Analysis of the Impact of 3-Point Shooting in the NBA

Kirtan Shah, Aaryan Bavishi, Griffin Edmunds

DS 340w, Pennsylvania State University

Abstract— The 3-point shooting in the National Basketball Association (NBA) has had a massive impact in terms of the dynamics of the game and their outcomes. This research paper investigates a comprehensive analysis of this impact of the transformation, using multiple related research papers, including "Evolution of Two-Point and Three-Point Shooting Trends in the NBA," "Application of Machine Learning on NBA Data Sets," and "Enhancing Basketball Game Outcome Prediction through Fused Graph Convolutional Networks and Random Forest Algorithm."

Our study for the research paper is to investigate and investigate the historical patterns, particularly of the three-point shooting and how it has impacted the game results. Over several decades, the basketball game has seen a steady increase of using more three-point attempts and efficiently, trying to reshape their offensive strategies. We combined various kinds of insights from the previously mentioned research papers and looked further to find a relationship between three-point shooting percentage and victories in basketball. In training our models, we utilized methods and features from these works, particularly focusing on Random Forest, PCA, and XGBoost techniques, to enhance the match prediction results and provide data-driven outcomes for success. The random forest model gave us the key features needed for the analyzation like file goal percentage, total point, 3-point shot percentage etc. The XGBoost model got much better results (83%) than the research paper which used random forest (81%). The results of our models, which feature key statistical measures, are instrumental for coaches, players, and analysts in strategizing and analyzing the game.

Keywords— Basketball, 3-Point Shots, 3-Point Shooting Percentage, Machine Learning Models, Feature Selection, Prediction, Random Forest, XGBoost, PCA.

I. Introduction

Over several years, the national basketball Association (NBA), has seen tremendous progress and change in terms of the playing style that is being used by players and teams as a strategy to win games. One of which is the constant use of three-point shooting which is considered one of the most noteworthy developments that is revolutionizing the trajectory of NBA history. 3-point shots were introduced in the 1979-1980 season, and it has been used more in recent years. Many teams have used it as a strategy like the Houston Rockets. This use of the long-range shots has changed the perspective of the basketball game and had a significant impact on the results for each match, resulting in more victories which the team have started adopting increasingly.

This paper goes deeper into the exploration of this complex, and a fascinating connection between the NBA, match victories, and the three-point shooting preferences. We do this, by understanding the trend and looking deeper into this fundamental shift, which has impacted the dynamics of the game and created a pattern that can be examined for team triumphs, by adapting the use of three-point shooting.

It is especially important and crucial to investigate the effects of this three-point, shooting, especially on the results of the game, because this would help the teams, coaches, and the analysts to investigate the techniques that could be improved. The results of the study would eventually help the teams prepare for matches and would improve the decision, making ability and their performance on the court. The future work of the project is to focus on recent data assets and try to implement data visualizations which machine learning models to illustrate the ongoing trend and try to explore the surge in using more three-point shots, to contribute to the teams, success, and victory. We also intend to investigate by looking into other statistical features like f1 score, precision, accuracy, and machine learning or prediction models like Random Forest, XGBoost, SVM (Support Vector Machine) to determine the impact of using the three-point shots, and how the predictive accuracy of the team success is influenced on it. These findings would have a direct impact on the game outcome as well as helped the teams assist their potential weaknesses as well as focus on the offensive and defensive strategies and predict a future success by working on the areas of improvement and personnel changes.

Additionally, this research paper not only recognizes the historical aspect of the NBA three-point shooting patterns, but also emphasizes to investigate this area for future studies. The purpose of this document is to review and assess a collection of three research papers that have expanded and added to the field of basketball

match prediction. The research papers being discussed will explore implementing a variety of different machine learning tactics – Random Forest, PCA and XGBoost to predict the outcome of NBA games. Each paper utilizes previous basketball game data and various features to enhance their predictions. We will now provide a brief overview of three papers.

