Predictive Analytics in Sports

Using NBA Statistics Data to Gain a Competitive Edge and Optimize Performance

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DSI508 Capstone

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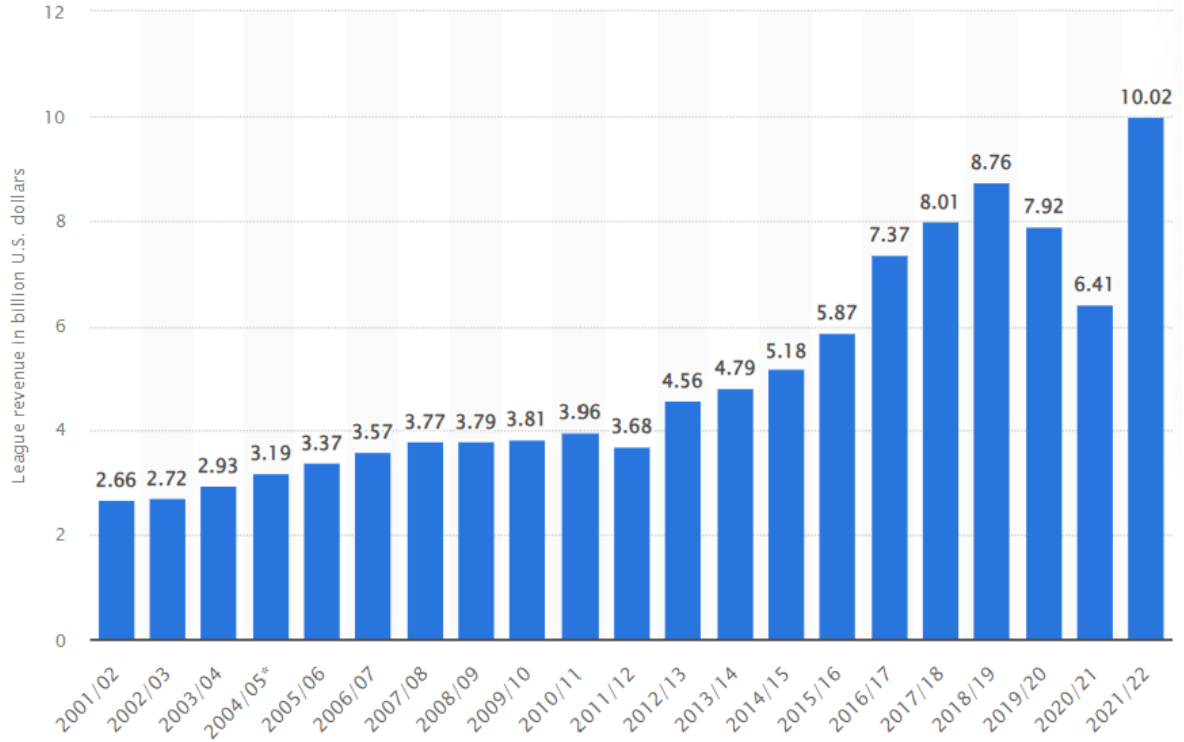
Problem Statement

Background

The NBA has experienced a remarkable **surge in popularity** over the past few decades, solidifying its position as one of the world's premier sports leagues. Following a decrease in revenue due to the COVID-19 pandemic, the league set a revenue record of **$10B in 2022**.



Problem Statement

Background

The NBA has experienced a remarkable **surge in popularity** over the past few decades, solidifying its position as one of the world's premier sports leagues. Following a decrease in revenue due to the COVID-19 pandemic, the league set a revenue record of $10B in 2022[1,2].

Client and Issue

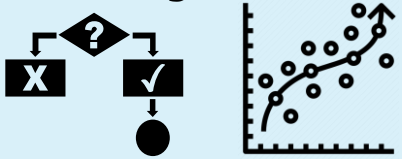
NBA Team Management recognizes the importance of data-driven insights and advanced analytics to remain competitive and devise effective strategies.

With rising revenues, smart **financial forecasting** and management are essential for ensuring long-term success and sustainability.

Objective

The objective is to help NBA Team Management project and account for **salary negotiations** that are bound to take place with top or upcoming players.

With this, we will also identify opportunities for teams that will **optimize player performance** and team success by efficiently allocating resources.



Methodology & Analysis

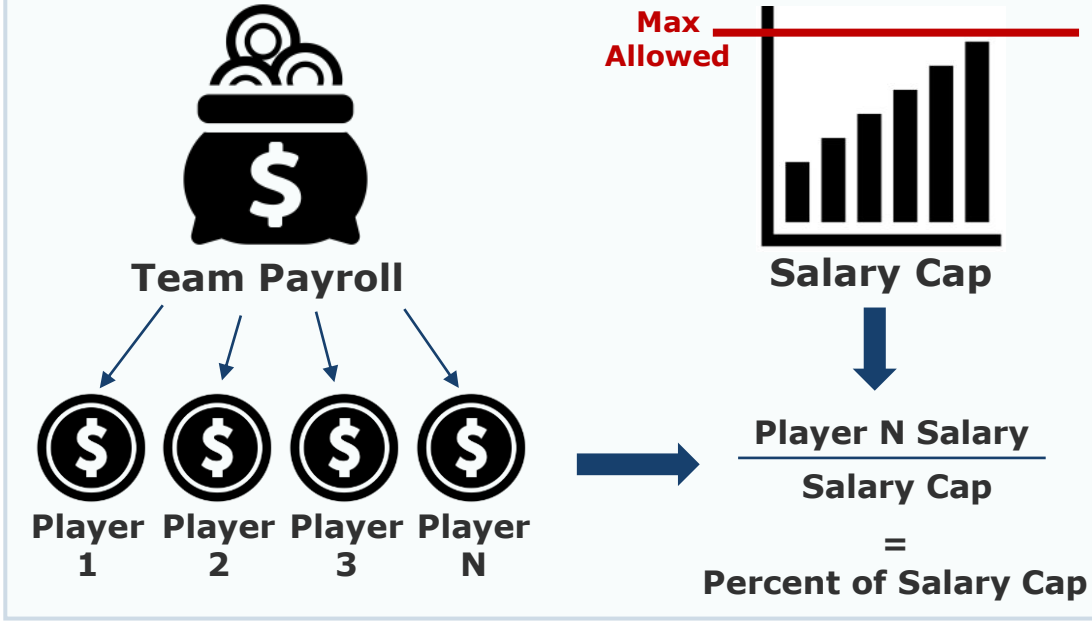
- Acquire data via statistics **webscraping**
- Conduct **exploratory data analysis**, cleaning, and feature engineering/ data transformation
- Build and test various **regression and classification** models
- Evaluate with **special error metrics**

1. https://www.premiumtimesng.com/promoted/596711-exploring-the-reasons-behind-the-success-of-the-nba.html/
2. https://randerson112358.medium.com/how-the-nba-uses-data-analytics-6eac3c43a096

