data binning for continuous variables like age and height.
- Making charts fully responsive and visually balanced across screens.

## Interactive World Map

The interactive world map is a centerpiece of the project, offering both a traditional 2D view and an immersive 3D globe. It allows users to explore Olympic achievements across different countries through geographic and statistical perspectives. I implemented a fully interactive **3D globe** using `globe.js`, where countries are **clickable**, and each selection dynamically reveals detailed Olympic statistics — such as total medal count, most successful sports, and participation trends. The globe features **color-coded country shading**, where the intensity reflects total medal counts, effectively acting as a geographic **heatmap**. This design enables users to intuitively grasp the global distribution of Olympic performance at a glance.

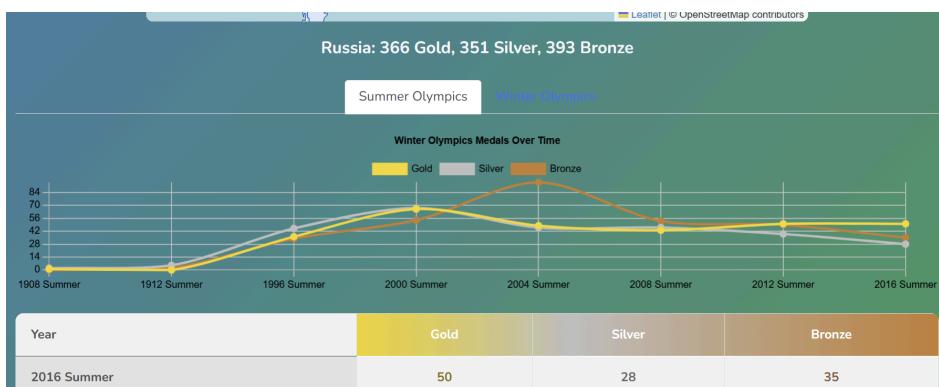
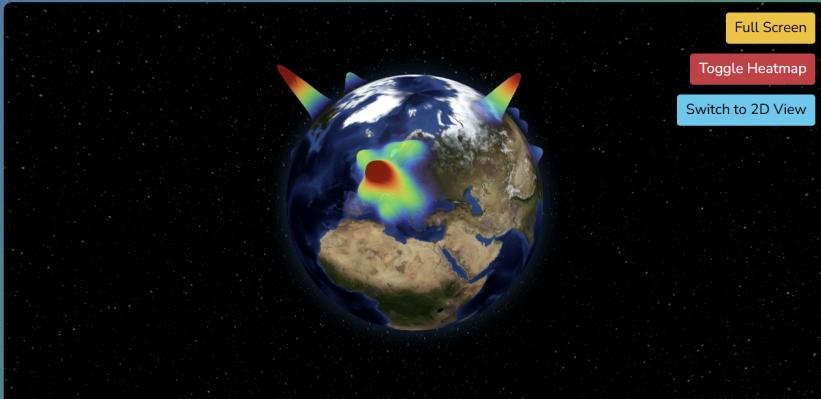
In parallel, a 2D map version (built using D3.js and Leaflet) is also being developed to offer another spatial perspective, with similar interactivity: hover previews and fullscreen exploration.