The first paper that we will be reviewing is "Long-Term Trends in Shooting Performance in the NBA: An Analysis of Two- and Three-Point Shooting across 40 Consecutive Seasons." This paper's purpose was to understand the changes in playing styles as time progressed. Analysis was conducted through various time-series methods like moving averages, trend analysis, and season-by-season comparisons. The researchers used archived NBA seasons data, containing 40 total seasons, from the public website basketball reference. The team used this statistical analysis to evaluate the shift in shooting trends over the years.

The second paper that we will be reviewing is "Application of Machine Learning on NBA Data Sets." This paper was to determine which basketball statistics are most important to team success. Analysis was conducted through several different models including K-Nearest Neighbor Classification, Logistic Regression, Decision Tree, Random Forest, Gradient Boosting, and Principal Component Analysis (PCA). The researchers used game data from the 2020-2021 NBA season to test and train their models. Their models' performance was then compared based on accuracy, precision, recall, and F1 scores to determine which model was the best at predicting match outcomes.

The third paper that we will be reviewing is "Enhancing Basketball Game Outcome Prediction through Fused Graph Convolutional Networks and Random Forest Algorithm." This paper's purpose was to take an innovative approach towards predicting NBA outcomes. The researchers developed a Graph Convolutional Networks (GCN) model to make predictions. Unlike previous models, this GCN model considers non-traditional features that impact games beyond standard basketball statistics. The group also implemented feature engineering and extraction methods such as PCA, Lasso, and Random Forest to narrow down the most key features.

Our interest in this research topic of using machine learning methods to analyze impactful basketball trends stems from our love of basketball. Each of our team members are massive fans of NBA basketball and specific teams within the league. We have an ardent desire to connect our passion for basketball with our studies in the classroom. We are driven to take the previous research we have found on the topic and apply it towards discovering our own new insights that will further advance the field of basketball predictions.

The impact of our research extends far beyond the basketball court, as it will offer teams valuable insights regarding coaching decisions that revolve around team strategies and player personnel. By examining the relationship between winning basketball and the three-point shot, we aim to provide a more in-depth analysis and understanding of one of the game's most important shifts, and its impact on players, coaches, teams, and executives.

II. Literature Review

In this section of the literature review, we will go into the deeper analysis of the three research papers related to our topic and introduced before. Each paper has its own unique contribution and gives various kinds of insights to compile it altogether to help work on our research and help us get valuable findings and have potential applications.

[1] "Evolution of Two-Point and Three-Point Shooting Trends in the NBA: Implications for Game Outcomes (1979-2019)"

This research paper has been written by Tomasz Zaj and his team which delves into exploring how the two-point and three-point shooting trends have been in the NBA from 1979 to 2019. Their focus is looking into the game outcomes trends. This research study is significantly relevant to our research topic as it revolves around the prediction and looking into the evolution of three-point shooting in the NBA.

The authors of the research paper have done a lot of analysis on the NBA data over four decades, and they provide lots of valuable information that has had a significant impact on the dynamics of the game. Something that they found was that the three-point line when introduced in the NBA had a significant impact, especially when the teams started using that for shooting strategies and had a greater emphasis on using that three-point shooting method. This research paper is very well aligned to our research primary focus that is to investigate the increase of three-point shots and how it has contributed to different teams' success.

[2] "Application of Machine Learning on NBA Data Sets"

This paper by Jingru Wang and Qishi Fan investigates different perspectives, especially in terms of machine learning techniques that can be integrated in the analysis of NBA data. The research paper is truly relevant to our topic as it goes deep into using various kinds of statistical methods and other machine learning algorithms to predict NBA game outcomes.

