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of
Master of Science in Business Analytics

League of Legends Victory Prediction Analysis

By

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Executive Summary

(1000 words; 10% of marks)

Set out on its own immediately after the title page. This often takes the form of a series of summary statements, ordered under similar headings to those used within the Dissertation. These summarise the key information or findings. The Executive summary should be written for an intelligent layman. An example of an Executive summary can be found in SurreyLearn.

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Name: Calum Palmer

Signature:

Date: 07/09/2022

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Acronyms

MOBA Multiplayer Online Battle Arena

Glossary

baron A neutral monster that spawns after the 20-minute mark that will give a powerful buff when slain. 3

champion A unique player-controlled character possessing a distinct set of abilities and attributes. 3, 4

dragon A neutral monster that spawns every 5 minutes that will give a moderate team-wide buff when slain. 3

jungle A section of the map where neutral monsters spawn that can be slain for gold, experience and buffs. 3

meta The most effective strategy for winning. 2

minion A unit that periodically spawns from the Nexus, advances along a lane towards the enemy Nexus and engages with any enemy they encounter. 3

nexus A structure that serves as the primary objective of the game. When the enemy Nexus is destroyed, victory is achieved. 3

patch A version of the game with a set of changes made to the game to update, improve or balance. 4, 5

rift herald A neutral monster that spawns between the 8 and 20-minute mark that can be used as a powerful tower sieging tool when slain. 3

tower A structure that deals damage to enemies that come into its radius and must be destroyed in order to reach the Nexus. 3

ward A deployable unit that grants vision of the surrounding area for a duration, they are typically used to gain valuable information on the enemy. 3

Chapter 1

Introduction

1.1 Context

Esports is a form of competition using video games where participants will compete either individually or in a team for a chance at victory. These competitions attract millions of viewers, with estimates of 532 million spectators by the end of 2022, and this value is expected to grow annually at a value of roughly 8.7% (Newzoo 2022). The rapid growth in Esports has led to the industry becoming professional, with hundreds of players contracted on full-time contracts competing for prize pools of up to $40 million (Esports Earnings n.d.). According to Newzoo (2022) this viewership will help the industry generate over $1.38 billion in revenue by the end of 2022. As the Esports industry continues to grow, so does the importance on teams to win and remain relevant in the industry.

In traditional sports, analytics has become an extremely popular field with teams investing heavily in some form of analytics. These analytics can be used from evaluating opposing teams, to individual player forecasting and even used to decide signings or team selection (Sarlis & Tjortjis 2020, Apostolou & Tjortjis 2019). Apostolou & Tjortjis (2019), Sarlis & Tjortjis (2020) shows that these analytics can be applied for each athlete, giving an accurate estimation of key metrics such as goals scored per season or the number

of shots attempted in a given match. This same methodology could be applied to Esports, using these machine learning techniques could highlight specific factors both pre-game and in-game, helping analysts and coaches refine strategies within the game.

The ease of data collection coming from each match has led to a rise in Esports analytics. In-depth analysis of matches, teams and pre-game factors become key techniques for teams to gain this advantage over their competitors, with teams being required by their leagues to have at least one dedicated coach and analyst similar to traditional sports teams (LoLEsports 2022). These coaches and analysts use predictive analytics to maximise their team's likelihood of winning by altering numerous features related to pre-game and in-game strategies, current meta analysis and common patterns of their competition (Kokkinakis et al. 2021). However, this analysis is often completed manually by watching key highlights of matches using the analyst's intuition and using rudimentary analysis of in-game factors.

If matches can be accurately predicted using machine learning techniques, then analysts can provide new opportunities to optimise player strategies and can lead their teams to better outcomes. Applying the same findings found in Gray & Wert-Gray (2012), it can be seen that the overall performance and fan satisfaction with a sports team's performance has a measurable impact on revenue via fan attendance and their media response. Esports fans also appear to increasingly demand skillful performances especially from players that are deemed as *'superstars'*, with these players being more likely to attract new viewers, thus increasing the economic gain of the market (Mangeloja 2019, Ward & Harmon 2019). It would then be in the interest of both teams and individual players to maximise their abilities and career longevity using these advanced analytics, so they can fully realise their potential; especially when the volatility of a players job security results in only the top 10% of players having lasting, stable careers (Ward & Harmon 2019).