Predictive Model Targets and Data

1. All-NBA Team Voter Share and Selection

2. Player Salaries Based on Performance

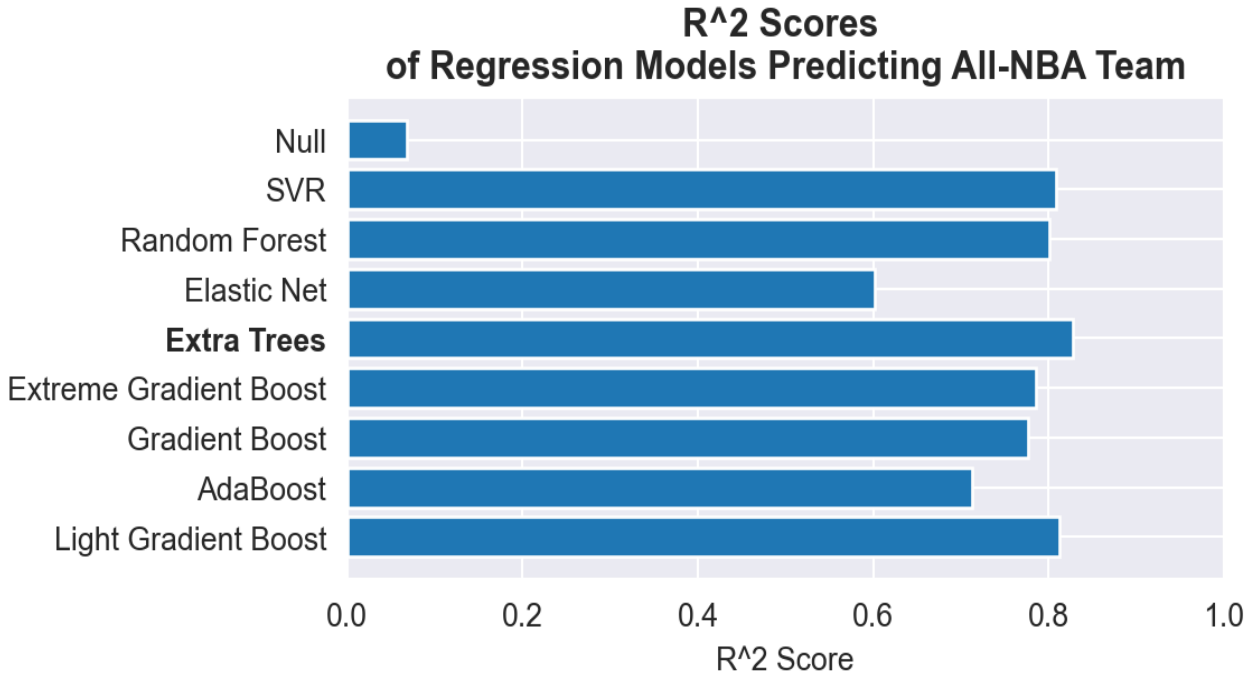


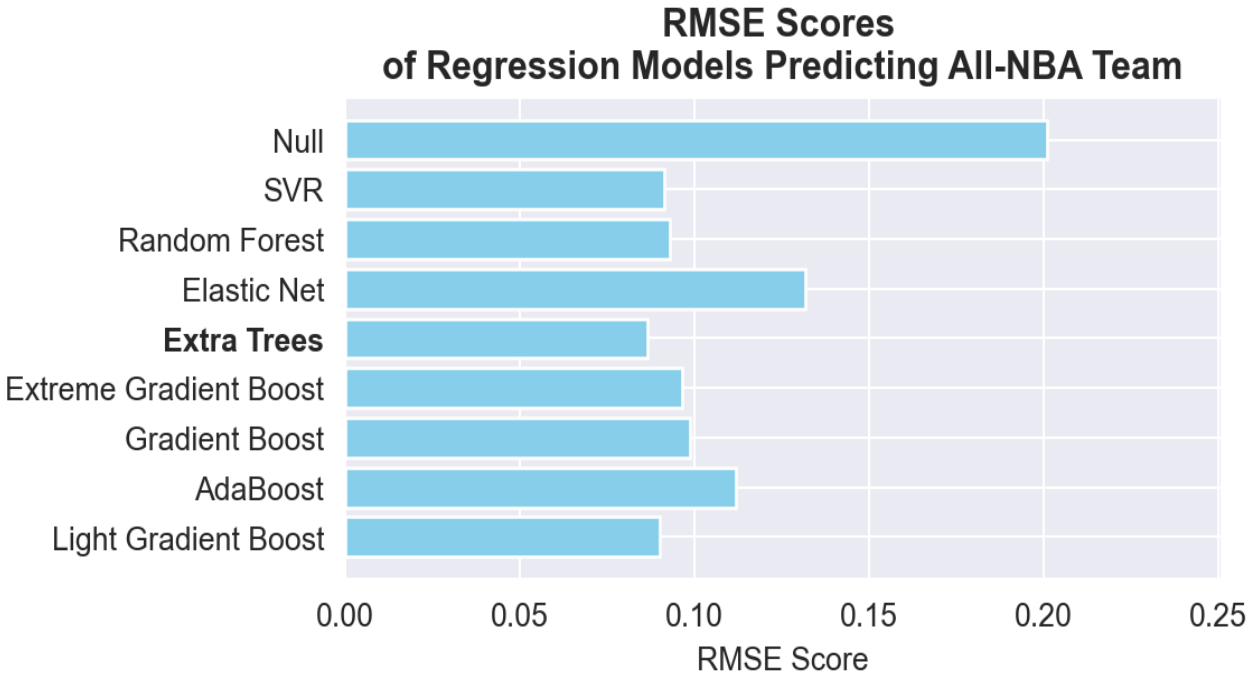
Data Scraped:	Player Performance:	Team:	Financial:	Other:
	Advanced, Per-Game, Totals	Team Rank, Team Payroll	Salary, Salary Cap	All-Star Selection, Draft Year

Predicting All-NBA Team – Part I

Regression

- **Purpose:** Predict voter share to ultimately use for ranking the Top 15 players
- **Models Fit:** 8 total





All models performed better than the null model. Before selecting one, we wanted to be critical about our evaluation metrics and assure those were optimal.