The study has used many approaches and techniques to analyze the NBA data, as well as utilizes various kinds

of machine learning techniques like logistic regression, K, nearest neighbor classification, random forest, decision tree, gradient boosting, and Principal component analysis. The unique part of this research paper is that after getting all the outcomes, it tries to use different techniques to compare and analyze these machine learning models so we can get the best model that can be performed later. These various kinds of techniques, give lots of insight, and a thorough examination of the game dynamics and a deeper look into the investigation of three-point shooting evolution in the NBA and its impact on the success of team.

[3] "Enhancing Basketball Game Outcome Prediction through Fused Graph Convolutional Networks and Random Forest Algorithm"

This research paper by Kai Zhao, Chunjie Du, and Guangxin Tan shows a streamlined and a straightforward approach for NBA game outcome prediction. Their focus is to use machine learning models, especially graph neural networks (GCN) with random force algorithms to get valuable insights that can be used as an application for advanced techniques to predict game outcomes.

This research paper is truly relevant to our topic because it analyzes the evolution of the three-point shooting in the NBA and helps to understand the basketball game dynamics for making future and actor predictions for further decision making. This research paper can also be connected well to the second research paper because they are both utilizing distinct kinds of machine learning techniques, which can be compared and analyzed to get the best results based on the team's success. This paper specifically investigates the game output prediction, as well as the most notable features that can be extracted later and could align well with the goal of finding the key features that lead to game victories.

Overall, these papers provide a sturdy base for our research paper and study. They highlight how data-driven analysis can be used in the field of basketball, serving as a foundation upon which we build our understanding of the relationship between winning NBA games and three-point shooting.

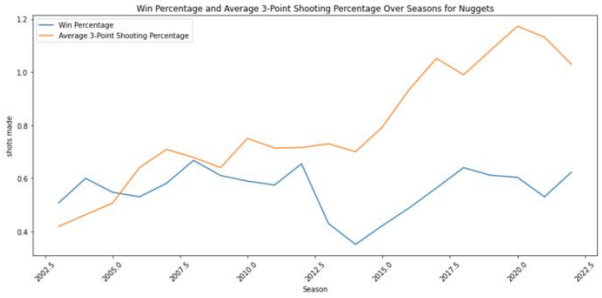

Figure 1: 3-point shot and win percentage for the Nuggets evolution from 2003-2022

III. Contributions

This research paper outlines a sequential manner of steps that can be addressed to look for a correlation between three-point shots and win percentage prediction. These steps are comprehensively decided to investigate analyzing the trends, uncover some key and valuable insights, and investigate valuable predictions. This outline initially looks for proper and clean data set that can be pre-processed in a format that can be directly applied for other feature engineering and machine learning model implementation. Overall, this outline gives an idea of how the model has been implemented, and the methods that have been used in our research which shows a sequential and transparent view of the process.

Our research is based upon the previous parent papers that we analyzed, particularly starting off the first parent paper, which showed a relationship between the three-point shots and the win percentage in NBA. The parent paper provided a fundamental understanding by showing the statistics and graphical trends of the three-point shooting. Our target was to use this as a base and after replicating that we were planning to implement other methods based on other research papers, and then put up more stuff from our end.

A. Our Plan for Implementation

Initially, we decided to use the data set there was provided in paper 1 and try to replicate it by showing graphs specifically on the trend of three-point shots versus the Vin percentage, as well as make it more into an analytical framework by integrating some learning techniques and some feature pre-processing to get the best results. The parent paper was very well analyzed in terms of showing the three-point shooting trend, as well as giving many insights that would have been useful on how each game was impacted.

B. What Happened

As we started to implement the first research paper with the data that they said that they had provided, we realized that the data said was too concise and heavily modified, which was not suitable for further implementation. The data set existing form had to be changed, and made larger, to implement our future plan. This limitation of dataset led us to pivot from our original plan and try to look for another data set or a completely new research paper.

C. New Plan for Implementation

Subsequently, we did not have to look for another research paper, but instead we got a data set from Kaggle which was large and aligned with our implementation plan. Thus, we were able to replicate the

first research paper by adopting its method of showing graphs, especially the ones focused on showing a series analysis of the three-point percentage correlated with victory percentage. This investigation of graph was overly broad, but also enriched our investigation by capturing the three-point, shooting efficiency to game victories for each team.

