ai-nba-predict: Predicting the NBA Champion

Project Members

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I. Introduction

The National Basketball Assosciation (NBA) is a North American basketball league made up of 30 teams. Every year from October to April, the teams compete in a regular season tournament of 82 games each, in order to determine their seeding in the playoffs. The top 8 teams in each conference are placed in the playoff bracket, where the eventual winner is crowned the NBA Champion.

Because we follow the NBA it would be great if we could predict the champions of the future seasons. On the one hand its just for our interest. On the other hand, if our prediction succeeds, we could start betting on the prediction. The final goal is to predict the champion of the next season by analyzing the past 40 years and find patterns, with the help of AI, with which we can predict future champions.

II. Dataset

Like many sports leagues, the NBA tracks and records various statistics from all of their games. These statistics range from simple statistics such as win percentage, to advanced statistics such as effective field goal percentage. Baksetball Reference provides a massive collection of NBA statistics from team stats to individual player statistics.

The dataset that we used for our project was provided by JK-Future-Github, who used a web crawler to collect data from Basketball Reference. He also added additional features such as Top_3_Conference, which describes whether the team finished within the top 3 in their respective conference. We removed seasons before 1980, as that was the year when the 3 point line was introduced, and the 2023 season, as the data collected from that season was from an incomplete season.

III. Methodology

i. Algorithms

We decided to use different regression algorithms and compare the results of each algorithms predictions. The two algorithms that we chose were Gradient Boosting and Random Forest.

We used the libraries provided by XGBoost and scikit-learn:

```
import pandas as pd
import matplotlib.pyplot as plt
```

```
import numpy as np
import random
from xgboost import XGBRegressor
from sklearn.ensemble import RandomForestRegressor
from sklearn.metrics import mean_squared_error
import shap
```

ii. Training and Test Data

First, we divided the dataset into training and test data. Instead of a complete random splitting of the dataset, we decided to randomly select two seasons from each decade. The reasoning behind this method is because the NBA game has evolved with time, causing changes in playstyles which altered which skillsets were considered valuable to winning. For example, the modern NBA has seen the rise and absolute necessity of having good three point shooting, whereas in previous eras the three point shot was considered an inefficient shot.

```
#Read CSV and drop empty values
nba stats = pd.read csv('nba team data.csv')
nba_stats = nba_stats.dropna()
#Create feature columns
exclude_columns = ['season', 'name', 'conference', 'Champion_Win_Share']
feature_columns = [col for col in nba_stats.columns if col not in
exclude_columns]
random seed = 12345
random_seed(random_seed)
#Split by randomly selecting 2 Seasons each decade and save in train_set
and test_set
nba_stats['season'] = nba_stats['season'].astype(str)
nba_stats['Decade'] = nba_stats['season'].apply(lambda x: x[:3] + '0')
unique_decades = nba_stats['Decade'].unique()
train_set = pd.DataFrame()
test_set = pd.DataFrame()
for decade in unique_decades:
    decade_data = nba_stats[nba_stats['Decade'] == decade]
    # Randomly select two seasons for the test set
    test_seasons = random.sample(list(decade_data['season']), k=2)
    test_set = pd.concat([test_set,
decade_data[decade_data['season'].isin(test_seasons)]])
    train_set = pd.concat([train_set,
decade_data[~decade_data['season'].isin(test_seasons)]])
train_set = train_set.drop(columns=['Decade'])
test_set = test_set.drop(columns=['Decade'])
#Save test season list
test_seasons = test_set['season'].unique()
```

iii. Target Feature

The target feature is Champion_Win_Share. This is defined to be the total wins that a team gets in the playoffs divided by the max number of wins that a team can get (16 wins). A team with a greater number of playoff wins will have a higher Champion_Win_Share, and be considered to be more successful. The championship team will have a value of 1.