Predicting All-NBA Team – Part I

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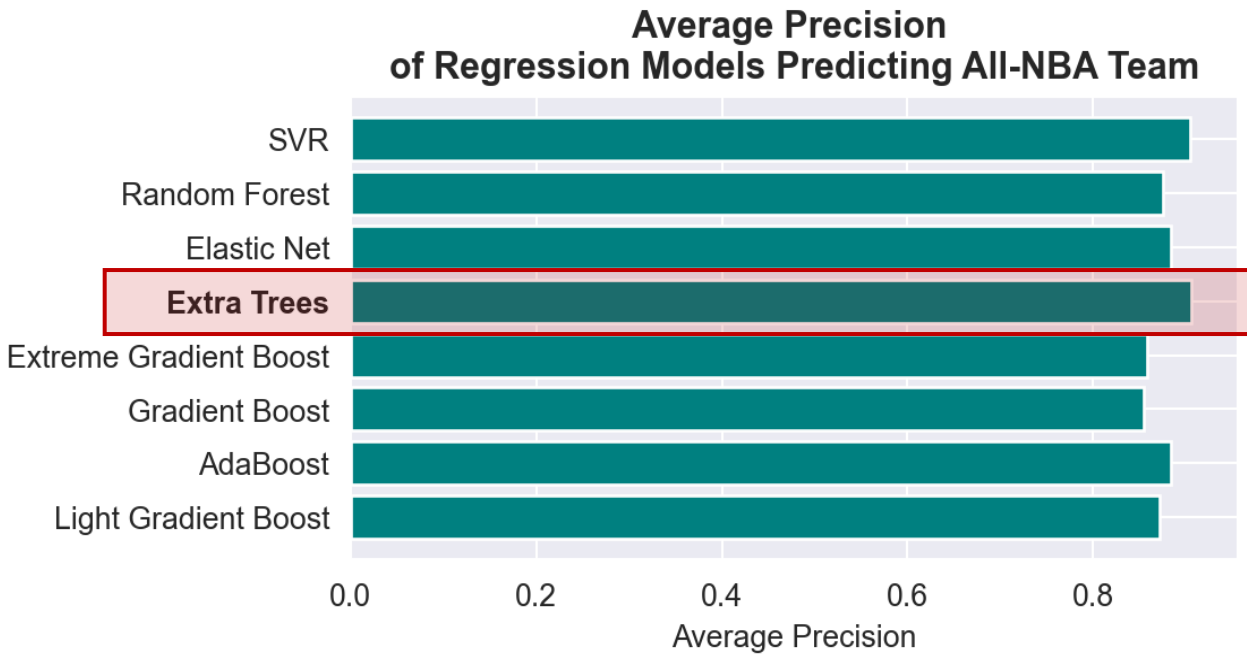
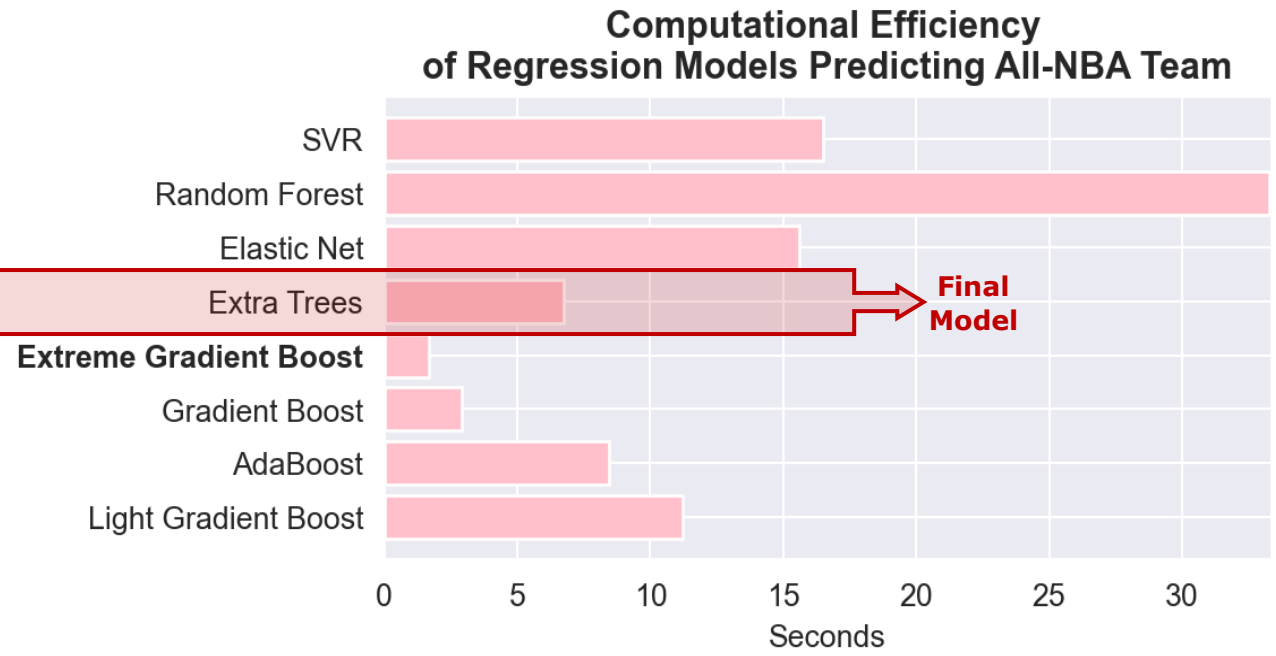
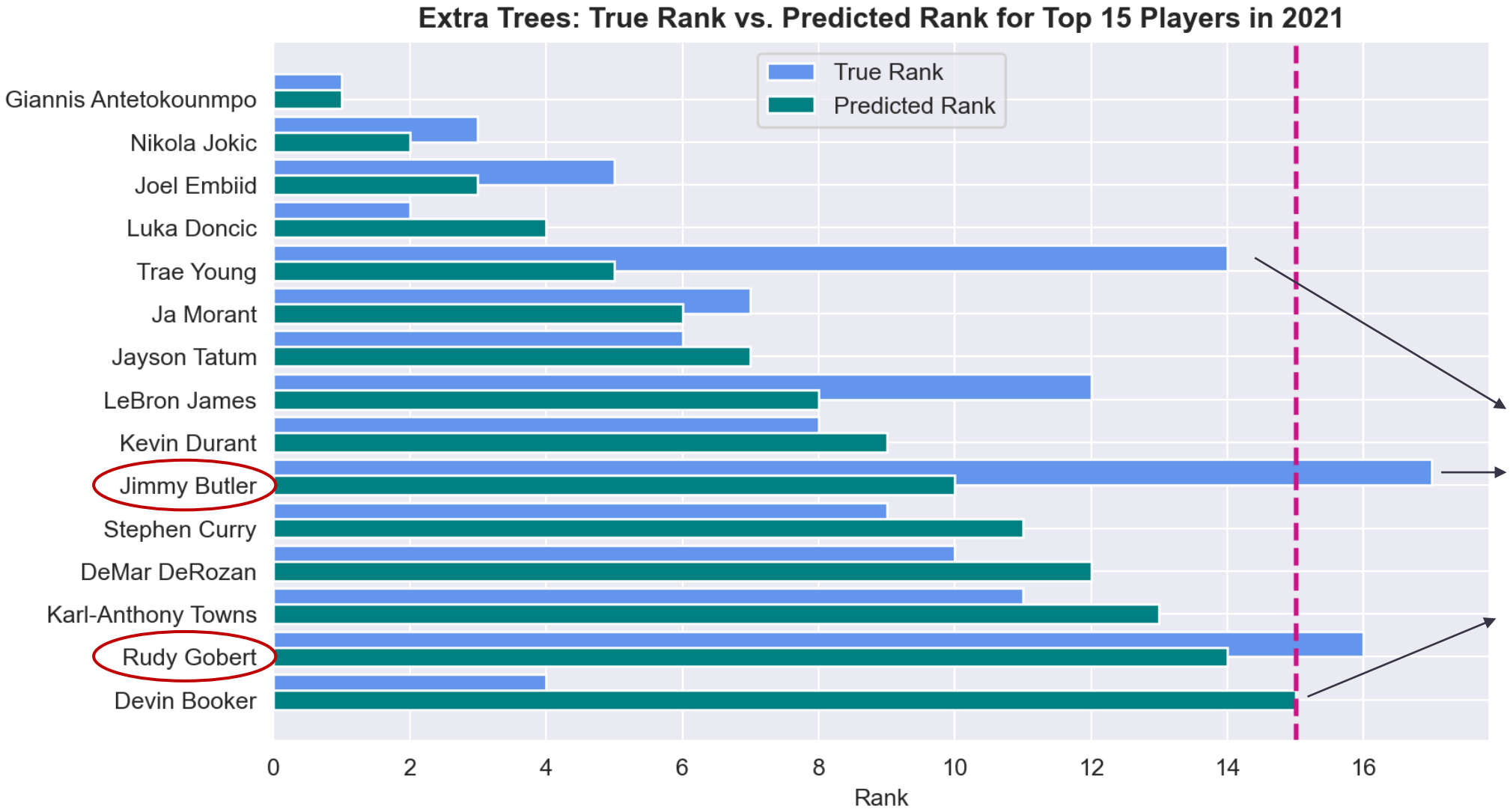




