Data-Driven Selection of the Optimal Team USA Olympic Artistic Gymnastics Squads

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ABSTRACT

The field of sports analytics, propelled by advancements in machine learning and data science, has revolutionized decision-making processes across various athletic disciplines. This research paper explores the comprehensive process of data scraping, cleaning, exploratory data analysis (EDA), and modeling, with the ultimate goal of selecting the best Men's and Women's Team and Individual USA Olympic Artistic Gymnasts. The notion of "best" is approached with flexibility, as we leave its interpretation to the entrant, although, for the purposes of this paper, "best" is operationalized as maximizing the total medal count for the United States at the Olympic Games. By embracing the power of data-driven decision-making, this research contributes to the evolving landscape of sports analytics and presents a comprehensive approach to assembling elite gymnastics teams for the United States. Ultimately, our objective is to equip Team USA with the talent, diversity, and strategies that will maximize their medal count and enhance the nation's standing in Olympic Artistic Gymnastics competitions.

Related Work

THE PREDICTION OF ALL-AROUND EVENT FINAL SCORE BASED ON D AND E SCORE FACTORS IN WOMEN'S ARTISTIC GYMNASTICS

HOW APPARATUS DIFFICULTY SCORES AFFECT ALL

AROUND RESULTS IN MEN'S ARTISTIC GYMNASTICS

MODELING THE FINAL SCORE IN ARTISTIC GYMNASTICS

BY DIFFERENT WEIGHTS OF DIFFICULTY AND

EXECUTION

WI LL ELEVATING THE DIFFICULTY SCORES IMPROVE THE ODDS OF WINNING? THE CASE OF ARTISTIC GYMNASTICS EVENT FINALS

1 Proposed Work

Research will follow the following steps:

1. **Research on Problem-Specific Terminology and Trends:**
2. In-depth study of gymnastics-specific terminology and rules.
3. Historical analysis of trends in Men's and Women's Team and Individual Artistic Gymnastics.
4. Examination of scoring systems, judging criteria, and recent rule changes.
5. Identification of key performance metrics and their relevance to team and Individual success.
6. **Exploratory Data Analysis (EDA):**
7. Comprehensive exploration of the dataset to uncover insights.
8. Identification of patterns, correlations, and outliers in historical gymnastics data.
9. Visualization of key EDA findings to inform subsequent modeling.
10. **Model Building:**
11. Development of predictive models tailored to gymnastics team competition.
12. Experimentation with various machine learning and statistical algorithms.
13. Feature engineering to capture athlete strengths, weaknesses, and historical performance.
14. Fine-tuning model parameters for optimal predictive accuracy.
15. **Model Evaluation:**
16. Rigorous evaluation of model performance using cross-validation techniques.
17. Application of relevant evaluation metrics, including accuracy, precision, recall, F1-score, and AUC-ROC.
18. Assessment of models' ability to generalize across different scenarios.
19. Sensitivity analysis to identify influential factors affecting predictions.
20. **Final Visualizations:**
21. Creation of informative and intuitive visualizations.
22. Visualization of predicted outcomes for Men's and Women's Team Artistic Gymnastics.
23. Clear presentation of predicted winners and comparisons of teams.
24. Visual representation of the research findings for stakeholders.

Evaluation

To ensure the accuracy and reliability of our predictive models, I employ a rigorous evaluation process. This process involves assessing the performance of our models, both quantitatively and qualitatively, to determine their effectiveness in making accurate predictions.

**Quantitative Evaluation Metrics:**

**Accuracy:** Accuracy measures the proportion of correctly predicted outcomes among all predictions. It provides an overall assessment of model correctness.

**Precision and Recall:** Precision measures the proportion of true positive predictions among all positive predictions, while recall measures the proportion of true positives among all actual positives. These metrics are particularly useful in assessing the model's ability to identify winners accurately.

**F1-Score:** The F1-Score combines precision and recall to provide a balanced measure of a model's performance. It is especially valuable when dealing with imbalanced datasets.

**Area Under the ROC Curve (AUC-ROC):** AUC-ROC assesses the model's ability to discriminate between winners and non-winners across different probability thresholds. A higher AUC-ROC indicates better discrimination.

**Confusion Matrix:** We analyze the confusion matrix to gain insights into false positives, false negatives, true positives, and true negatives, providing a deeper understanding of model behavior.

Discussion

Conclusion

References

Future work?

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