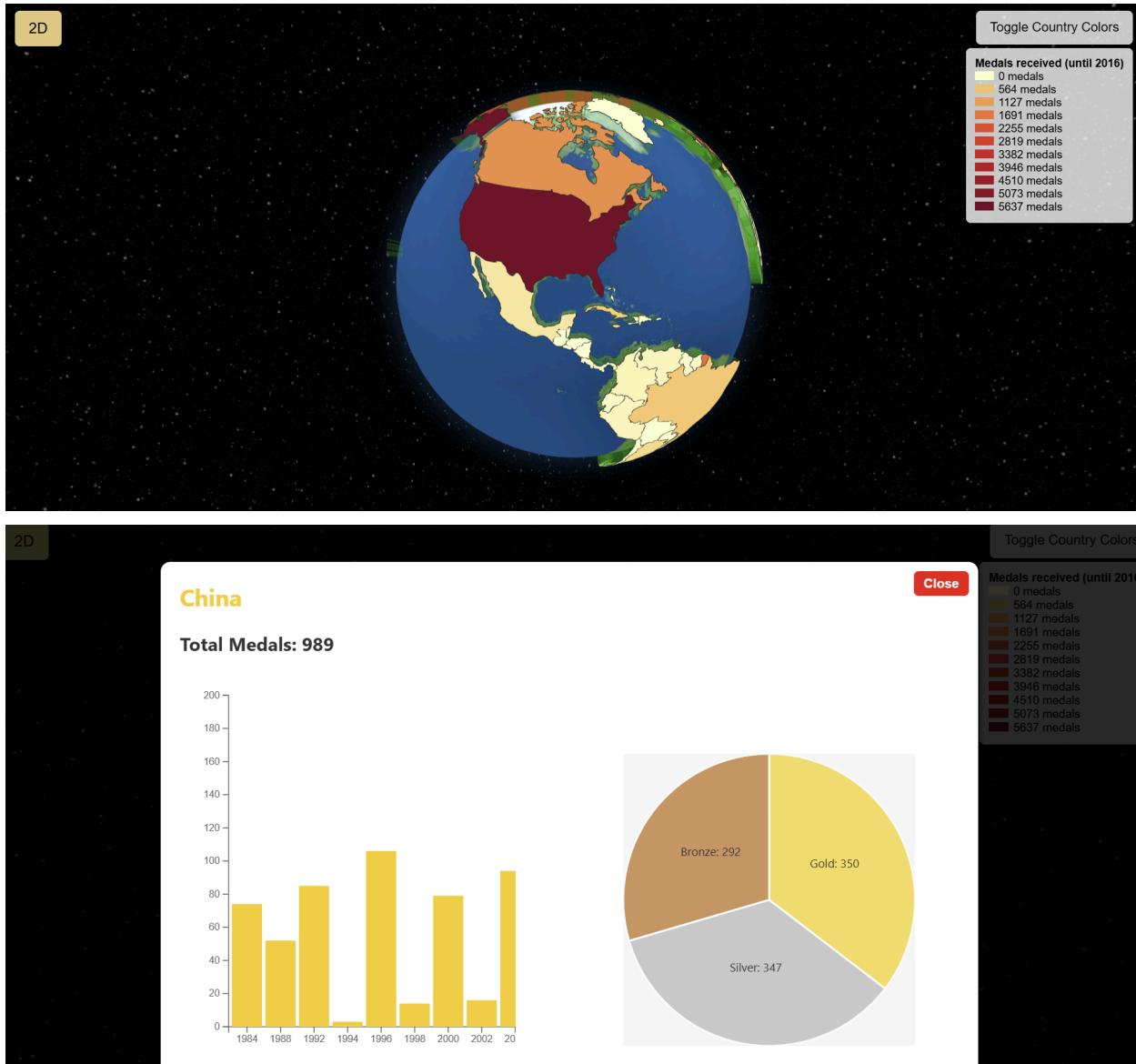
### Purpose:

The purpose of this visualization is to let users explore Olympic success through a global lens, enabling both high-level overviews and detailed country-specific insights. By combining spatial data with interactive storytelling, the map encourages users to reflect on how geography, history, and socio-political factors have influenced Olympic performance over time. The dual-mode design (2D map and 3D globe) also makes the experience more engaging and adaptable to different user preferences.



## EXPLORE THE MAP





- Tools: D3.js, Leaflet.js and globe.gl, custom heatmap layer, and external dataset for mapping NOC codes to coordinates.
- Design Decisions:
  - Blue-to-red gradient heatmap for visualizing medal density.
  - Fullscreen toggle for detailed exploration.
  - Clickable countries
  - 2D map and 3D globe
  - The display of statistic charts about the clicked country
  - 3D globe: Color the countries depending on the total number of medals
- Challenges:
  - Managing interaction between clickable features and the heatmap overlay.

- Ensuring smooth performance with large datasets.
- Mapping inconsistencies between Olympic NOC codes and geographical data.
- Implement a map using [D3.js](#) (since D3 is pretty low level) and clickable country. It is pretty challenging to work with.
- Integrate globes, display the data on it correctly and meaningfully
- Managing navigation in order to tell a coherent story and lead the user correctly