Our Average Precision Scores were high for all models, we were able to successfully predict most of the Top 15 All-NBA winners using Voter Share.

Predicting All-NBA Team – Part I

Rankings Achieved

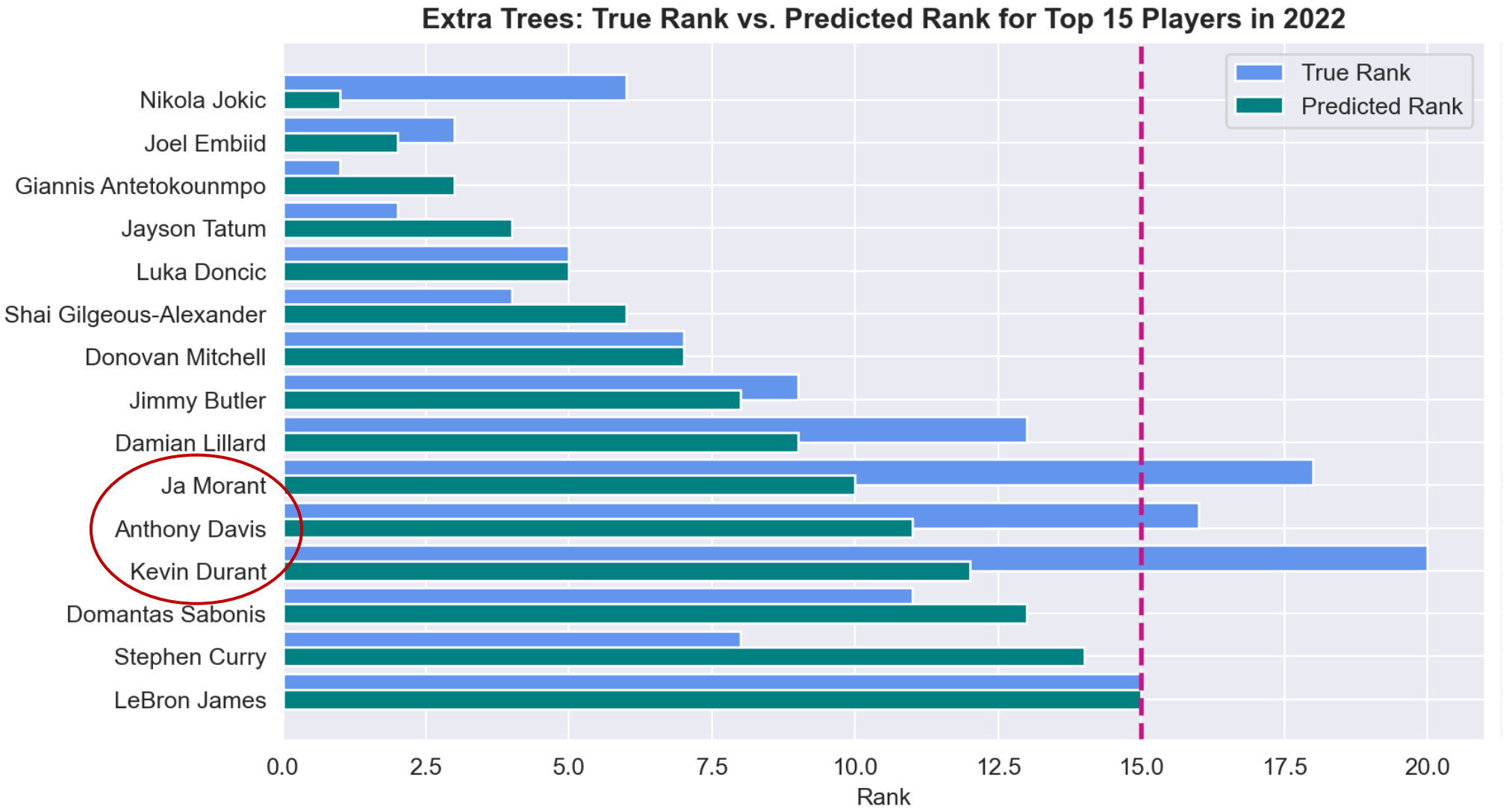


We predicted 13 of the Top 15 correctly.

While we successfully predicted most of the Top 15 players, some of our rankings are quite off, suggesting that more was at play than just performance statistics when making these decisions.

