Institute of Applied Mathematics
Financial Mathematics

Predicting of Market Value of Football Players by Using the Gamma Distribution Function

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Introduction

The objective of this project is to predict and analyze the future transfer values of football players based on their statistical performance in the previous season. Using the Gamma Distribution Function, the project aims to model and forecast transfer values, providing insights into the accuracy of predictions and the factors influencing market value changes.

Process of Project

1. Data Description:

-Import and process player data again, including statistics and transfer values.
-Ensure data integrity by converting transfer values to numeric format and handling missing or non-finite values in order to get better results.

At this project, the statistics of Premier League players is used. The general data is obtained from “TransferMarket” and “excel4soccer” to use their market values and statistics (age, goals, assists etc.), respectively.

Name	Age	Position	Average Play Time(min)	Appearances	Assists	Goals	Transfer Value at 2023	Transfer Value at 2024
Erling Haaland	23	Forward	89,2	31	5	27	180 M	180 M
Cole Palmer	22	Midfielder	84,0	34	11	22	32 M	80 M
Alexander Isak	24	Forward	81,0	30	2	21	70 M	75 M
Ollie Watkins	28	Forward	95,1	37	14	19	55 M	65 M
Phil Foden	23	Midfielder	87,8	35	8	19	110 M	150 M
Dominic Solanke	26	Forward	95,1	38	3	19	20 M	40 M
Mohamed Salah	31	Forward	86,3	32	10	18	65 M	55 M
Son Heung-Min	31	Forward	90,3	35	9	17	50 M	45 M
Bukayo Saka	22	Forward	89,3	35	8	16	120 M	140 M

Figure 1: *Sample from Data*

2. Statistical Analysis:

-Analyze the distribution of various player statistics such as average playtime, appearances, goal assists, and total goals.
-Understand the relationship between these statistics and the players' transfer values.

The resulting graphs at this project are below:

