The Strength of Champions

Crafting TSA Scores from Strength Training Data for Elite Athletic Performance

PURDUE UNIVERSITY | The Data Mine

ATHLETIC TRAINING

INTRODUCTION

- This project aims to use strength training data from basketball and wrestling to create a single, holistic number (TSA Score) that encapsulates athletic performance and will be meaningful for various parties involved in the athletic training process.
- **Objectives:**
  - Find standardized scores for each athlete across a range of metrics.
  - Scale and combine the scores into an athletic ability score.
  - Create visualizations to demonstrate differences among athletes.
- **Research:**
  - The strength metrics used were taken from the Hawkins Dynamics Data that athletes use in their training regimens.
  - We also included athletic and speed metrics from recognized combine drills to look at different types of strength metrics.
  - Our research included an analysis of which strength metrics create a holistic overview of TSA. These metrics look at multiple different aspects of individual athletic performance which are important to their sport.
  - We built upon existing research concerning TSA scores to build our own unique TSA scores that we could use across various sports.

Total Score of Athleticism (TSA)

- **What is a TSA score?**
  - A TSA score is a one holistic measure used to evaluate the overall athleticism of each of our athletes using their weight room data.
- **Why use a TSA score?**
  - TSA scores are effective because they allow us to achieve a complete understanding of many different factors that impact total athleticism.
  - We can combine strength, speed, size, and endurance into one overall statistic for each of our athletes.
  - One drawback of using a TSA score is that based off metrics chosen certain athletes will be favored. E.g. larger athletes will struggle in a TSA score largely based on speed metrics.
- **How do we create a TSA score?**
  - Using athletes weight room metrics, we can evaluate their overall athletic ability in comparison to other team members.
  - To measure comparison within team members, we derived T-scores:
    - T-Scores: equivalent to number of standard deviation away from team's average
  - Scaled T-scores from 0-1 (0 - lowest among average, 1 - best among average)
  - TSA Score: Averaged scaled T-scores for all metrics for each individual athlete, scaled to 100

TSA Table

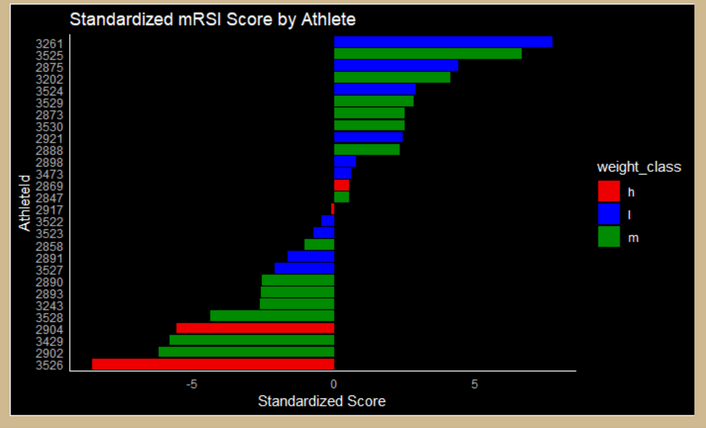
AthleteID	TSA Score	TSA Score NO Relative	TSA Score NO Peak
3337	35.58399216	29.37756287	45.75084706
3334	26.96742885	31.79376076	16.42077719
1517	50.95973481	47.20700293	46.34604195
1527	56.81793448	56.52837339	54.72035141
1522	44.50666516	56.2998125	29.77499463
3155	36.037528	44.7765042	35.5022186
3534	15.1611407	10.80335407	17.59089474
3338	71.36739443	63.18664998	79.78471874
3336	37.57206775	40.17474732	35.08113589
3533	47.11893911	51.18500496	48.79081468
1537	69.66105498	64.49744039	66.17437006
3531	57.56337537	55.20843055	60.72838784
3156	53.81621145	51.99170172	60.59335047
3154	54.1008545	55.11516207	52.27272917
1534	51.57907833	49.26460538	60.50988406
3335	66.39459842	65.79095059	69.69356195

