Predictive Analysis and Machine Learning in MOBA Games: Forecasting League of Legends Game Outcomes

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March 2024

1 Introduction

Predicting game outcomes has emerged as an intriguing challenge for modern machine learning in the fast-paced world of eSports, especially in the strategy-rich environment of multiplayer online battle arenas (MOBAs) like League of Legends. The perfect setting for using modern analytical techniques to forecast match outcomes is this arena, where making quick decisions and using strategic thinking are essential. In addition to providing new opportunities for enhancing player experiences and strategic planning, machine learning makes a substantial contribution to the expanding field of eSport statistics. The novel studies that make use of player performance measurements and early game data are examined in this overview of the literature. Through an analysis of various machine learning techniques, algorithms, and research implementations, this review seeks to shed light on the strengths and weaknesses of current prediction models. By demonstrating how early-game choices and behaviours can be utilised to forecast match results, it emphasises the significance of these actions. This analysis also sheds light on how important feature and algorithm selection are when building prediction models that work, and it offers insights into how eSports analytics is changing and where it might go in the future.

2 Literature

2.1 Machine Learning Methods for Predicting League of Legends Game Outcome.

Juan-Agustin Hitar-Garcia, L. Moran-Fernandez, and V. Bolon-Canedo (2023) emphasise the use of early game data while focusing on using machine learning to forecast results in League of Legends games. The attention of the have a look at is to determine which early game metrics are most dependable in predicting match effects. Their dataset, which includes an extensive range of in-recreation performance measures, is evaluated using a group of machine gaining

knowledge of models. The AdaBoost approach is given unique interest due to its robust overall performance in handling quite a few records capabilities. The evaluation standards showcased AdaBoost's extraordinary predictive skills by emphasising accuracy, precision, and bear in mind measures. The paper does point out certain boundaries with the dataset, maximum considerably the absence of actual-time statistics integration, which could improve prediction accuracy. Recommendations involve expanding the dataset to consist of greater dynamic in-recreation instances, as well as investigating deeper learning models for greater unique predictions. [1]

2.2 A machine learning approach to predict the result of League of Legends.

Q. Shen (2022) expands on this investigation by utilising a variety of machine learning methods, such as Random Forest and Gradient Boosting, to forecast League of Legends match results. The significance of selecting appropriate variables for prediction and the potential dynamic complexities associated with MOBA games have been demonstrated by Shen's research. The work makes use of an extensive dataset that specifies players' early game performances in order to train and test the models and evaluate their prediction accuracy in real-world scenarios. It has been noted that one of the limitations of this approach is that it uses static data, which may make it challenging to depict the dynamic flow of game play. Time-series data, according to Shen, can be used to more accurately illustrate how each match is changing over time. [2]

2.3 Victory prediction in League of Legends using Feature Selection and Ensemble methods.

Ani R et al. (2019) investigate feature selection and ensemble approaches for win prediction. The focus of this study is on determining the critical game characteristics that have the biggest impact on match outcomes, which makes it unique. By using a dataset that has been improved with thorough match statistics, the study shows the value of ensemble methods especially when combined with rigorous feature selection processes. The evaluation demonstrates the challenging process of overfitting in higher dimensional data and the critical need to strike a compromise between feature relevance and model complexity. The primary causes of the study's shortcomings are the dataset's representativeness and the static feature selection procedure. It is recommended to use varied datasets and dynamic feature selection procedures to improve the generalizability of the model. [3]

2.4 A Machine Learning Based Predictive Analysis Use Case For eSports Games.

The work by A. Tuzcu et al. demonstrates how predictive analysis has shifted to a machine learning-based, nuanced understanding of early game dynamics.

Table 1: Accuracy of our models evaluated using different ensemble methods

Methods	Pre-Match	Within Match	Combined
Random Forest	95.52%	98.18%	99.75%
Adaboost	57.22%	96.31%	96.25%
Gradient Boosting	65.67%	96.82%	97.01%
Extreme Gradient Boosting	65.12%	96.83%	97.21%

Table 2: Top-3 features with their importance

Pre-match	**Within-Match**
Ban - 0.18	Turret - 0.22
Champion - 0.08	KD - 0.19
Patch no - 0.07	GSPD - 0.06

Their method, which focuses on post-feature selection AdaBoost and Gradient Boosting techniques, represents a major advancement in improving model performance by careful data preprocessing. The results show that the early game information have a considerable predictive power for match outcomes. This study draws attention to the constraints pertaining to the dataset's scope and the possibility of adding more thorough game event data. The investigation of deep learning models, which may provide fresh perspectives on intricate game dynamics, is one of the suggested directions for further study. [4]