Predicting All-NBA Team – Part I

Ranking Achieved

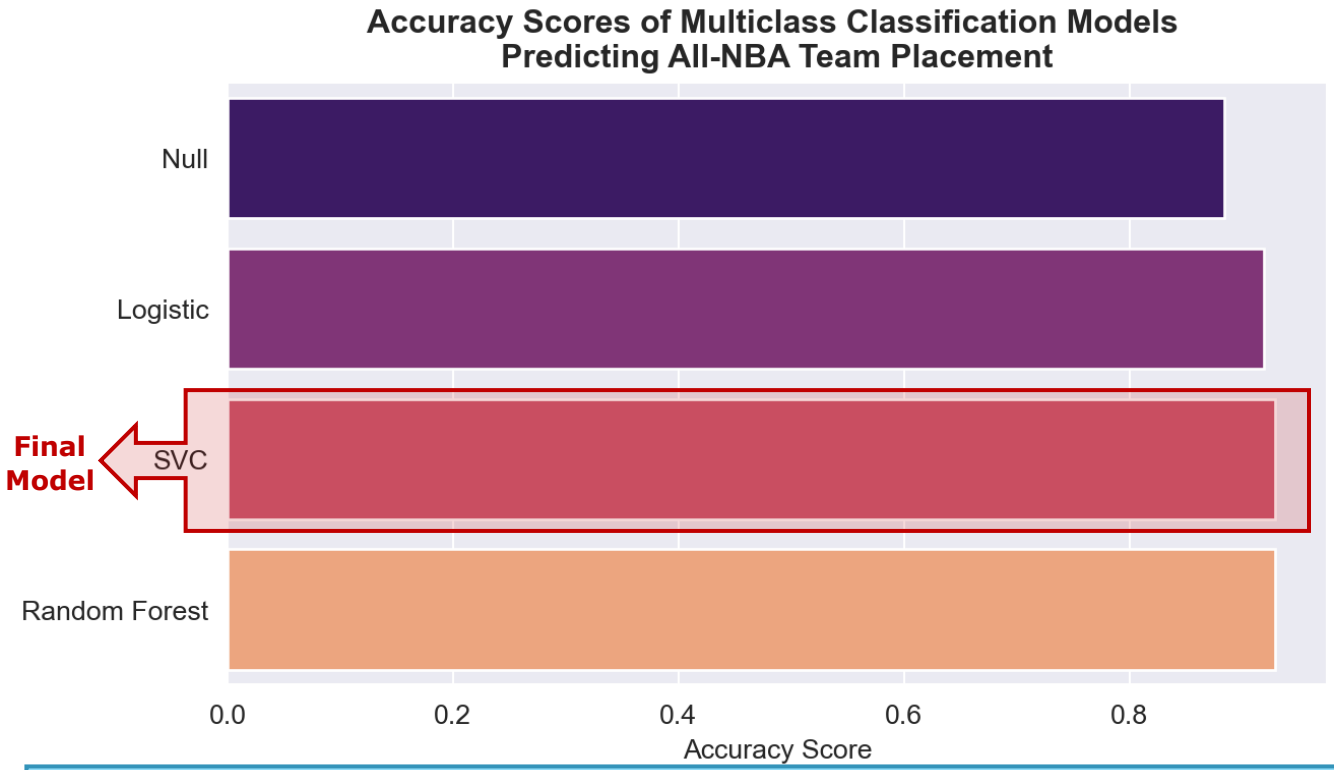


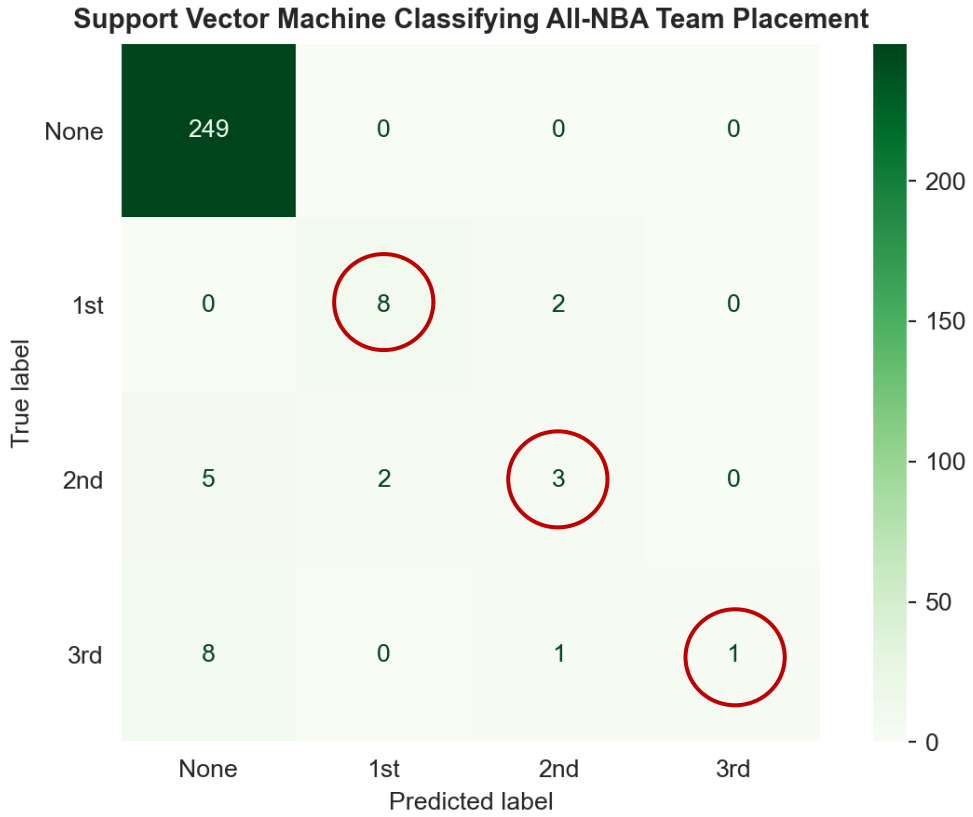
We predicted 12 of the Top 15 correctly.

Predicting All-NBA Team – Part II

Multi-Class Classification

- **Purpose:** Predict whether a player is categorized as 1st, 2nd, or 3rd Team All-NBA
- **Models Fit:** 3 total