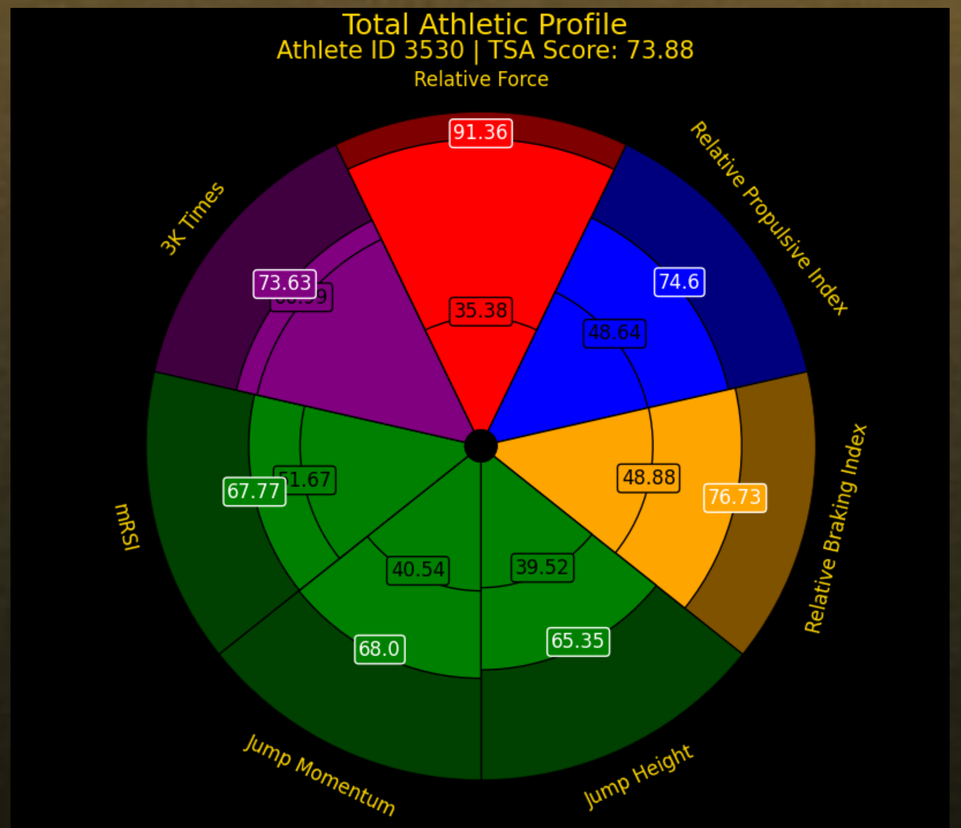
Min | Q1 | Q2 | Q3 | Q4

T-SCORE/SPIDER GRAPH VISUALIZATION

To control for comparison within the team members, we had to find averages for each athlete and to do this, we created T-score bar charts.

- **T-Scores**:
  - Using these averages, we create bar charts from a negative to a positive T-score, where a 0 represents the team's mean
  - From these bar charts, we are able to analyze which athletes excel the most and the athletes that are lacking for the metric
- **Grouping**
  - We obtained a multiple “buckets” that we used to compare similar types of athletes. These included weight class, height and minutes played, all ranging from low to high.
  - We found that bigger athletes tend to have a lower TSA score due to the fact that most of the metrics we use mainly account for agility, not strength
  - We need to acknowledge this when interpreting the TSA for athletes but overall, a higher TSA score indicates a more athletic athlete
- **Spider Graph:**
  - From the T-score bar charts, we can rank these T-scores for a certain metric for a given athlete scaled from 0-1
  - The spider graph for each athlete is essentially a ranked score for each metric from the T-score averages in the bar charts





The white boxes represent athletes' scores, and the black boxes represent team averages for each metric
Red slices represent force, blue slices represent propulsive, yellow slices represent braking, green slices represent output, and purple slices represent conditioning metrics.

FURTHER AVENUES FOR EXPLORATION

There are many different avenues that you could explore from this point in time. There is an incredible amount of data that lies within the training that goes on with Purdue Athletes, and it's almost impossible for a small team like this to get to all of it. With this being said, here are a few possible avenues to explore.

- Explore the Hawkins' data over a span of time. You could check to see if the training is effective, and when it's most effective.
- Checking if it's possible to correlate the TSA to in game performance, but this would be extremely difficult due to the number of confounding variables that affect sports.
- Explore how different exercises in the weight room correlate to changes in the Hawkins metrics or TSA Score.
- Creating a dashboard so you don't have to create the TSA manually.
- Expanding the project to different sports.

These obviously aren't the only possible paths this project could take in the future, but they are great ideas in general.

References and Acknowledgements

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