The end goal will be use a single season's data on our model to estimate each team's Champion_Win_Share. The team with the highest Champion_Win_Share will be considered as the winner of that NBA season.

```
#Create the feature and target sets
X_train = train_set[feature_columns]
y_train = train_set['Champion_Win_Share']
X_test = test_set[feature_columns]
y_test = test_set['Champion_Win_Share']
```

iv. Model Fitting and Predictions

We then trained our model and made predictions with the test dataset.

```
# Set random seed for models
random_seed = 21
random.seed(random_seed)

xgb_model = XGBRegressor(random_state=random_seed)
xgb_model.fit(X_train, y_train)

rf_model = RandomForestRegressor(random_state=random_seed)
rf_model.fit(X_train, y_train)

xgb_predictions = xgb_model.predict(X_test)
rf_predictions = rf_model.predict(X_test)

test_set['XGB_Predicted_Champion'] = xgb_predictions
test_set['RF_Predicted_Champion'] = rf_predictions
```

IV. Evaluation and Analysis

i. Root Mean Squared Error

Calculations of the Root Mean Square Error of XBG and Random Forest suggested that the Random Forest algorithm was slightly more accurate than Gradient Boosting.

```
xgb_rmse = np.sqrt(mean_squared_error(y_test, xgb_predictions))
rf_rmse = np.sqrt(mean_squared_error(y_test, rf_predictions))
```

```
print("XGBoost Mean Squared error:")
print(xgb_rmse)
print("Random Forest Mean Squared error:")
print(rf rmse)
```

XGBoost Mean Squared error: 0.16948661337862525 Random Forest Mean Squared error: 0.14994427109053007

ii. Prediction Results

We tested each NBA season from our test dataset for both models, and received the following results:

```
for season in test_seasons:
   print(f"\nResults for {season} Season:")
   xgb output = test set[(test set['season'] == str(season))][['name',
'XGB_Predicted_Champion','Champion_Win_Share']].sort_values(by='XGB_Predic
ted_Champion', ascending=False).head(8)
   print("XGBoost Predictions:")
   print(xgb_output)
    rf_output = test_set[(test_set['season'] == str(season))][['name',
'RF_Predicted_Champion','Champion_Win_Share']].sort_values(by='RF_Predicte
d_Champion', ascending=False).head(8)
   print("\nRandom Forest Predictions:")
   print(rf_output)
```

Doc	ults for 2022 Season:			Doc	ults for 2021 Season:		
	RESULTS 101 2022 Season: RESULTS 101 2022 Season: KGBnost Predictions: KGBnost Predictions:						
AGDC	name	XGB_Predicted_Champion	Champion Win Share	AGD		KGB_Predicted_Champion	Champion Win Share
21	Golden State Warriors	0.932403	1.0000	32	Brooklyn Nets	0.636510	0.4375
3	Phoenix Suns	0.725190	0.4375	30	Phoenix Suns	0.503888	0.4373 0.8750
_							
23	Milwaukee Bucks	0.653609	0.4375	41	Boston Celtics	0.492383	0.0625
26	Miami Heat	0.576241	0.6875	49	Utah Jazz	0.436725	0.3750
16	Memphis Grizzlies	0.569955	0.3750	48	Milwaukee Bucks	0.429333	1.0000
19	Boston Celtics	0.395949	0.8750	34	Miami Heat	0.410697	0.0000
27	Philadelphia 76ers	0.303881	0.3750	37	Philadelphia 76ers	0.407649	0.4375
24	Utah Jazz	0.274240	0.1250	38	Denver Nuggets	0.396213	0.2500
Pane	dom Forest Predictions:			Dan	dom Forest Predictions		
Kanc		DE Brodisted Champion	Champion Win Share	Kan			Champion Win Sharo
21	name Golden State Warriors	RF_Predicted_Champion 0.732250	Champion_Win_Share 1.0000	27	name	RF_Predicted_Champion	Champion_Win_Share
				37	Philadelphia 76ers	0.637000	0.4375
23	Milwaukee Bucks	0.642542	0.4375	32	Brooklyn Nets	0.581208	0.4375
3	Phoenix Suns	0.619958	0.4375	30	Phoenix Suns	0.566417	0.8750
26	Miami Heat	0.516333	0.6875	49	Utah Jazz	0.559917	0.3750
16	Memphis Grizzlies	0.504500	0.3750	34	Miami Heat	0.541542	0.0000
27	Philadelphia 76ers	0.484708	0.3750	48	Milwaukee Bucks	0.499833	1.0000
19	Boston Celtics	0.469417	0.8750	38	Denver Nuggets	0.456292	0.2500
24	Utah Jazz	0.280000	0.1250	31	Los Angeles Clippers	0.397750	0.6250
D = =	.l+- f 2014 C			D = = :			
	ilts for 2014 Season:				ults for 2013 Season:		
XGBo	ost Predictions:	V00 0 11 1 1 01 1		XGB	oost Predictions:		
	name	XGB_Predicted_Champion	. – –		nam		
249	Oklahoma City Thunder	0.883442		271	Miami Hea		
253	Miami Heat	0.777698		290	Oklahoma City Thunde		
260	loc Angoloc Clinnons	a co10ac		200	Danuar Mussat	0 EE 43	22 0 1250
			4 /	/ 9			