1.2 League of Legends

1.2.1 General Information

League of Legends is a Multiplayer Online Battle Arena (MOBA) game developed by Riot Games released in 2009, it is one of most popular esports games in the world with over 180 million monthly players and a peak of 73.8 million concurrent viewers (Riot Games 2021, McLaughlin 2021). A MOBA is fusion genre of real-time strategy, role-playing and action games in which two sets of teams will compete in a known arena. The objective of each game is to defeat the opposition by destroying the enemy's base.

Each player will select and control a unique champion with their own set of distinct abilities, this champion will be selected before the game starts and cannot be changed until the game has ended - this will be covered further in Section 1.2.2. Players can strengthen their champions by gaining experience and gold, this can be done by slaying enemy minions, jungle monsters, enemy structures or enemy champions. This gold can be spent in the shop allowing players to purchase items that enhance the attributes of their champion, as well as various utility items such as wards.

A map of League of Legends can be seen in Figure 1.1. There are three lanes, Top, Middle and Bottom, with the jungle filling the space between these lanes. Typically, a player will be assigned to each of these lanes including the jungle, the exception being two players assigned to the bottom lane. Each coloured dot represents a tower that must be taken in order to reach the enemy Nexus. A river separates the territories between the Blue (Team 1) and the Red team (Team 2) along the dotted black line seen in Figure 1.1. In this river you can find Baron or Rift herald in top-side and the Dragon in the bottom-side, they are key objectives that will often be contested.

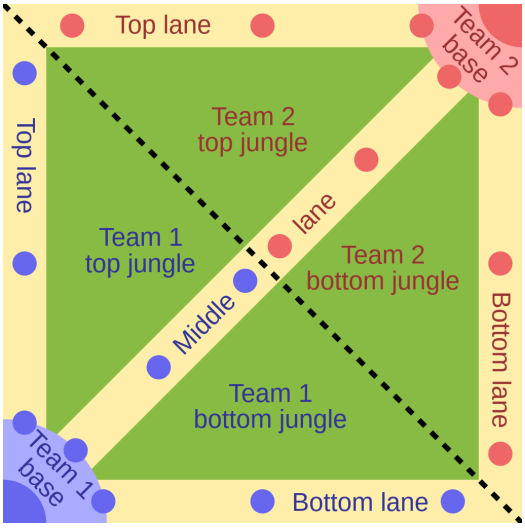

Figure 1.1: Map of League of Legends

1.2.2 Champion Selection

Champion Selection plays an important part in every game of League of Legends. Certain champions have inherent synergies with one another, meaning they are beneficial to be picked with each other. Likewise, some champions are considered counter matchups when they are good at stopping another champion. This means that picking a good mixture of champions that are solid synergistically, whilst also ensuring the opponents champions do not counter yours is vital. These ideas are the fundamentals of champion selection, and they are what professional coaches and analysts attempt to solve each week. Factors such as player champion experience, the current game balance patch or a champion's ability to be flexible across different lanes will change champion select from game to game.

As seen in Figure 1.2, the current draft phase works as follows:

- Ban Phase 1 begins with the Blue team, in turn each team bans three champions from the pool.
- Pick Phase 1 begins with a singular pick from the Blue side, followed by two picks from the Red side. Blue side will get two more picks,

followed by a singular pick from Red side for three picks each.

- It will then enter Ban Phase 2. Here both teams will ban two more champions in turn, with Red side starting.
- Pick Phase 2 will begin. Here Red side get their fourth champion pick, followed by the final two picks from Blue side and finally Red side pick their final champion.