As we were able to succeed in the first part of our implementation, we continued the approach by refining the dataset and marking each game with binary indicators like 1 and 0 for wins and losses, respectively. This dataset construction was helpful as it helped us create a correlation metrics that would look deeper into the relationship between the three-point percentage and the victory.

Another main objective was to investigate features most influential on the predictions after using the machine learning techniques. We had to pre-select some features in the data set that would have a massive impact on our results. We used a feature engineering method, random forest, to select the pertinent features effectively. Random forest is beneficial as it not only served as a robust method to analyze the impact of individual factors on game, but they also provided a manner full, and a clear rank of which feature was most important based on its predictive accuracy.

As the data size was exceptionally large, we had to overcome this challenge by using another method called principal component analysis PCA. This method was very instrumental and reduced the dimensionality of the data set. It helped to retain about 95% of its variance, which made the data set simple and was more manageable and focused for the analysis.

D. Another Issue with our Implementation

After the dataset was ready, we started exploring how to apply support vector machine techniques to our data. Though SVM has a lot of potential to handle high dimensional data and decipher complex data, we started countering some competition issues because the model required a lot of extensive time to process. After running the whole technique. The accuracy that was achieved by SVM was around 78%, which was slightly lower than the one that was obtained initially by the original code.

E. New Plan

So, we decided to investigate other methods that would be more favorable than SVM, but also take less computational time and give us higher predictive accuracy. looked into the advantages of XG boost which was superior at handling sparse data as well as head faster, processing time and gave a higher accuracy. In our case all these advantages were positive, so we started implementing XG boost and got an accuracy of about 83%.

Overall, we did encounter small and large, technical, and analytical issues, but each step brought us to a closure understanding of the model as well as the strategic importance of the three-point shooting in basketball.

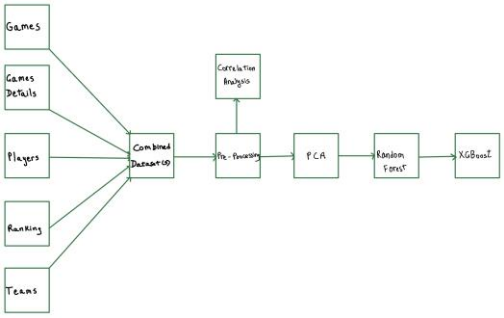

Figure 2: Process Flow

IV. Dataset

This paper comprises of several comprehensive datasets that we got from Kaggle, which has multiple components and will be used to understand the evolution of the three-point shooting in NBA. The primary data set for the topic contains all the up-to-date information on NBA games that have been played since 2004. Includes many crucial details like dates, teams, and other vital game statistics. This dataset will help get an in-depth look and explore different team performances and game outcomes. Second data set is more focused on each game detail, especially more focused on the details about players, statistics, player names, team affiliation, and other game metrics related to points, assist, rebounds, etc. Third data set is focused completely on the up-to-date NBA rankings, which, concisely shows the team performance and game statistics. Lastly, the team's dataset is focused on showing data on NBA teams, as well as their affiliation, arenas, and their history. The dataset was modified by adding a binary column where each game has a 1 or 0 marker for every win or loss, respectively. This was used particularly for the creation of the correlation matrix. Overall, these data sets together make a comprehensive platform and a foundation for the research, as well as give valuable insights and information to facilitate robust analysis on the three-point shooting trend and its impact on NBA games. Here the figure below shows a summary of the process via a flow chart. This flow chart shows a sequential manner of how the data is used to get the final predictions.

```
seasons.head()
```

	GAME_ID	SEASON
0	22200477	2022
1	22200478	2022
2	22200466	2022
3	22200467	2022
4	22200468	2022

```
df.head()
```