∠0⊎	Los Angeles Clippers	A'001ARO	W.3/3W	290	Deliver Nuggers	W.334222	Ø.1230
246	Indiana Pacers	0.470598	0.6250	297	New York Knicks	0.535287	0.3750
269	Chicago Bulls	0.289826	0.0625	284	Brooklyn Nets	0.393295	0.1875
266 254	Toronto Raptors San Antonio Spurs	0.237718 0.224729	0.1875 1.0000	282 285	Boston Celtics Los Angeles Clippers	0.354804 0.354613	0.1250 0.1250
250	Golden State Warriors	0.203595	0.1875	278	Los Angeles Lakers	0.245232	0.0000
230	Gottach State Wall 1015	0.203333	011075	270	LOS Angeles Lukers	01243232	010000
Rand	om Forest Predictions:			Rand	om Forest Predictions:		
	name	RF_Predicted_Champion	Champion_Win_Share		name	RF_Predicted_Champion	Champion_Win_Share
249	Oklahoma City Thunder	0.725958	0.6250	271	Miami Heat	0.733208	1.0000
254	San Antonio Spurs	0.692792	1.0000	290	Oklahoma City Thunder	0.717292	0.3125
253	Miami Heat	0.691500	0.8125	291	San Antonio Spurs	0.661292	0.9375
260	Los Angeles Clippers	0.615167	0.3750	298 297	Denver Nuggets	0.564042	0.1250
246 269	Indiana Pacers	0.474833	0.6250	284	New York Knicks	0.559750	0.3750
259	Chicago Bulls Houston Rockets	0.353542 0.239667	0.0625 0.1250	282	Brooklyn Nets Boston Celtics	0.420250 0.369875	0.1875 0.1250
258	Brooklyn Nets	0.217167	0.3125	285	Los Angeles Clippers	0.280000	0.1250
	,						
Resu	lts for 2006 Season:			Resu	ults for 2005 Season:		
	ost Predictions:			XGBo	oost Predictions:		
	name :	KGB_Predicted_Champion (Champion_Win_Share		name XG	B_Predicted_Champion Ch	ampion_Win_Share
488	Detroit Pistons	0.639705	0.6250	510	Miami Heat	0.729509	0.6875
503	Miami Heat	0.624961	1.0000	512	Dallas Mavericks	0.573328	0.3750
484	San Antonio Spurs	0.606858	0.4375	533	San Antonio Spurs	0.572287	1.0000
481	Dallas Mavericks	0.529078	0.8750	514	Detroit Pistons	0.561145	0.9375
480	Phoenix Suns	0.525985	0.6250	528	Phoenix Suns	0.437242	0.5625
501	Cleveland Cavaliers	0.525163	0.4375	516 520	Chicago Bulls Houston Rockets	0.343127	0.1250
489 507	New Jersey Nets	0.264907	0.3125	527		0.323569 0.236380	0.1875 0.0625
307	Indiana Pacers	0.263731	0.1250	327	Denver Nuggets	0.230380	0.0025
Rand	om Forest Predictions:			Rand	dom Forest Predictions:		
		RF_Predicted_Champion Ch	hampion_Win_Share			RF_Predicted_Champion C	hampion_Win_Share
484	San Antonio Spurs	0.723625	0.4375	510	Miami Heat	0.727042	0.6875
503	Miami Heat	0.626250	1.0000	514	Detroit Pistons	0.594667	0.9375
488	Detroit Pistons	0.586500	0.6250	533	San Antonio Spurs	0.551083	1.0000
481	Dallas Mavericks	0.491250	0.8750	512	Dallas Mavericks	0.504583	0.3750
501	Cleveland Cavaliers	0.470292	0.4375	528	Phoenix Suns	0.485750	0.5625
480	Phoenix Suns	0.425833	0.6250	516	Chicago Bulls	0.433583	0.1250
495	Chicago Bulls	0.207917	0.1250	520	Houston Rockets	0.213708	0.1875
492	Memphis Grizzlies	0.192333	0.0000	521	Seattle SuperSonics	0.192792	0.3750
Pocul	lts for 1997 Season:			Deci.	lts for 1992 Season:		
