Optimizing Medal Count for the US Artistic Gymnastics Teams at the Paris 2024 Olympics

By: Anusha Bhat, Sarah Li, Shivani Ramalingam

Project Advisor: Ron Yurko

Introduction

- 2024 United States Olympic & Paralympic Committee Data Challenge Competition:
  - **Objective: Determining the highest scoring combination of 5 male and 5 female gymnasts**
- Goals:
  1. **Exploring the relationship and correlation between different apparatuses**
  2. **Creating a model for generating medal outcomes for all competition events**
  3. **Using the model to pick the best teams**

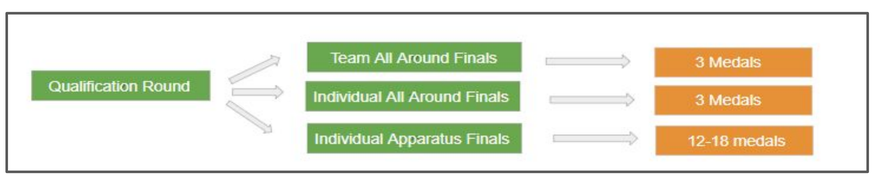
Data

- Data from 39 competitions held between 2022-2023 for 109 countries and 1,917 individuals
  - Athlete's *score* for an *apparatus* in a *round* in a *competition*
- **Men's Apparatuses (6):**
  - Floor Exercise, Pommel Horse, Still Rings, Vault, Parallel Bars, High Bar
- **Women's Apparatuses (4):**
  - Floor Exercise, Uneven Bars, Balance Beam, Vault
- Assumed the 11 other teams from the qualifying countries in the 2023 World Champs
- **Important Variables:** Name, Country, Apparatus, Round, and Scores
- **Score triad**: total score, execution score, difficulty score
- **3 data groups:** US data, 11 other qualifying countries, remaining countries
- **3 finals:** individual apparatuses, individual all around, team all around

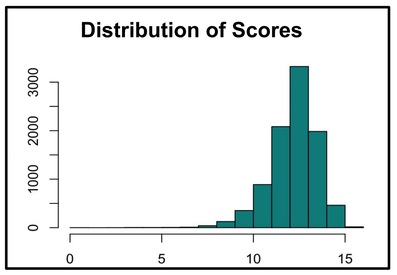
Methods

- Predict medal outcomes for a certain US team given historical data and other fixed nations
- Fixed nations by assuming the top 4 athletes from each country
- **Simulation** using random sampling to model competition rounds
- **For one round of the simulation:**
  1. Qualifying: For all 96 athletes, randomly sample the score triad
     - From the athlete's score distribution or their country's if individual data is not available
  2. Determine which players advance to final rounds
     - 2 athletes/country for individual apparatuses & all around
     - 3 athletes for team all around; top 8 teams
  3. For each final event, sample scores for qualifying athletes
  4. Determine winners
  5. Count USA medals
- **Model Outcome: Average medal count over 1000 rounds of simulation**

Flowchart of the simulation model and the total number of medal winners for each event.