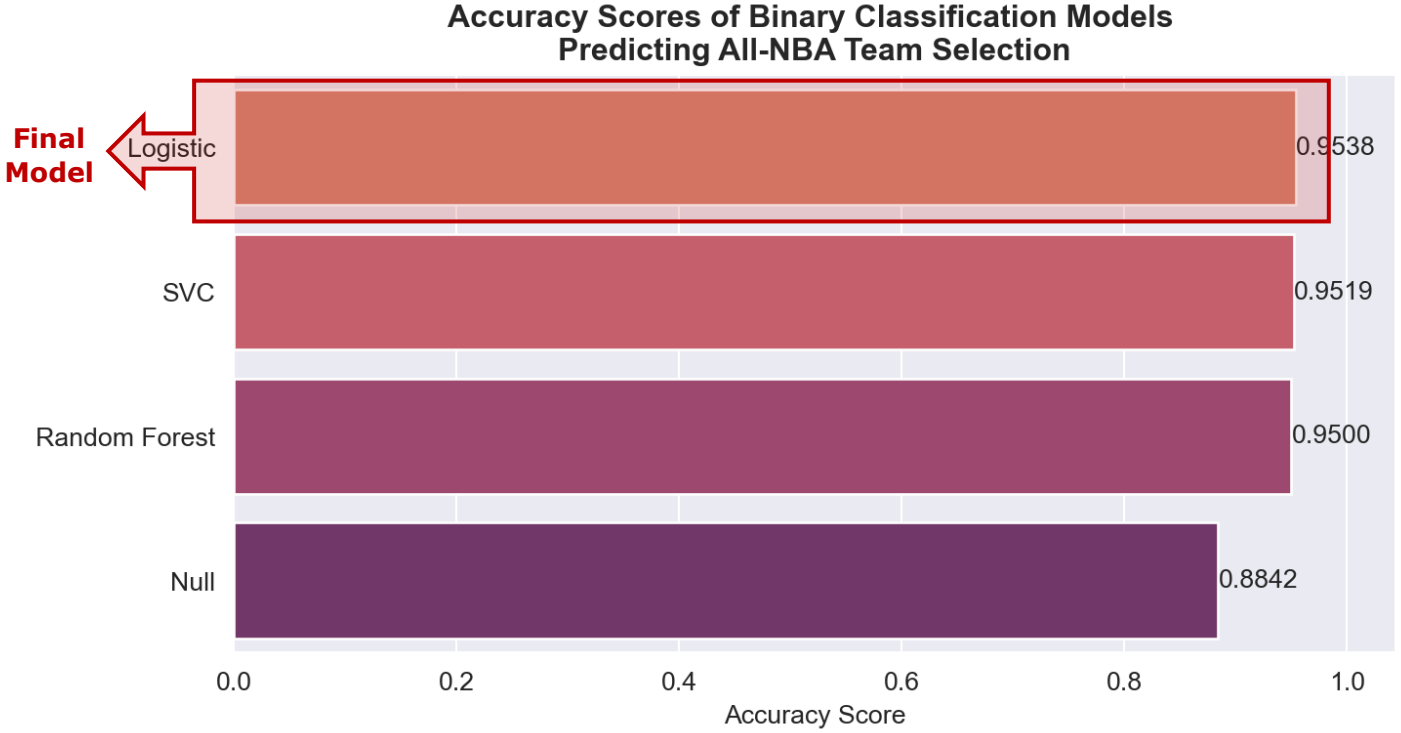


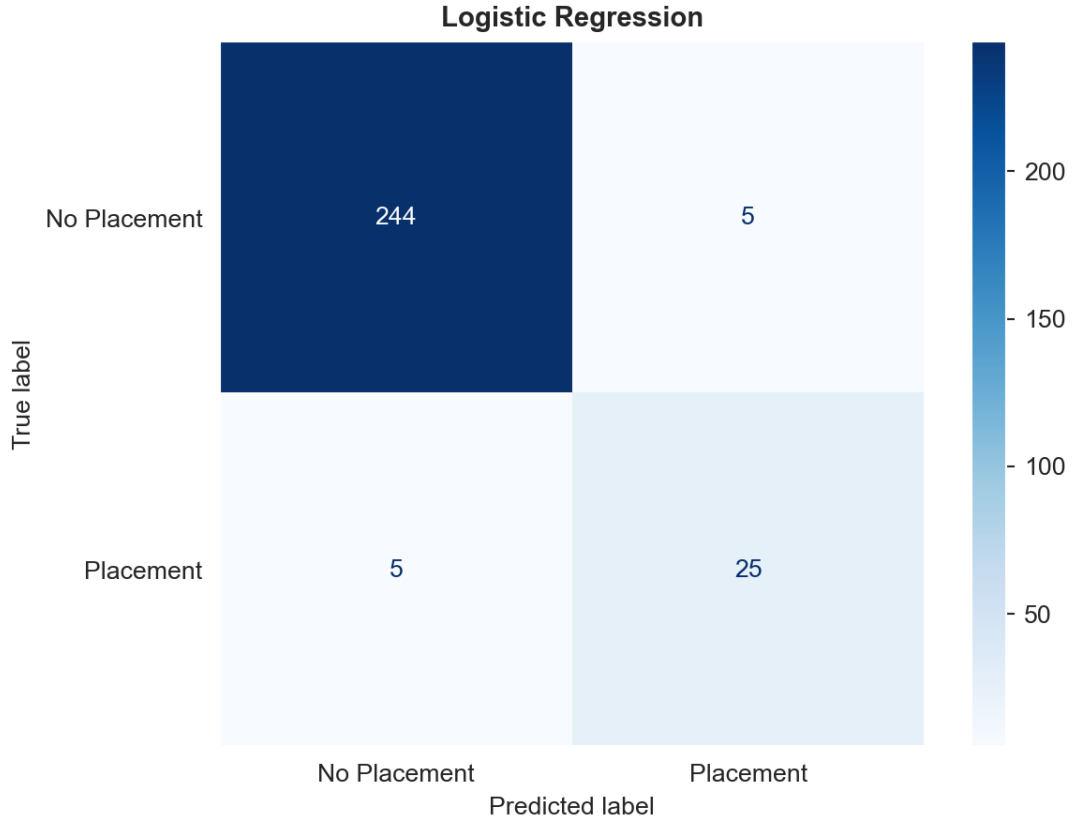
While the accuracy of our multiclass classification outperformed the baseline model, granular All-NBA Team placements contained much misclassfication. This is an opportunity to conduct other types of analysis beyond statistics to see if additional nuances are captured.

Predicting All-NBA Team

Binary Classification

- **Purpose:** Predict whether a player is selected to the All-NBA Team or not
- **Models Fit:** 3 total