	its for 1997 Season:			nesu	tts for 1992 Season.		
	net Predictions:			XGRoo	nst Predictions:		
XGBOO	ost Predictions:	XGB Predicted Champion	Champion Win Share	XGBoo	ost Predictions:	XGB Predicted Champion	Champion Win Share
	name				name	= = :	
759 756		XGB_Predicted_Champion 1.066725 0.759611	1.000000	897		1.015030	1.000000
759	name Chicago Bulls	1.066725	1.000000	897 891	name Chicago Bulls	1.015030 0.546900	1.000000
759 756	name Chicago Bulls Houston Rockets	1.066725 0.759611	1.000000 0.600000 0.400000 0.533333	897 891 902 885	name Chicago Bulls Boston Celtics	1.015030 0.546900 0.446584	1.000000 0.400000 0.866667
759 756 753 749 768	name Chicago Bulls Houston Rockets New York Knicks Miami Heat Utah Jazz	1.066725 0.759611 0.682844 0.632136 0.501059	1.000000 0.600000 0.400000 0.533333 0.866667	897 891 902 885 898	name Chicago Bulls Boston Celtics Portland Trail Blazers Cleveland Cavaliers Golden State Warriors	1.015030 0.546900 0.446584 0.406120 0.391522	1.000000 0.400000 0.866667 0.600000 0.066667
759 756 753 749 768 757	name Chicago Bulls Houston Rockets New York Knicks Miami Heat Utah Jazz Seattle SuperSonics	1.066725 0.759611 0.682844 0.632136 0.501059 0.443911	1.00000 0.600000 0.400000 0.53333 0.866667 0.40000	897 891 902 885 898 907	name Chicago Bulls Boston Celtics Portland Trail Blazers Cleveland Cavaliers Golden State Warriors Utah Jazz	1.015030 0.546900 0.446512 0.391522 0.348364	1.000000 0.400000 0.86667 0.600000 0.06667 0.600000
759 756 753 749 768 757 748	name Chicago Bulls Houston Rockets New York Knicks Miami Heat Utah Jazz Seattle SuperSonics Portland Trail Blazers	1.066725 0.759611 0.682844 0.632136 0.501059 0.443911	1.00000 0.600000 0.40000 0.53333 0.866667 0.40000 0.06667	897 891 902 885 898 907 882	name Chicago Bulls Boston Celtics Portland Trail Blazers Cleveland Cavaliers Golden State Warriors Utah Jazz Indiana Pacers	1.015030 0.546900 0.44658 0.40612 0.391522 0.348364	1.00000 0.40000 0.86667 0.60000 0.06667 0.60000 0.006667
759 756 753 749 768 757	name Chicago Bulls Houston Rockets New York Knicks Miami Heat Utah Jazz Seattle SuperSonics	1.066725 0.759611 0.682844 0.632136 0.501059 0.443911	1.00000 0.60000 0.40000 0.53333 0.86667 0.40000 0.06667	897 891 902 885 898 907 882	name Chicago Bulls Boston Celtics Portland Trail Blazers Cleveland Cavaliers Golden State Warriors Utah Jazz	1.015030 0.546900 0.44658 0.40612 0.391522 0.34836	1.00000 0.40000 0.86667 0.60000 0.06667 0.00000 0.00000
759 756 753 749 768 757 748 762	name Chicago Bulls Houston Rockets New York Knicks Miami Heat Utah Jazz Seattle SuperSonics Portland Trail Blazers Los Angeles Lakers	1.066725 0.759611 0.682844 0.632136 0.501059 0.443911	1.00000 0.600000 0.40000 0.53333 0.866667 0.40000 0.06667	897 891 902 885 898 907 882 889	name Chicago Bulls Boston Celtics Portland Trail Blazers Cleveland Cavaliers Golden State Warriors Utah Jazz Indiana Pacers Phoenix Suns	1.015030 0.546900 0.44658 0.40612 0.391522 0.348364	1.00000 0.40000 0.86667 0.60000 0.06667 0.00000 0.00000