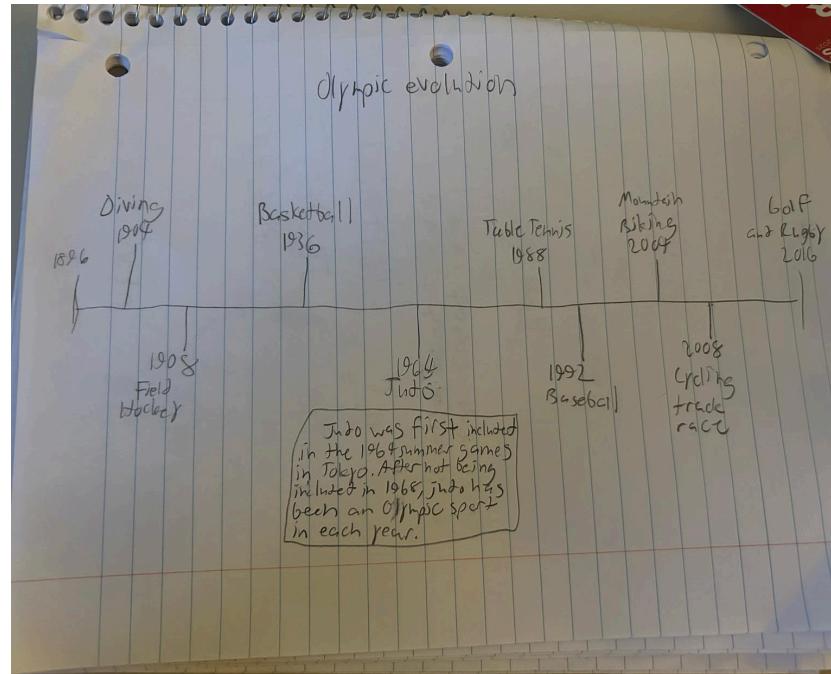
Together, these visualizations form a narrative that blends historical data, geographic context, and user interaction. While each element was challenging to implement alone, careful planning and iteration helped overcome the technical barriers, all with a user-friendly experience in mind.

### 3. Future Improvements

Unfortunately, we were not able to implement the **Olympic Timeline** visualization as originally planned. This was due in part to the lack of contribution from one team member who was assigned this feature but did not participate during the milestone. As a result, development efforts had to be prioritized toward the core visualizations and overall site structure.

However, there are several improvements and additional features that could elevate the experience and impact of the project:

- **Complete and integrate the Olympic Timeline:** Using libraries such as D3.js or Timeline.js, we could add an interactive timeline that highlights key historical moments, debut of new sports, and changes in participation. This would offer important chronological context to accompany the statistics and maps.
- **Time slider on the map:** Implement a year-by-year filtering mechanism so users can observe how country performance has evolved over time on both the 2D and 3D maps.
- **Dark/Light mode toggle:** Allow users to switch between visual themes for improved accessibility and visual comfort.
- **Statistical deep-dives:** Enable users to compare countries side-by-side or view medal efficiency metrics (e.g., medals per athlete).
- **Search bar for countries or sports:** Help users quickly navigate to specific nations or disciplines across all visualizations.
- **Additional storytelling elements:** Add narrative text or guided exploration modes that walk users through Olympic milestones and insights.



- **Accessibility improvements:** Improve keyboard navigation, alt text, and ARIA labels to make the project more inclusive.
- **Quiz or trivia section:** As an optional interactive module, a short quiz could reinforce learning and make exploration more fun.
- **Export or share views:** Let users download or share specific charts or map snapshots to encourage engagement and discussion.

These improvements would further enhance the project's storytelling, usability, and interactivity, especially as more collaborators become available to support development.

## 4. Team Contributions

### **Member 1: Tuan Dang Nguyen - 361089**

(basically everything except for what Dmitry did)

- Structured the project's goals, planned the visualization components, and defined the storytelling approach.
- Developed the full website frontend using HTML, CSS, JavaScript, and Bootstrap for responsiveness.
- Created and styled the navigation bar, accordion layout, and overall Olympic-themed design.
- Implemented the Key Statistics Dashboard with Chart.js, including interactive bar, doughnut, and pie charts.
- Managed responsive design, tooltips, legends, and data binning to ensure visual clarity.
- Built the foundation of the Interactive World Map using Leaflet.js with a medal-based heatmap overlay.
- Mapped NOC codes to countries using an external dataset in the implementation of the heatmap and added fullscreen functionality.
- Build a full screen mechanism that leads to a big 2D map, hoverable, countries clickable created by using [D3.js](#)
- Integrate a 3D globe that shows heatmap statistics, basically the same functionality with the 2D map
- Create all the charts in full screen map (3D) (using [Chart.js](#) and [D3.js](#))
- Write this Process book

### **Member 2: Dmitry Teplokhov - 339647**

- Make a chart about evolution of gold medals received by a country
- Make a table about medals received by a country for each olympic season
- Write readme

### **Member 3: Kokkalera Yaash Nachappa - 403860**

\*\* Didn't contribute anything to this milestone\*\*