

NBA Data Analysis and Prediction

Milestone: Performance Evaluation and Interpretation

Group 11

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1. Problem Setting

The NBA is the biggest and the most well-known basketball league in the world. Since basketball is a sport of scoring, the statistical data of all players in the league was carefully tracked by the NBA and saved on their website, which provides an opportunity for analysts to study the players and the sport itself. In the NBA, there are some major awards for players and teams, such as MVP, DPOY, ROY, SMOY, and the championship. Thus, in this project, we want to build supervised learning models on the NBA data and finally predict the award winners, future players' stats, and more.

2. Problem Definition

- a. For the MVP, DPOY, and ROY awards, is there a pattern that is based on stats?
- b. Who is going to win the MVP, DPOY, ROY, and SMOY awards this year?
- c. How should a team perform to succeed in the playoffs?
- d. Can a machine predict a player's stat of next year based on the current stats?

3. Data Sources

https://github.com/gmalim/NBA_analysis

4. Data Description

The data contains the following:

- a. Players' basic stats (points, rebounds, assists, etc.) from 1999-2000 season to 2019-2020 season.
- b. Players' advanced stats from 1999-2000 season to 2019-2020 season.
- c. Separated basic stats for all-star players (1999-2000 season to 2019-2020 season).
- d. Separated basic stats for rookies (1999-2000 season to 2019-2020 season).
- e. MVP, DPOY, ROY voting results from 1999-2000 season to 2019-2020 season.
- f. SMOY voting results for 2018-2019 season to 2019-2020 season.
- g. NBA team stats from 1999-2000 season to 2019-2020 season

Each dataset contains the data of every player involved in that category, e.g., every player in the league for player basic stats and every player who got at least a score in MVP voting for MVP voting result dataset, to name a few.

5. Data Collection and Preprocessing

For this part, we performed the following steps on the data:

- a. Read the data into different dictionaries, separated by the award, e.g., MVP data is stored in MVP_dict, where the keys are the year to the season and the values are the dataframes.
- b. Combine the advanced stats of the players onto the data stored in step a.
- c. Drop the duplicated columns in the advanced dataset and the award datasets.
- d. Drop the irrelevant columns that we think do not represent the performance of a player, such as team names, player names, and position.
- e. Fill the NA values with 0, since the NA values appear only on the three-point percentage column because the player has not taken a three-point shot in the whole season.
- f. Combine the data from each year for each award and put the 'share' column on the last position, because the score share will be our target variable for future analysis.
- g. Output the big datasets for each award as CSV files.

6. Data Exploration and Visualization

For the exploration and visualization part, in order to get a better understanding of the data, we created the following plots:

- a. The heatmap of the whole dataset, to visualize the correlation between each variable.
- b. The distribution plot of the stats (win-share, points per game, etc.) of the players in the MVP discussion and the rest of the players, to visualize how the MVP players differ from the rest of the league.
- c. Line charts showing the most popular players' performance throughout their career (LeBron James, Stephen Curry, Kobe Bryant, etc.)
- d. The scatter plot of OBPM/DBPM DPOY and MVP candidates separated from other players.

7. Model Exploration and Model Selection

For model exploration and selection part, we want to apply several models and several data preprocessing tools onto the dataset for prediction.

The model we applied are listed as the following:

- a. Linear Regression
- b. Kernal SVM
- c. KNN Regression
- d. Random Forest
- e. Neural Network

We will also explore probabilities of preprocessing tools that might increase model performance such as clustering, PCA and K-fold method.

After trying all the probabilities, we will evaluate the performance using RMSE analysis and select the model that yields the best result.

8. Implementation of Selected Models

For implementation, we first split the dataset in a special way. Since every season has its own vote share for the award candidates, we separate the dataset by year, standardize each individual dataset, split the dataset into training set and test set, and finally combine them for the dataset for the implementation of models.

After the preprocessing is done, we implement the model, acquire the regression error, and draw the regression lift chart to evaluate model performance.

9. Performance Evaluation and Interpretation

For performance evaluation and interpretation, we split this part into two separate parts, one for our regression model which predicts the win share of each award, the other one for the classification model for who would get nominated to be the award candidates. For regression interpretation, we simply used the RMSE to evaluate the performance, for classification interpretation, we listed the accuracy score for every model and drew the lift chart for the model that applies e.g., logistic regression, neural network.