759 756 753 749 768 757 748 762	name Chicago Bulls Houston Rockets New York Knicks Miami Heat Utah Jazz Seattle SuperSonics Portland Trail Blazers Los Angeles Lakers	1.066725 0.759611 0.682844 0.632136 0.501059 0.443911 0.175713	1.00000 0.60000 0.40000 0.53333 0.86667 0.40000 0.06667	897 891 902 885 898 907 882 889	name Chicago Bulls Boston Celtics Portland Trail Blazers Cleveland Cavaliers Golden State Warriors Utah Jazz Indiana Pacers Phoenix Suns	1.015030 0.546900 0.446512 0.391522 0.348364 0.256973 0.201952	1.000000 0.400000 0.866667 0.600000 0.066667 0.600000 0.000000 0.266667
759 756 753 749 768 757 748 762	name Chicago Bulls Houston Rockets New York Knicks Miami Heat Utah Jazz Seattle SuperSonics Portland Trail Blazers Los Angeles Lakers	1.066725 0.759611 0.682844 0.632136 0.501059 0.443911 0.175713 0.174035	1.000000 0.600000 0.400000 0.533333 0.866667 0.40000 0.066667 0.266667	897 891 902 885 898 907 882 889	name Chicago Bulls Boston Celtics Portland Trail Blazers Cleveland Cavaliers Golden State Warriors Utah Jazz Indiana Pacers Phoenix Suns om Forest Predictions: name	1.015036 0.546900 0.4465126 0.391522 0.348364 0.256973 0.201952	1.00000 0.40000 0.86667 0.60000 0.06667 0.00000 0.00000
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759 756 753 749 768 757 748 762	name Chicago Bulls Houston Rockets New York Knicks Miami Heat Utah Jazz Seattle SuperSonics Portland Trail Blazers Los Angeles Lakers	1.066725 0.759611 0.682844 0.632136 0.501059 0.443911 0.175713 0.174035 RF_Predicted_Champion 0.890500 0.653250	1.000000 0.600000 0.400000 0.533333 0.866667 0.40000 0.066667 0.266667	897 891 902 885 898 907 882 889 Rando	name Chicago Bulls Boston Celtics Portland Trail Blazers Cleveland Cavaliers Golden State Warriors Utah Jazz Indiana Pacers Phoenix Suns om Forest Predictions: name Chicago Bulls	1.015036 0.546904 0.44658 0.406126 0.391522 0.34836 0.256973 0.201952 RF_Predicted_Champion 0.866208 0.680583	1.000000 0.400000 0.86667 0.600000 0.06667 0.600000 0.26667 Champion_Win_Share 1.000000
759 756 753 749 768 757 748 762 Rando	name Chicago Bulls Houston Rockets New York Knicks Miami Heat Utah Jazz Seattle SuperSonics Portland Trail Blazers Los Angeles Lakers om Forest Predictions: name Chicago Bulls Houston Rockets	1.066725 0.759611 0.682844 0.632136 0.501059 0.443911 0.175713 0.174035 RF_Predicted_Champion 0.890500 0.653250	1.000000 0.600000 0.400000 0.533333 0.866667 0.400000 0.066667 0.266667	897 891 902 885 898 907 882 889 Rando	name Chicago Bulls Boston Celtics Portland Trail Blazers Cleveland Cavaliers Golden State Warriors Utah Jazz Indiana Pacers Phoenix Suns om Forest Predictions: name Chicago Bulls Boston Celtics	1.015036 0.546904 0.446584 0.406126 0.391527 0.348364 0.256973 0.201952 RF_Predicted_Champion 0.866208 0.680583 0.549750	1.000000 0.400000 0.866667 0.600000 0.066667 0.600000 0.266667 Champion_Win_Share 1.000000 0.400000 0.866667 0.600000