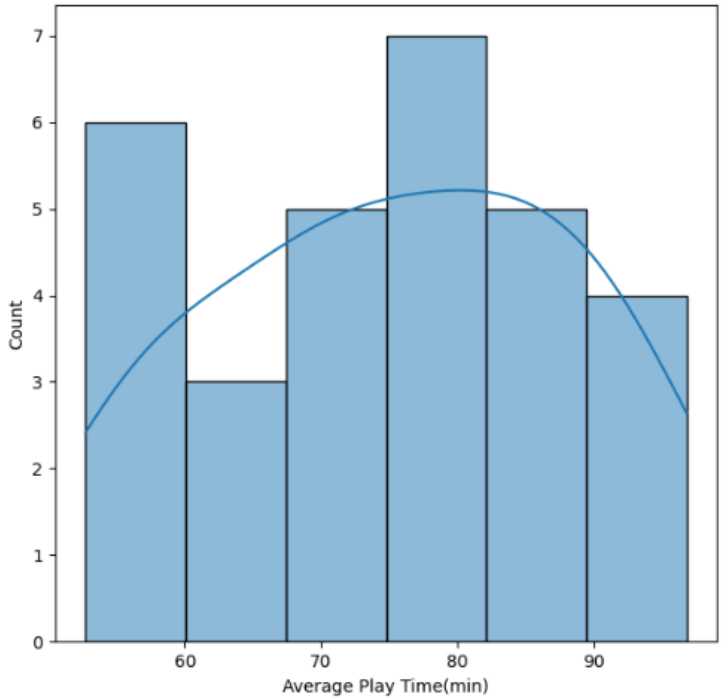

Figure 2: *Distribution of Average Play Time (min)*

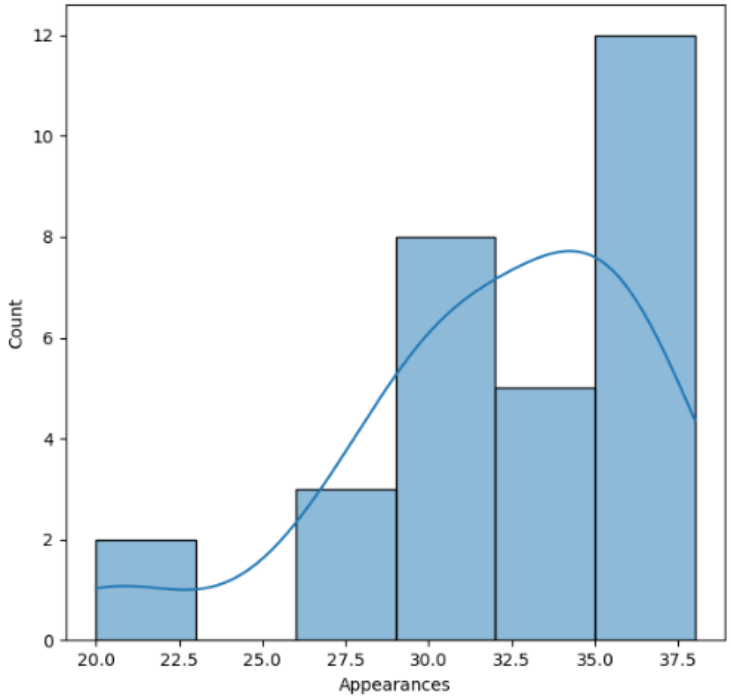

Figure 3: *Distribution of Appearances*

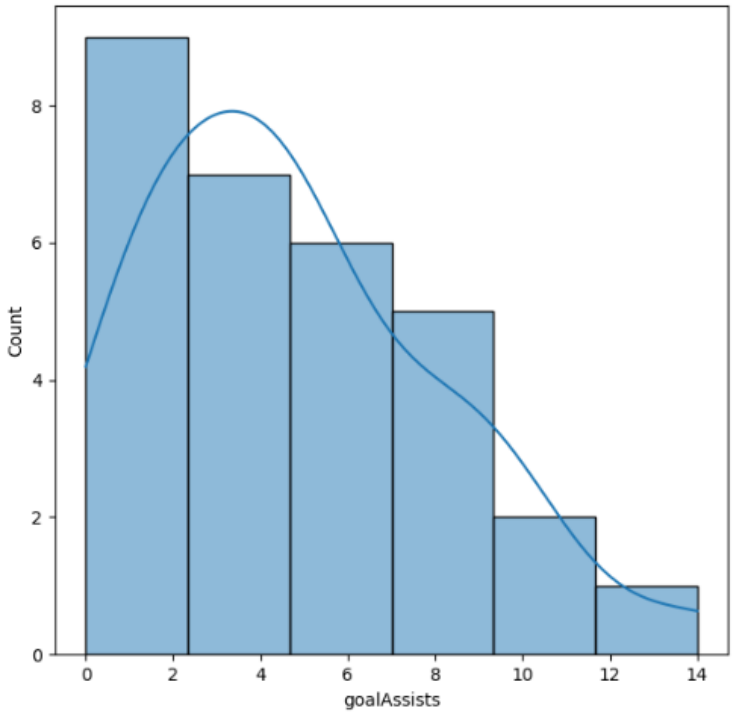

Figure 4: *Distribution of Goal Assists*

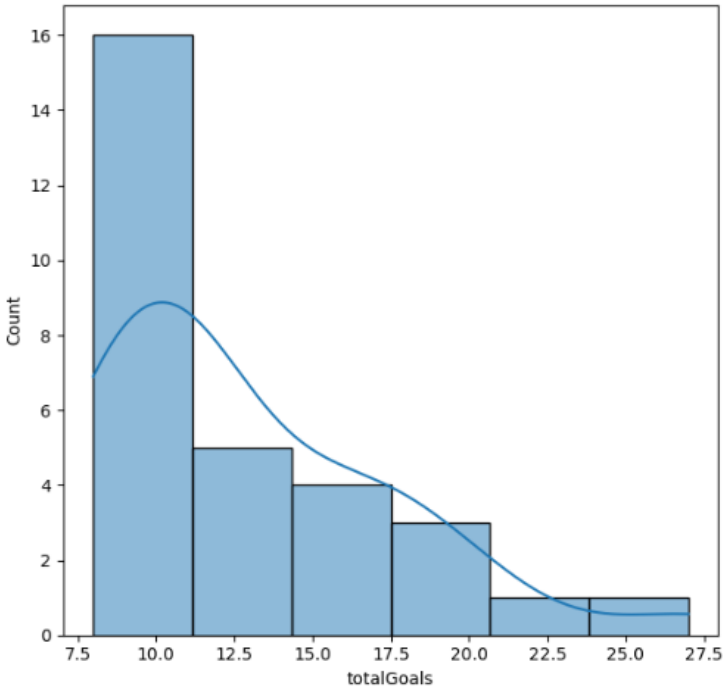

Figure 5: *Distribution of Total Goals*

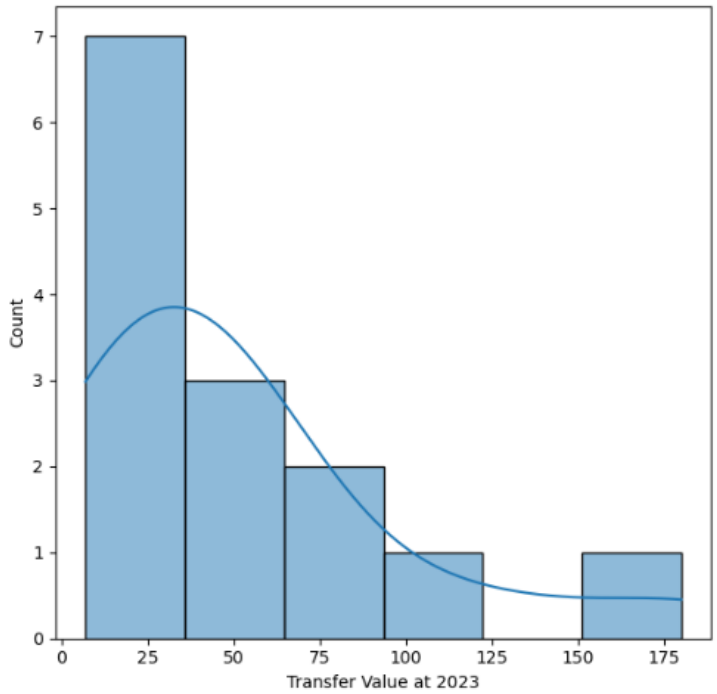

Figure 6: *Distribution of Transfer Value at 2023*

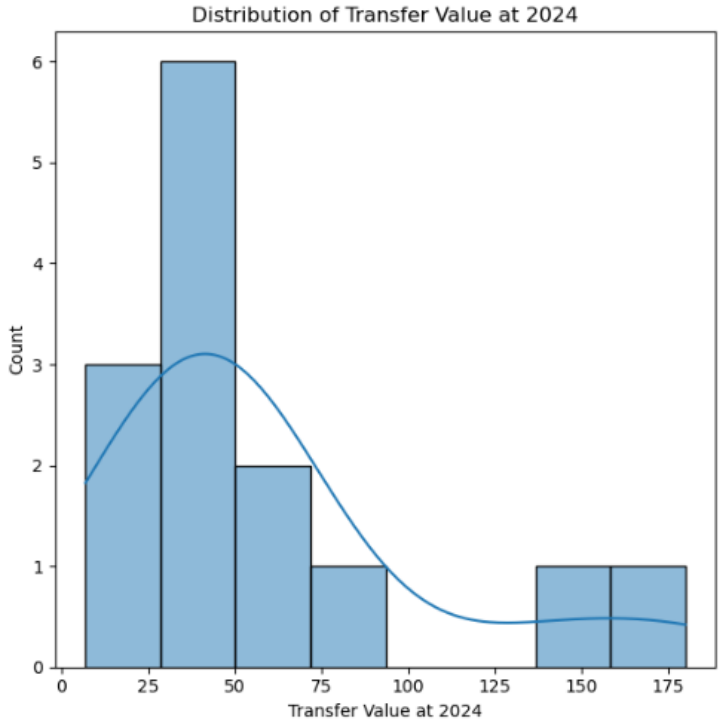

Figure 7: *Distribution of Transfer Value at 2024*

3. Gamma Distribution Fitting:

-Fit a Gamma Distribution to the transfer values from the previous season.
-Use this distribution to model the expected transfer values for the upcoming season.

4. Prediction of Future Transfer Values:

-Predict the transfer values for the next season using the fitted Gamma Distribution.
-Compare these predicted values with the actual transfer values to evaluate the model's accuracy.

Output:

	Player	Actual Transfer Value at 2024	Predicted Transfer Value at 2024
0	Erling Haaland	180.0	29.600498
1	Alexander Isak	75.0	10.976438
2	Ollie Watkins	65.0	53.418565
3	Dominic Solanke	40.0	35.242542
4	Mohamed Salah	55.0	167.731994
5	Son Heung-Min	45.0	13.939402
6	Bukayo Saka	140.0	14.600497
7	Jarrod Bowen	50.0	115.989095
8	Jean-Philippe Mateta	20.0	8.386979
9	Nicolas Jackson	35.0	137.487938
10	Chris Wood	7.0	23.269513
11	Matheus Cunha	45.0	40.756263
12	Hwang Hee-Chan	25.0	16.406292
13	Leandro Trossard	35.0	26.693675

Figure 8: *Actual vs Prediction*

5. Error Analysis:

-Calculate the Mean Absolute Error (MAE) between the predicted and actual transfer values.
-Provide insights into the prediction accuracy and areas for improvement.