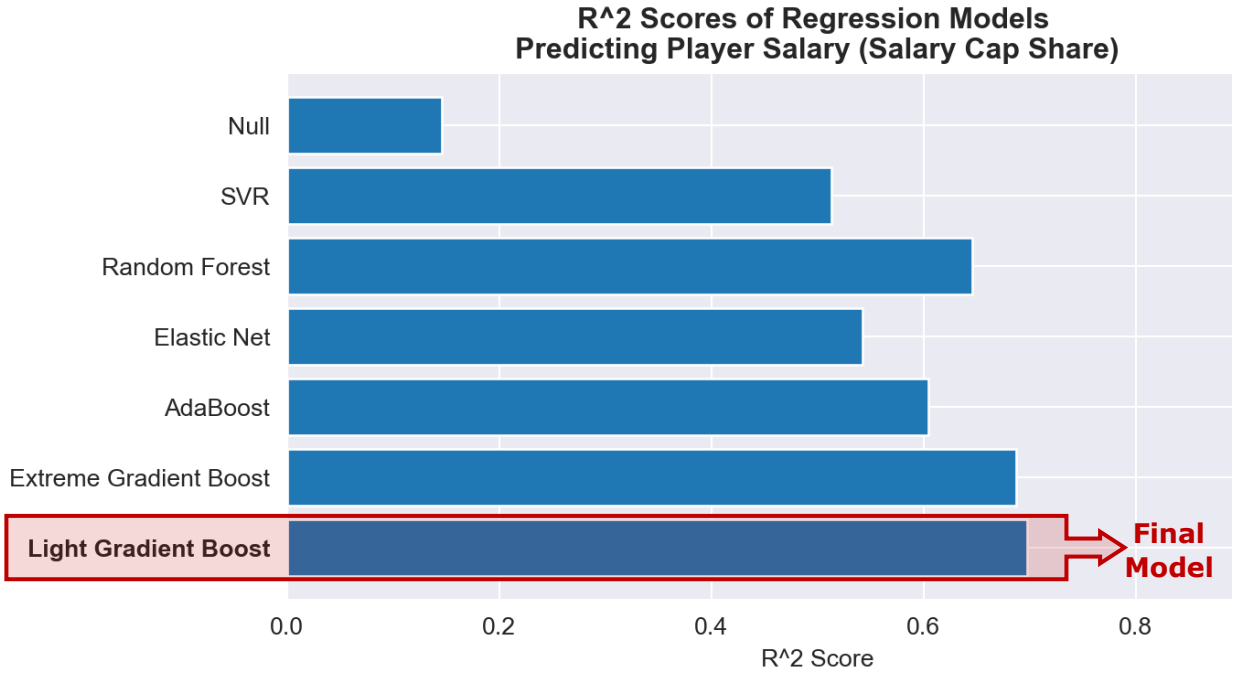


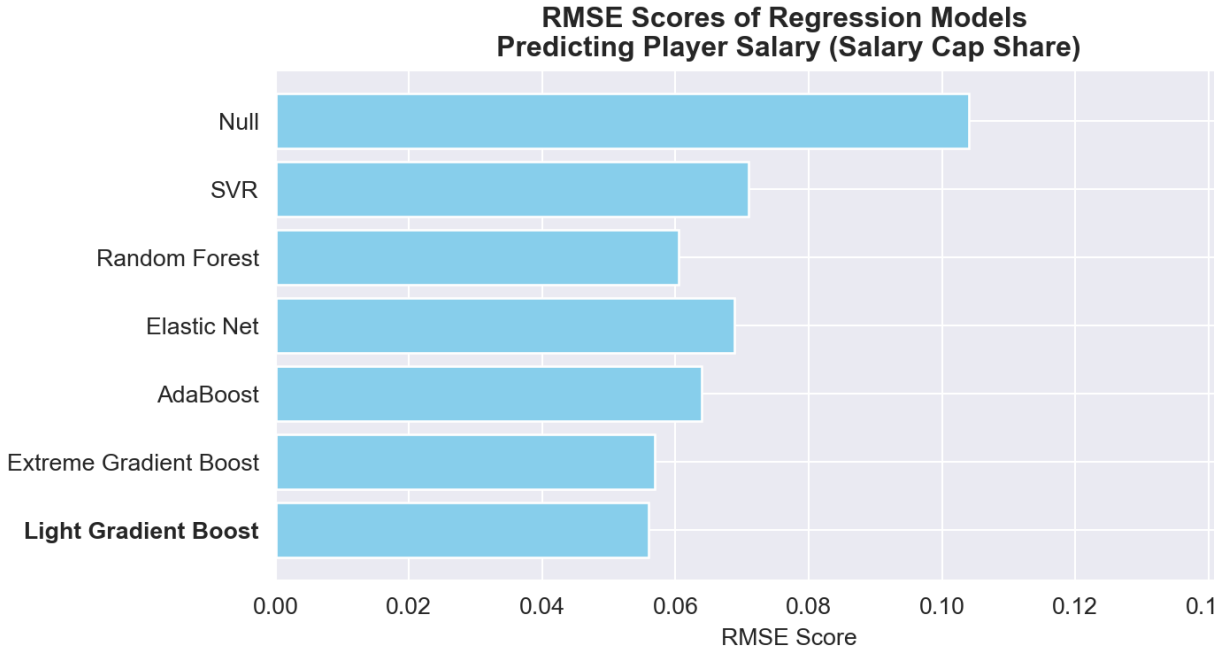


Predicting Player Salaries – Part I

Regression

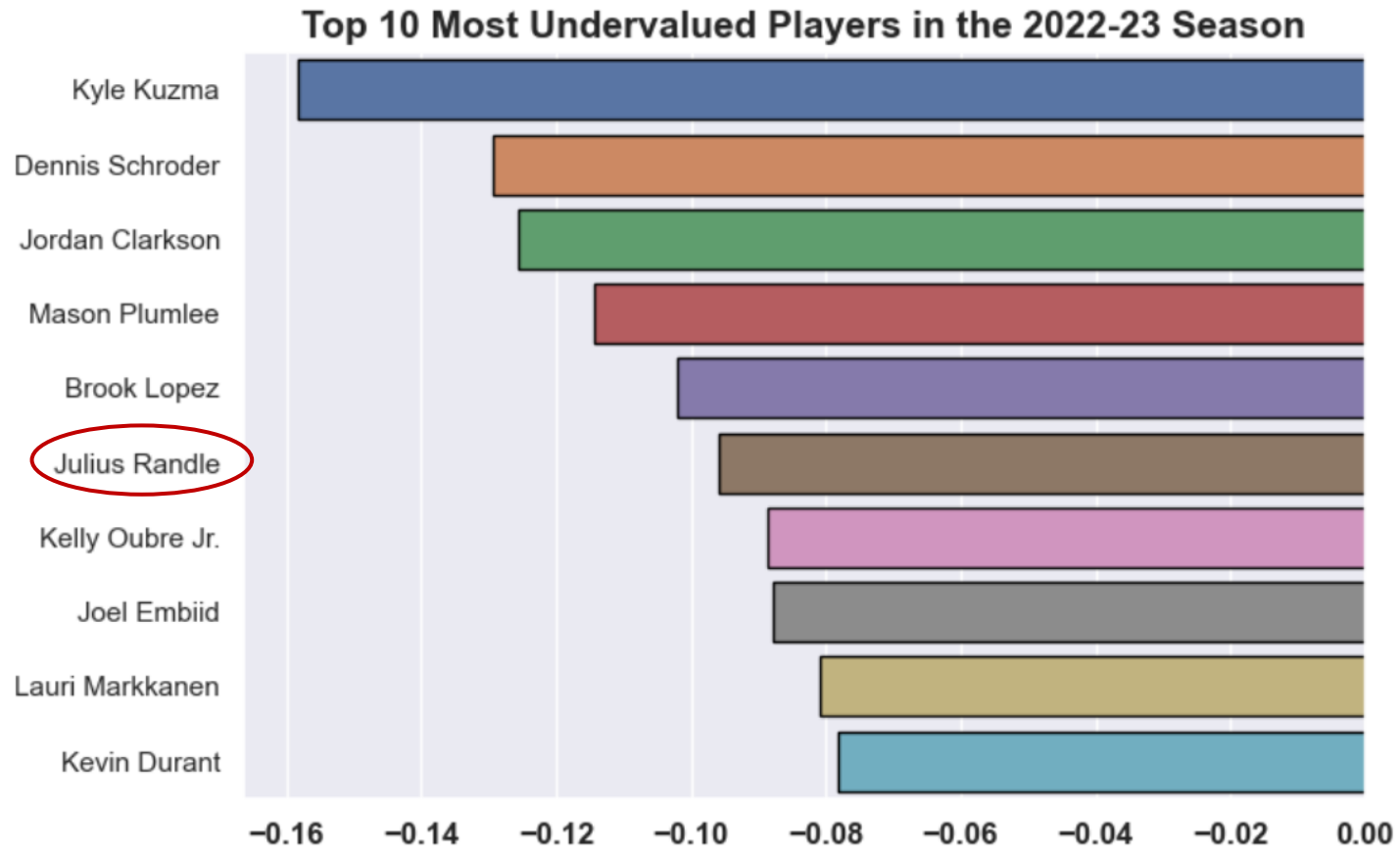
- **Purpose:** Predict the percent of salary cap per player salary to evaluate players who are under- or overvalued
- **Models Fit:** 9 total (only 6 shown below)