759 756 753 749 768 757 748 762 Rando	name Chicago Bulls Houston Rockets New York Knicks Miami Heat Utah Jazz Seattle SuperSonics Portland Trail Blazers Los Angeles Lakers om Forest Predictions: name Chicago Bulls Houston Rockets Utah Jazz	1.066725 0.759611 0.682844 0.632136 0.501059 0.443911 0.175713 0.174035 RF_Predicted_Champion 0.890500 0.653250 0.635667	1.000000 0.600000 0.400000 0.533333 0.866667 0.400000 0.066667 0.266667 Champion_Win_Share 1.000000 0.6600000 0.866667	897 891 902 885 898 907 882 889 Rando 897 891 902 907 898	name Chicago Bulls Boston Celtics Portland Trail Blazers Cleveland Cavaliers Golden State Warriors Utah Jazz Indiana Pacers Phoenix Suns om Forest Predictions: name Chicago Bulls Boston Celtics Portland Trail Blazers Utah Jazz Golden State Warriors	1.015036 0.546904 0.446584 0.406126 0.391522 0.348364 0.256973 0.201952 RF_Predicted_Champion 0.866208 0.680583 0.54975 0.486292 0.433833	1.000000 0.400000 0.400000 0.86667 0.600000 0.066667 Champion_Win_Share 1.000000 0.400000 0.400000 0.400000 0.866667 0.600000
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759 756 753 749 768 757 748 762 Rando 759 756 768 757 753 749 744	name Chicago Bulls Houston Rockets New York Knicks Miami Heat Utah Jazz Seattle SuperSonics Portland Trail Blazers Los Angeles Lakers om Forest Predictions: name Chicago Bulls Houston Rockets Utah Jazz Seattle SuperSonics New York Knicks Miami Heat Detroit Pistons	1.066725 0.759611 0.682844 0.632136 0.501059 0.443911 0.175713 0.174035 RF_Predicted_Champion 0.890500 0.653250 0.635667 0.538000 0.479125 0.450958 0.275458	1.000000 0.600000 0.400000 0.533333 0.866667 0.400000 0.066667 0.266667 Champion_Win_Share 1.000000 0.866667 0.400000 0.866667 0.400000 0.533333 0.133333	897 891 902 885 898 907 882 889 Rando 897 891 902 907 898 885 885	name Chicago Bulls Boston Celtics Portland Trail Blazers Cleveland Cavaliers Golden State Warriors Utah Jazz Indiana Pacers Phoenix Suns om Forest Predictions: name Chicago Bulls Boston Celtics Portland Trail Blazers Utah Jazz Golden State Warriors Cleveland Cavaliers Indiana Pacers	1.015030 0.546900 0.446584 0.406120 0.391522 0.348364 0.256973 0.201952 RF_Predicted_Champion 0.866208 0.680583 0.549750 0.486292 0.433833 0.331000 0.218875	1.000000 0.400000 0.866667 0.600000 0.000000 0.266667 Champion_Win_Share 1.000000 0.400000 0.866667 0.600000 0.066667 0.600000 0.000000
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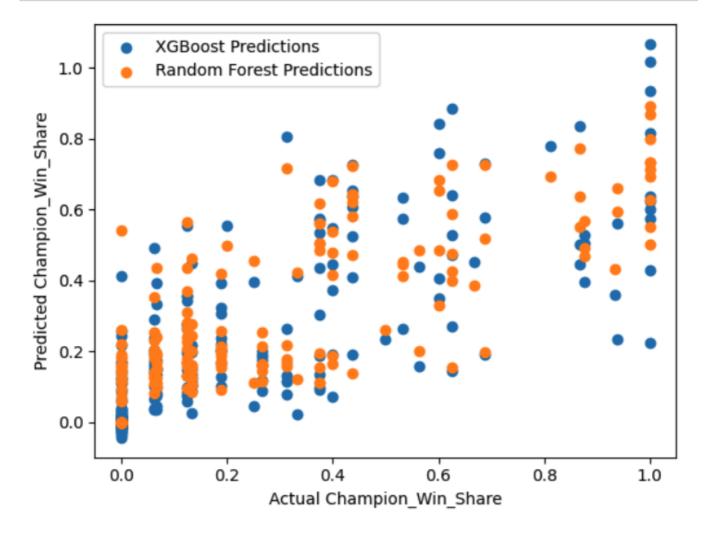
Although both the Gradient Boosting model and the Random Forest model yielded relatively similar results, Random Forest was found to be slightly more accurate.