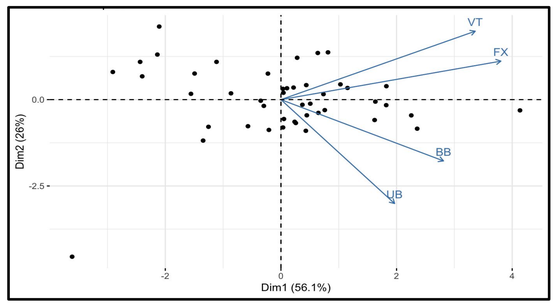


Results

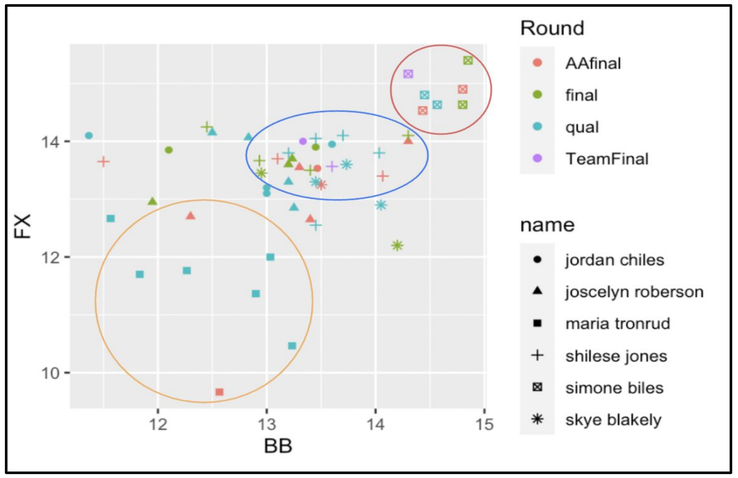


Total scores are left skewed and range between (~7, ~15), with a max of 16 points.

The apparatuses are positively correlated with each other.

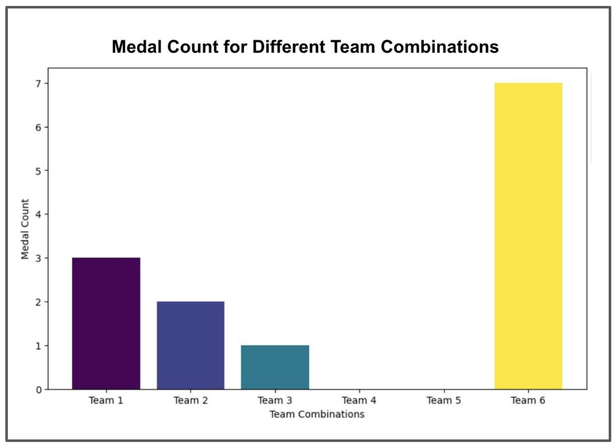


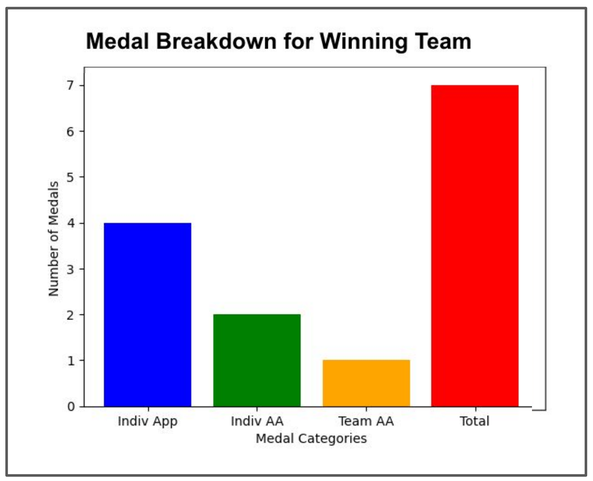
Positive correlation explained by individual athlete clusters.



The US team won 4 medals in Individual Apparatus, 2 medals in Individual All-Around, and 1 medal in Team All-Around.

Team 6 resulted in the highest expected medal count, winning 7 out of 11 possible medals.





Discussion

- Best women's team: Simone Biles, Skye Blakely, Jordan Chiles, Shiles Jones, and 1 alternative player.
- Future works: mixed effects linear regression, weighted medal counts, and penalties in model

References

1. "2022 2024 Code of Points World Artistic Gymnastics." *Federation Internationale De Gymnastique*, FIG Executive Committee , www.gymnastics.sport/publicdir/rules/files/en_2022-2024%20RG%20Code%20of%20Points.pdf. Accessed 6 Dec. 2023.
2. *UCSAS 2024 : UCSAS 2024 USOPC Data Challenge*, statds.org/events/ucsas2024/challenge.html
3. UCSAS. *GitHub*, github.com/ucsas/gym2024data/tree/main