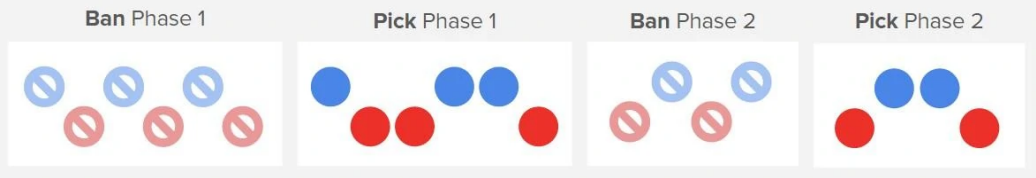

Figure 1.2: Champion Select

This champion selection structure leads to clear opportunities for teams to ban out champions that are deemed too strong in Ban Phase 1. Blue side getting the first pick gives them a chance to pick any champion that is deemed too strong that still remains after Ban Phase 1. Whilst Red side getting the last pick gives a defined opportunity to pick a counter match-up to any given lane. These factors can give one side the edge based on the Patch, leading to varying strength levels of Blue side vs Red side and can make side selection important.

1.3 Structure, Aims, and Objectives

The following section explores an overview of this dissertation:

The next chapter, Chapter 2, discusses the role of...

Chapter 3 follows the techniques and tools used for predicting the effect of pre-game choices on the outcome of the match. Beginning with...

Chapter 4 then proceeds with a discussion of the work carried out and presents the outputs of the model created. An evaluation of...

Finally, chapter 5 will conclude the dissertation giving an overall summary of the work completed, as well as any further opportunities for research.

Having pre-established the landscape of Esports and its relationship with analytics, it is clear that refinement in the way that this industry uses its highly available data is needed. Many academics have predicted the outcomes of matches in Esports titles such as Silva et al. (2018). However, performing these studies, few academics addressed the implications of the champion select phase on the overall outcome on a given League of Legends match. Often it is put into the model as a singular feature defined as champion or ban, without giving much implication on how an individual champion effects a game more than another. In contrast to other studies, this study uses a much larger, updated dataset and will concentrate much more on the overall effects of the pre-game choices that a team will make inside champion select. This includes the effects of each individual champion on the likelihood of winning a match. Therefore, the research question that will be addressed is as follows:

Can the outcome of a League of Legends match be predicted?

This research will provide an overview of the changing ways in which video games are being consumed, both in the emergence of esports and of the betting activities associated therewith. Subsequently, this article outlines the hypothesised relationships between demographic characteristics, media consumption practices and esports betting practices before describing the research model employed in this study. After outlining the methods, measures, participants and procedures this article presents, the results of the study in reference to demographic characteristics and measures of consumption. The findings are discussed alongside their theoretical and practical implications, potential avenues of future research, and the limitations of this work.

This research will thus contribute to the growing body of literature related to the convergence of gambling and (video) gaming. Specifically, this study investigates the interrelations between the motivations for consuming esports, consumption of digital media products associated with esports and

participation in esports betting. As such, this work will provide evidence whether esports betting replicates relationships present in traditional sports betting, or if this emergent activity is accompanied by novel relationships.

Chapter 2

Literature Review

Research Problem. - Can the outcome of a League of Legends match be predicted?

Research Objectives. - To understand how prediction exists in existing literature. - To evaluate how predictions change through game time. - To make key recommendations of champion picks within champion selection.

This section aims to review previous literature of prediction models in the esports industry that was explored during in Chapter 1. These literatures will help create a better working understanding of how to properly model, extract and gain knowledge from the datasets. It will cover papers from traditional sports where prediction models are widespread and lesser researched esports models, to research on the betting industry with its new relation to esports.

2.1 Esports Prediction Modelling

2.1.1 Match Outcome Prediction

In the mid to late 2000s the use of prediction modelling exploded academically, being applied to a multitude of fields from biology and medicine to political sciences. This academic surge of interest caused thousands of studies all using various forms of predictive modelling. Not only did this evolve many practises across these fields, but it also helped develop the techniques

of predictive modelling today. The work of predictive modelling in esports only started in the mid 2010s, with one of the original papers by Lin (2016) exploring match outcomes in League of Legends. This work focused on the relationship between the potential feature-sets that a game such as League of Legends can create, and how they impact the predicted match outcome both pre-game and in-game. The data was collected using the Riot API from matches with average ranked players, with the in-game data being extracted from the statistics published at the end of a match. It becomes apparent that the data used in this initial study appears to be highly correlated with the match result, and this is reflected by the 95% success rate on prediction using in-game data.