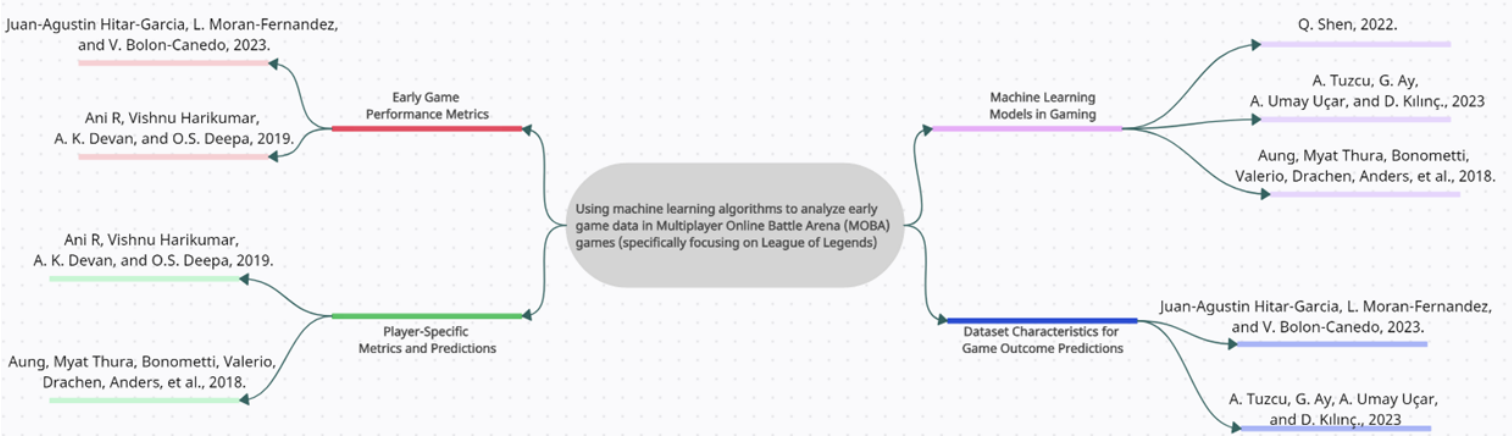
2.5 Predicting Skill Learning in a Large, Longitudinal MOBA Dataset.

Using a longitudinal approach, Aung et al. (2018) look at skill growth over time to forecast player performance in the long run. To find out if there is a correlation between early performance and season-ending results, the study employs Random Forest and Logistic Regression models with a season-spanning dataset. This method points to cognitive components that may be involved in skill growth and performance enhancement, highlighting the early game data's potential as a future success predictor. One limitation of the study is that it only looked at data from one game, which makes it difficult to say how generalizable the findings are to other MOBA games. To increase the explanatory power of the predictive models, Aung et al. suggest conducting additional research on the psychological and cognitive elements of gaming. [5]

3 Conclusion

To sum up, the literature analysis expands our understanding of machine learning's application in predicting MOBA game outcomes. The studies emphasise how important early game performance metrics, algorithmic accuracy, and feature selection are for predicting game outcomes. Despite challenges with data comprehensiveness and model generalizability, these research programmes seek to construct more sophisticated prediction models. With suggestions for future study including broadening the breadth of data, incorporating real-time analytics, and looking at cognitive components to further improve prediction accuracy, this work offers fascinating potential for eSports analytics and cognitive gaming research.

4 Literature Map



5 References

[1] Juan-Agustin Hitar-Garcia, L. Moran-Fernandez, and V. Bolon-Canedo, "Machine Learning Methods for Predicting League of Legends Game Outcome," IEEE transactions on games, vol. 15, no. 2, pp. 171–181, Jun. 2023, doi: https://doi.org/10.1109/tg.2022.3153086.

[2] Q. Shen, "A machine learning approach to predict the result of League of Legends," Feb. 2022, doi: https://doi.org/10.1109/mlke55170.2022.00013.

[3] Ani R, Vishnu Harikumar, A. K. Devan, and O.S. Deepa, "Victory prediction in League of Legends using Feature Selection and Ensemble methods," May 2019, doi: https://doi.org/10.1109/iccs45141.2019.9065758.

[4] A. Tuzcu, G. Ay, A. Umay Uçar, and D. Kılınç, "A Machine Learning Based Predictive Analysis Use Case For eSports Games." Available: https://dergipark.org.tr/en/download/article-file/2990904

[5] M. Aung et al., "Predicting Skill Learning in a Large, Longitudinal MOBA Dataset." Available: https://eprints.whiterose.ac.uk/132541/1/predicting_skill_learning.pdf