	GAME_ID	TEAM_ID	TEAM_ABBREVIATION	TEAM_CITY	PLAYER_ID	PLAYER_NAME	NICKNAME	START_POSITION	COMMI
0	22200477	1610612759	SAS	San Antonio	1629641	Romeo Langford	Romeo	F	
1	22200477	1610612759	SAS	San Antonio	1631110	Jeremy Sochan	Jeremy	F	
2	22200477	1610612759	SAS	San Antonio	1627751	Jakob Poeltl	Jakob	C	
3	22200477	1610612759	SAS	San Antonio	1630170	Devin Vassell	Devin	G	
4	22200477	1610612759	SAS	San Antonio	1630200	Tre Jones	Tre	G	

Figure 3: Head of dataset: seasons and df = game details

A. Preprocessing

Before applying machine learning algorithms, it is crucial to pre-process the data to ensure that the data sets are consistent, clean, and ready to go for further analysis. We conducted different data preprocessing methods to make sure that the data sets were qualitative and reliable. First off, we started with removing the duplicates by trying to identify the duplicate entries in the dataset rows and eliminate them. This crucial step was important as it helped remove redundancy for the analysis and maintain the data integrity. We also tried to handle the null values, by removing the missing values or the rows, to ensure that the data set is suitable for analysis and remains complete. The handling of null values was important as it would impact accuracy in a drastic manner which could lead to bad results. Handling the first instance values was also a crucial step in our pre-processing journey, to ensure that only the most recent and relevant information for each game persisted. We also adopted some data type conversion, and data normalization method to get a consistent data representation and make sure that a particular feature does not take over in the analysis process. Additionally, our preprocessing included the use of Python libraries such as NumPy and Pandas for data manipulation, Seaborn and Matplotlib for data visualization, and Scikit-learn for applying machine learning algorithms like the RandomForestClassifier. We engaged in detailed data frame manipulation and feature engineering to tailor our data for optimal use in our predictive models. Overall, all this feature engineering and data pre-processing were important, to harmonize the datasets and integrate them for further unified analysis.

V. Implementation

A. Correlation Analysis

To show the correlation analysis for each team, we started with merging the data and compiling a list of unique team IDs from both Home and visitor teams. Then we investigated plotting the data by using the team when column and the three-point shot column.

We calculated the average number of three-point shots made by each team per season, and then integrated it into a graph. Each graph had two lines plotted, where one showed the wind percentage, and the other showed the average number of three-point shots made. We created a separate graph for each team, below are some example snippets for teams that showed a correlation of the three-point shooting performance to teams' success/victory. This type of time series graph helps show that the three-point shot focus has strategically changed the team's success over the years in basketball.

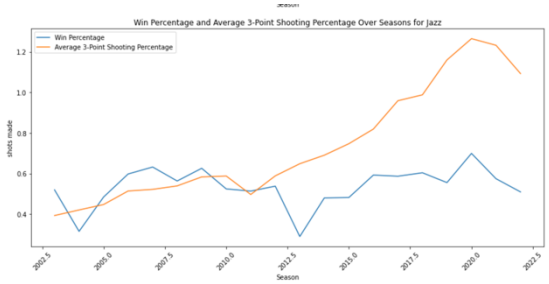

Figure 4: 3-point shot percentage to win percentage for Jazz

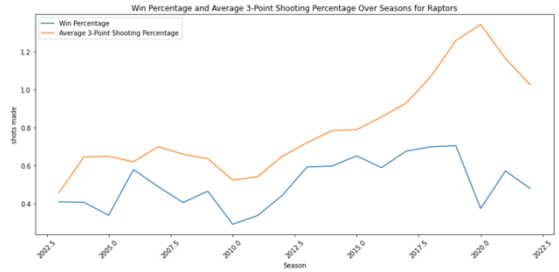

Figure 5: 3-point shot percentage to win percentage for Raptors

In figures 4 and 5, we can see how the line graph and the scatter plot correlate and show a similar pattern, giving us insight on the fact that the more 3-point shots made leads to a more winning chance.