Predicting Player Salaries – Part II

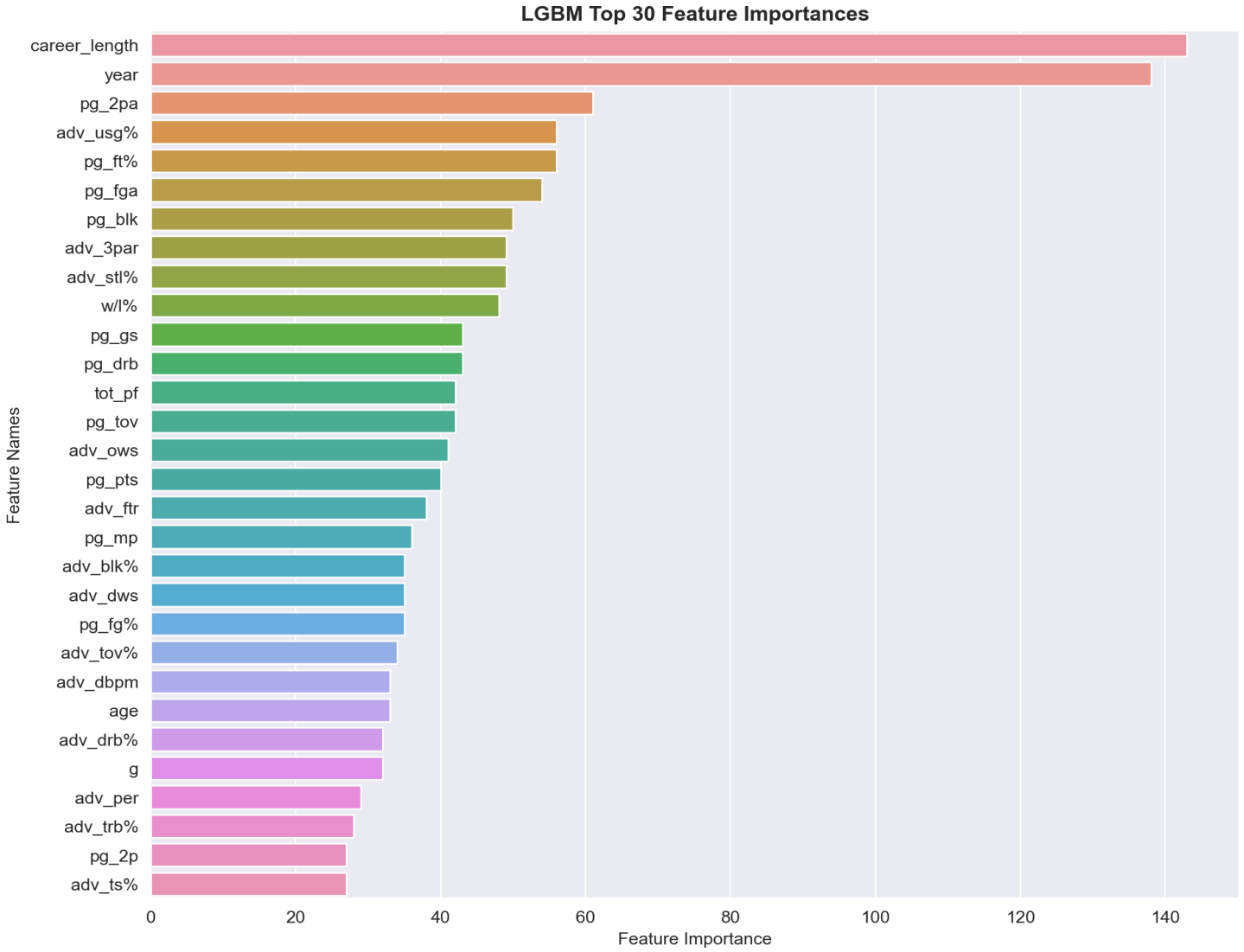
Valuing Players



With our predicted salaries (percent of cap share), which are built mainly on play performance statistics, we can compare between the actual salaries and our predictions to roughly determine the valuation of a player. Mainly role players on large and successful teams are undervalued.

Predicting Player Salaries – Part III

Regression



An important feature in predicting player salaries was career length. Coaches and players can leverage this information by strategizing contract negotiations and making informed decisions about player development, roles, and responsibilities.

Summary of Insights

While undertaking this analysis, many insights were produced. The key insights for NBA team management and executives, as they plan to use data to derive effective management strategies, include:

1. Granular player classification among the Top 15 players is **subject to much misclassification**. At this level, more holistic aspects of a player and their team get considered.

    a) There is an opportunity here for **sentiment analysis**, or deriving **interaction variables**, or statistics not typically captured in standard sports statistics.

2. Extra attention should be given to **role players**, who are often undervalued and greatly contribute to team success.

3. The most important features in predicting player salary include career length, season, and traditional performance metrics such as free throw percentage, blocks, and field goals attempted. Salary appears to be more **dependent on the "basics", traditional statistics**.

4. The most important features in predicting All-NBA Team selection include the value over replacement player and whether or not the player made the All-Star team in the middle of the season. All-NBA Team selection **appears to me more dependent on advanced statistics**.

Summary of Recommendations

Based on the insights derived from this analysis, we propose the following key recommendations for NBA team management.

These strategic actions will enhance team performance and enable proactive financial planning and informed decision-making for building and maintaining a robust team. We recommend the NBA managers use our model for the following areas:

Recommendation	Area	Action
1	**Player Retention Strategies**	Identify key players whose **performances surpass expectations** and implement retention strategies to secure their long-term commitment to the team. Recognizing and valuing exceptional talent will promote team loyalty and stability.
2	**Leverage Player Valuations for Proactive Engagement**	• Focus on **undervalued players**, as predicted by our model, and role players. • Use our model to **negotiate fair compensation** or put additional clauses in player contracts that make it clear their contributions are valued.
3	**Long-Term Contract Decisions**	Utilize the model's **player performance and salary projections**, coupled with factors like current career length, to make well-informed decisions on long-term contracts.

Summary of Recommendations

Based on the insights derived from this analysis, we propose the following key recommendations for NBA team management.

These strategic actions will not only enhance team performance but also enable proactive financial planning and informed decision-making for building and maintaining a robust team. We recommend the NBA managers use our model for the following areas:

Recommendation	Area	Action
4	**Salary Cap Management**	Examine the model's actual vs. predicted salaries and find a balance between player compensation and performance expectations to ensure **optimal resource allocation**.
5	**Player Development Strategies**	Use our model to organize players statistics and implement **targeted player development** programs to help players focus on areas they are struggling.

Questions?