2.1.2 Champion Select Prediction

Prediction using champion selections.

2.2 Esports Betting

As esports has grown, so has the ability of bookmakers to capitalise on a new developing market and create revenue. According to Absolute Reports (2022), the global esports betting market has been estimated to be worth up to $10 Billion in 2021, and is forecasted to double by the year 2028 with a compound annual growth rate of 13.1%. A new focus of esports has grown throughout traditional bookmakers, with an increasingly larger number of esports titles to bet on and some bookmakers even sponsoring some events (Byrne 2019). With the large variety of titles comes the challenge of creating odds that are representative of the outcomes that will occur. There are numerous studies showing how gambling markets in most traditional sports can change how a given team is evaluated, often with regard to sentiment bias (Feddersen et al. 2018, Na et al. 2019). This means that odds-makers must create predictive models that can accurately replicate the true likelihood of match outcome in order to ensure money is continually being made. According to the efficient-market hypothesis, sport bets should be

subject to all available information that may be publicly available and this information will be reflected in the odds themselves(Even & Noble 1992). The betting market is therefore thought of as a fair and efficient market in which match outcomes can be accurately predicted.

Betting within esports has taken on many forms. Money line bets and proposition bets are the most common types of bets. Money line bets are bets that are placed on the outcome of a specific match, with payouts based on the odds that are created by the odds-makers using their internal prediction models. Proposition bets are bets made based on whether a specific event will take place within the game itself while the match is ongoing. A common proposition bet is whether a team would achieve the first kill of the game - commonly referred to as First Blood. All these types of bets require highly calculated odds ensuring the bookmakers will make money. With esports betting being in its early form, there are no regulatory structures put in place to effectively to keep match integrity in place similar to those found within most sports (Dos Reis 2017). This lack of match integrity causes potential match-fixing scandals which threatens the competitive integrity of both the league and the gambling market, as well as ruining games for spectators alike. Whilst studies such as Abarbanel & Johnson (2019) claim that esports spectators aren't deeply concerned about potential match-fixing, with most spectators being willing to forgive infractions that have occurred previously. Cases of match-fixing have already been investigated, with a Chinese player- 'Bo' being suspended after being coerced into match-fixing in the Chinese academy leagues, subsequently causing a league-wide large-scale investigation (Dot Esports 2021). This caused a call for harsher punishments and stricter measures to ensure infractions like these would become highly disincentivised, however no regulatory structures apart from the league's punishment systems currently exist.

2.3 Summary

This chapter provided an overview of key literature in esports and prediction modelling found within it. These give a baseline understanding of how prediction models function... The betting industry was explored, showing its relation to the world of esports and how they use prediction modelling for their business.

With the information gained throughout this literature review, the following research hypotheses have been created:

Hypothesis 1: Esports prediction models are xyz.

Hypothesis 2: Esports prediction models are xyz.

Hypothesis 3: Esports betting indicates that highly accurate prediction models for match outcomes are feasible.

Chapter 3

Methodology

3000 words

This section evaluates and justifies the research methodology that will be used to obtain the data to answer the research questions. It states the research problem, discusses the operationalization of hypotheses (where relevant), discusses the research instrument used, the method of collecting the data – including sampling, the analysis of the data and the validity and reliability of data. It should contain enough detail to allow someone else to repeat your study.

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Chapter 4

Results

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Chapter 5

Conclusion

1500 words

It can be hard to know which section to discuss your results – this or the preceding one – and you may decide to combine these two sections into one or more chapters based on theme, depending on your topic and your supervisor's views. However, what is vital is that your Dissertation contains sufficient analytical discussion in addition to the more descriptive 'scene setting' material of the literature review sections, and presentation of results. It is here that you will compare and contrast your findings with those already reported in the literature.

Here you need to answer the "So what?" question. What significance do your research findings have? For whom? Why? and How? In this chapter you link the research problem with literature review and findings, stating what you can conclude based on the work conducted. Based on your conclusions you should comment on managerial implications, the limitations of the research, suggest further work and better ways to resolve the problem.

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