Output:

	Player	Actual Transfer Value at 2024	Error
0	Erling Haaland	180.0	150.399502
1	Alexander Isak	75.0	64.023562
2	Ollie Watkins	65.0	11.581435
3	Dominic Solanke	40.0	4.757458
4	Mohamed Salah	55.0	112.731994
5	Son Heung-Min	45.0	31.060598
6	Bukayo Saka	140.0	125.399503
7	Jarrod Bowen	50.0	65.989095
8	Jean-Philippe Mateta	20.0	11.613021
9	Nicolas Jackson	35.0	102.487938
10	Chris Wood	7.0	16.269513
11	Matheus Cunha	45.0	4.243737
12	Hwang Hee-Chan	25.0	8.593708
13	Leandro Trossard	35.0	8.306325

Figure 9: *Errors*

At this part, we obtain Mean Absolute Error (MAE) = 51.24695629760597.

6. Visualization:

-Visualize the distribution of player statistics and transfer values.

-Plot the comparison between actual and predicted transfer values to provide a clear understanding of the model's performance.

After applying formula on data, output:

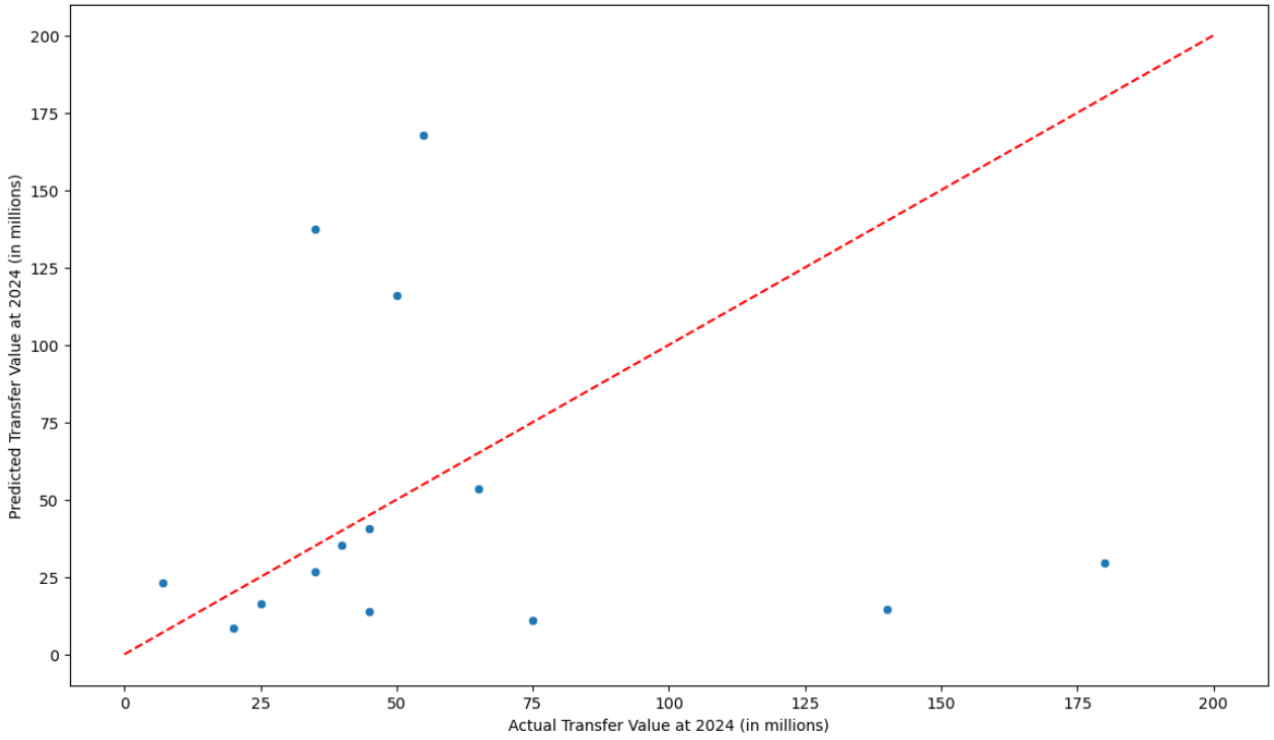

Figure 10: *Actual vs Predicted Transfer Values for 2024*

Conclusion

We can say that this project partially successfully demonstrates the application of statistical modeling using the Gamma Distribution to predict the future transfer values of football players. Because the method we used gave better results between 0 and 50 M. It didn't give very close results after 50 M. We can say that this method can generally be used at values less than 50 M.

REFERENCES

Bain, L.J., Engelhardt, M. (1992). *Introduction to Probability and Mathematical Statistics.* (2nd Ed.). Duxbury Thomson Learning.

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