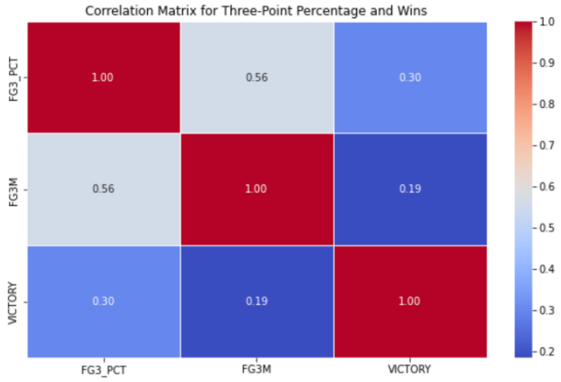

Figure 6: Correlation matrix after creating a binary column

In figure 6, the correlation matrix shows there is a positive correlation between three-point percentage, and victories. Similarity we also see a positive correlation between three-point shots and victories. Overall, this gives us some insight into whether the three-point shots and percentages have a positive impact on the victories.

B. Principal Component Analysis (PCA)

In our research paper, after preprocessing the data, we applied PCA to analyze the evolution of three-point shooting. We selected features impacting three-point shooting, like team performance, player contribution, number of three-point shots taken, percentage, and wins, after handling missing values and dropping irrelevant columns. These features formed the foundation of our PCA application. Using PCA with a hyperparameter setting of retaining 95% of the variance, we balanced dimensionality reduction with information preservation. This involved standardizing the selected features and creating a covariance matrix. Dimension reduction was applied to both the training and testing datasets, reducing complexity while preserving critical information.

The cumulative variance was the main factor to decide the 95% variance threshold. The results that we got from PCA investigated certain features like player, efficiency, and team strategies which seem to be the most influential in terms of three-point shooting trends. We saw that the first few principal components did show a strong correlation for the player efficiency rating, but we also observed that the strategy of the team that changed over seasons was also a vital component that affected other features.

To better understand the primary components' contributions to the dataset, we also conducted a thorough study of them for seasons. For outcomes that were easy to understand, visualization tools like scatter plots were employed. These revelations, together with graphics, emphasized the strong correlation between three-point shooting ability and final game results. The PCA results' scatter plots for the various seasons also demonstrated how the game is changing, with younger player talents and strategies taking center stage in more recent seasons. Overall, PCA proved to be a powerful tool in our research, uncovering valuable insights into the relationship between three-point shooting and NBA games.

C. Random Forest

We used random forest method to analyze the evolution of three-point, shooting in basketball by selecting the relevant features that were most influential to the game's outcome. Information gain and core relation analysis were some of the key techniques for this method. By using the RandomForestClassifier from sklearn, we worked on our data set by removing all the non-nary, columns and missing values. This was a major step to get the most relevant information for the models' accuracy. After training with the default, hyper parameters of random state as 42, we were able to get an accuracy of 81%. We also got balanced precision. Add recall metrics which showed that the predictive outcomes were effective. the use of random forest was done through using trees and to investigate the three-point, shooting trends against the winning probabilities. The model had a clear output as shown and figure 7. Here we see that the feature importance is ranged graphically to show which features are most important and have the most influence on the game victory outcome.