Seeding Offset	XGBoost	Random Forest
0 (Correct)	4	6

Seeding Offset	XGBoost	Random Forest
1	3	2
2	1	1
> 3	2	1

Below is a scatterplot of XGBoost and Random Forest predictions compared to the actual Champion_Win_Share.

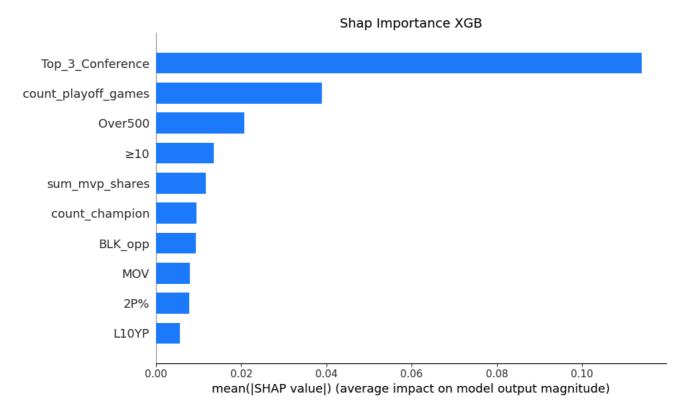
```
# Visualization
plt.scatter(y_test, xgb_predictions, label="XGBoost Predictions")
plt.scatter(y_test, rf_predictions, label="Random Forest Predictions")
plt.xlabel("Actual Champion_Win_Share")
plt.ylabel("Predicted Champion_Win_Share")
plt.legend()
plt.show()
```

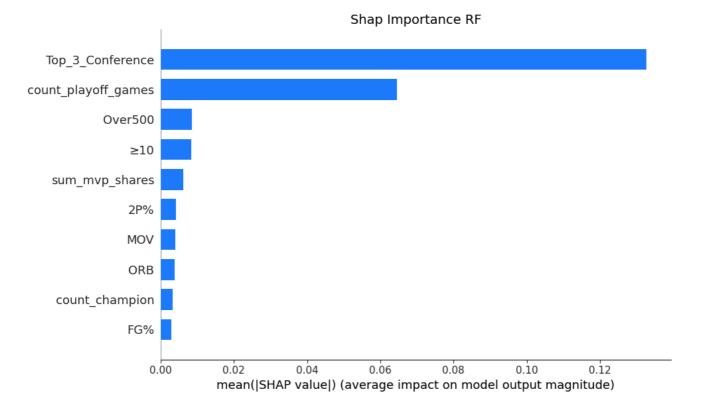


iii. Shap Importance

According to the creators of SHAP, "SHAP (SHapley Additive exPlanations) is a game theoretic approach to explain the output of any machine learning model." Using the SHAP library, we analyzed our results to see which features were the most important in determining Champion_Win_Share.

```
# Explain XGBoost predictions with SHAP
explainer_xgb = shap.Explainer(xgb_model)
shap values xgb = explainer xgb.shap values(X test)
# Explain Random Forest predictions with SHAP
explainer_rf = shap.Explainer(rf_model)
shap_values_rf = explainer_rf.shap_values(X_test)
# Summary plot for XGBoost
shap.summary_plot(shap_values_xgb, X_test, feature_names=feature_columns,
plot_type="bar", show=False, max_display=10)
fig = plt.gcf()
fig.set_size_inches(10, 6)
plt.title("Shap Importance XGB", fontsize=14, loc="center")
plt.tight_layout()
plt.show()
# Summary plot for Random Forest
shap.summary_plot(shap_values_rf, X_test, feature_names=feature_columns,
plot_type="bar", show=False, max_display=10)
fig = plt.gcf()
fig.set_size_inches(10, 6)
plt.title("Shap Importance RF", fontsize=14, loc="center")
plt.tight layout()
plt.show()
```





As shown in the graphs above, the Gradient Boosting and Random Forest algorithm determined a similar set of features to be the most important in determining whether or not an NBA team wins a championship. The five most important features of both models are not only identical but also in the same order. Furthermore, the two models also share three other features within the top 10 most impactful features.

Feature	Explanation
Top_3_Conference	True/False value on whether the team finished within the top 3 seeds in the regular season.
count_playoff_games	The total number of playoff games played by the players on the team.
Over500	Winrate against teams with a positive winrate
>= 10	Winrate with score differentials over 10 points
sum_mvp_shares	Indication of whether the team has a super star player
count_champion	Number of NBA champion players on the team
2P%	Two point percentage
MOV	Margin of victory

V. Related Work

ML Libraries/Tools:

- XGBoost (Gradient Boost)
- scikit-learn (Random Forest)
- SHAP (ML Model Analysis)

VI. Conclusion

Although