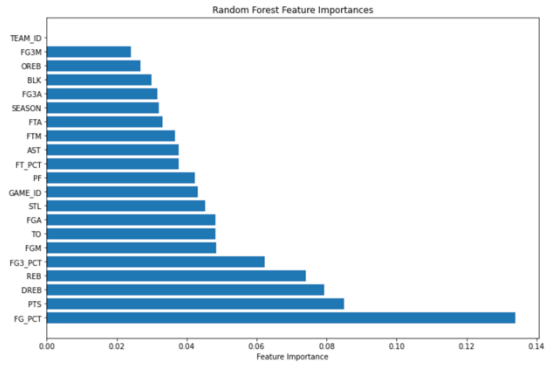

Figure 7: Important feature selection via Random Forest

```
Accuracy on the test set: 0.81
Top Features:
FG_PCT: 0.1339
PTS: 0.0849
DREB: 0.0793
REB: 0.0741
FG3_PCT: 0.0622
FGM: 0.0485
TO: 0.0483
FGA: 0.0482
STL: 0.0453
GAME_ID: 0.0432
```

Figure 8: Scores relating to important features affecting random forest model.

D. XGBoost

We incorporated an important machine learning method in our research to enhance our model's predictive accuracy. XGboost helped us find an effective relationship between the various game factors and the winning property. For this method, we split our data set into three distinct parts that is training, validation, test set.

We used XGBClassifier from the XGBoost library to train the model with a consistent random state of 42 to

get our results. We initially split the training set for 60% and the temporary set as 40%. After getting the results, split the temporary set into validation and test set giving both 20% of the original dataset. When the training set was implemented, we had an impressive accuracy of 92.03% which indicated that there was a strong learning from the data. The validation accuracy was 83.63% and the test accuracy was 82.86%. This showed that the model was reliable in these unseen scenarios.

The recall that we got from the classification report further shows that the model was well balanced and had the capacity to predict accurately. Both the metrics had an average of around 84% accuracy (figure 9) on the validation set which showed that the outcome was exceptionally reliable, and it was correctly identified using the XG boost model. The use of XG boost in our research was important to investigate the trend of three-point shooting in basketball. The model had a high accuracy and was balanced in a precise manner which gave valuable insights of how the three-point shooting was positively correlated to winning outcome.

Classification Report on Validation Set:

	precision	recall	f1-score	support
0.0	0.83	0.83	0.83	5241
1.0	0.84	0.84	0.84	5379
accuracy			0.84	10620
macro avg	0.84	0.84	0.84	10620
weighted avg	0.84	0.84	0.84	10620

Figure 9: Classification Report on Validation Set

E. Conclusion

After doing a comprehensive analysis and using several methods like random forest and XG boost, we were able to investigate a significant evolution in the game of basketball that showed that the three-point shooting had a positive impact on the game victory, as we can see the accuracy from figure 10.

```
Accuracy on Training Set: 0.9202762084118016
Accuracy on Validation Set: 0.8362523540489643
Accuracy on Test Set: 0.8286252354048964
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Figure 10: Accuracy on all tests using XGBoost

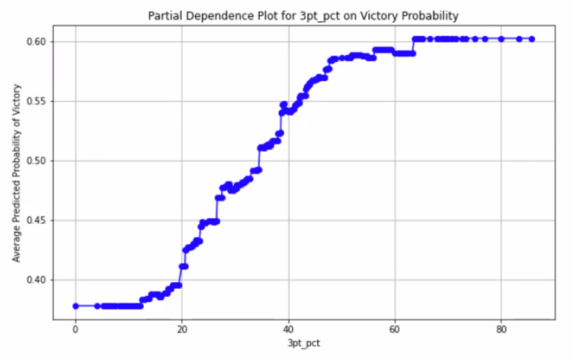

Figure 11: Partial Probability graph showing the trend/correlation between 3-points made to win percentage.

We were able to show an accuracy of around 83% which was quite reliable to see that the game outcomes were very well correlated with the three-point attempts. The data that we were working with shows a clear increase in the number of three-point attempts that have been used recently, which led to the wind, over the ears. This finding was not only observed as a trend over several years, but it is also seen by many three-point oriented players, like Stephen Curry.

Our analysis of using different modern techniques to implement the model, to look at the trend, was successful. We tried to match up the old school and modern play style using our model and we were able to see a consistent trend that the three-point shooting was positively impacted with the win percentage (Figure 11). It not only added a fun dimension to our research but has also been an impactful evolution on the basketball strategy.

VI. Novelty

The novelty in our research paper is used in a multifaceted approach where we try to adopt several types of methods and analysis to investigate the evolution of the three-point, shooting in the NBA. Our focus was on a correlation between three-point shots and win percentage. We are sure that the other research papers would also have a similar perspective, but we wanted to go beyond the papers and try to implement different methods and prove the three-point shots do have a substantial impact on victory in NBA. Our methods were built on foundational studies where we used advanced visualization techniques and implemented innovative machine learning models to get a unique perspective on the data analysis.

The main aspect of our novelty was to get an in-depth look into the visualization aspect. The base papers focused on providing a broad overview of the data, whereas we went beyond delving deeper into the data set. We started by creating many kinds of graphs. They were focused on each team, three-point percentage, which helped us gain a good amount of understanding on how the shots influenced game outcomes. To get a broader look we also analyzed other types of graphs and tried to uncover different patterns and trends, which gave us a more intricate view of the data set as well as an understanding of the model.

Another approach we used in our study was focusing on features by employing random forest, to diverge from the methods used in the original studies. This feature selection was necessary for our approach to get accurate results and save computational time. This approach

helped us get a better predictability and reliability of our analysis, as well as helped us to identify the features that were most influential on the impact of the three-point shooting and the game outcome.

We also focused on reducing the dimensionality of our approach by using the PCA model, which helped us get a streamlined and efficient analysis of our data. Papers the data set into three distinct parts, but we used PCA so that the complexity of the data said could be reduced and the important characteristics of the data set would be contained. The PCA model made over analysis, more comprehensive and robust. With that, we added a binary column in the data set to create a unique correlation matrix, which was crucial to our study. This matrix provided a lot of information, especially regarding the relationship between various aspects of the three-point shooting and the winning probability. It also helped us identify the key aspects that influence the game outcomes in this dynamic.

We also employed the use of XG boost, which was truly an innovative machine learning algorithm. The foundational papers were based on the traditional statistical methods and other machine learning models, but our data complexity had to be handled, which was done by XG boost effectively. This method produced a higher accuracy than SVM model that was implemented initially. It was also able to handle the large data set that you were working on.

VII. Future Work

Throughout this research, we have dedicated a lot of time to study the existing papers, looking over original data sets, and implementing over coding skills. Dispatch was very fulfilling as we achieved the conclusion that we were looking for. But there is, of course, many more approaches and perspectives that can be put into the future work, so to expand the scope of the current analysis that we have provided on the NBA three-point shooting trend.

For the future work, we would plan to expand and use econometric modeling techniques and apply them to our current research. The M of this technique would be to explore even further how the relationship between various kinds of variables impact the game outcome with the help of the impact of the three-point attempts. We would want to incorporate additional variables like team strategies, player, efficiency, and many other variables that would help us understand the dynamics. We would use regression analysis to deeply understand the outcome.

For the second future work, we would explore a time analysis, to look deeper into smaller time frames and uncover the evolving trend in the three-point shooting over various seasons. This analysis would help us get more details and insights, especially about how the game adaptation takes place, especially in terms of clear development, and the rule changes. This would give us a chronological perspective on how the NBA Strategies have shifted because of which the percentage has affected.

The third future work would be to use network analysis to get a deeper understanding and investigate structural relationships within the teams. This would give us more insights on how each player is interconnected based on their own court behavior, decision, and interaction. These three perspectives would give us an idea of how the three-point shots are made and give us a perspective on the key players and the strategies that contribute to the team's success.

These three future works at many other perspectives can be built upon the foundation that we have laid by our current research. The future work would give new insights and deeper dimensions to understand the strategies of the three-point shooting in the NBA. After all Sky is the limit, you can fly as high as you want, and get as many insights as possible.

VIII. References

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