



# **Machine learning approach to matchmaking for online first-person shooters.**

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## **1 Introduction**

With the rise of the video gaming industry in modern times as shown by the staggering US\$365.60bn revenue forecast expected in the year 2023, it has continued to be an important goal for developers in the industry to improve their products. These game development companies then must continue to identify methods to increase engagement with their game which in turn brings more money into the industry. There are many ways that these companies try to improve engagement whether it be by adding new items, gameplay mechanics or any other system to improve the overall experience of the game's audience. One of the popular systems that has been created to achieve this goal would be the matchmaking system which has been seen to be a very important part of any online video game these days.

## **2 Problem Statement**

According to Skinner (2021) "Matchmaking is the process of grouping players together for online play sessions." This grouping of players is usually done by looking at various factors such as location of and skill possessed by the players looking to play the game. The general goal of grouping these players with regards to skill would be to place them in such a way that everybody in the session is of an equal skill level thus creating a fair game which would be considered the best way to have an enjoyable experience. Such systems are used quite widely in many video games over many genres such as First Person Shooters (FPS) and Multiplayer Online Battle Arena (MOBA) games. Any person that plays these video games then rely on these match making systems as the main way to join an online gaming session.

The problem with these matchmaking systems however would be that they do not always create fair games for the players of the game. This then means that players of varying skill levels could be found in the same game which leads to 2 possible bad outcomes. Firstly, a player of a high skill level might be put against players of low skill levels, leading them to get bored as they do not feel challenged enough by the game. The other possible bad outcome would be if a lower skilled player gets matched against higher skilled players, this could then lead the lower skilled player to be discouraged by a one-sided game where they lose very badly. If the matchmaking system implemented by a game is then of low quality, the possibility of an unfair game occurring increases. This finally leads

to players of the game having consistent bad experiences playing the game and in turn losing interest to engage with said game. We can also see that such problems still plague popular games as such as Overwatch 2 as stated by Schwarz (2023) where a skill matching disparity of 12 divisions or greater has been experienced by the player base rather frequently in 2023.

From these low-quality matchmaking systems, we can then identify two heavily affected parties. Firstly, the main audience that would get affected by these systems would be the ones using them which would be the actual players of the game. As players of a game do lose interest and engage less with the game however, we can see how the companies that develop these games would get affected negatively as they lose their clients. It is then imperative that these matchmaking systems be improved to avoid these negative experiences from occurring and in turn increase player engagement in these video games.

In this paper, an improved matchmaking system will be created using machine learning techniques and detailed player statistics from online gaming sessions. Due to the large differences between gaming genres, this paper will also focus on a specific genre of game called First-Person Shooters and use a popular game in this genre as a focus for the model that will be created. It is also worth noting that machine learning approaches have been applied to matchmaking systems or predicting match outcomes as seen in Münnich (2015), Do *et al.* (2021) and Makarov *et al.* (2018). These approaches have seen to have various short comings with regards to amount of data points, features created and practicality, however. We will then review these approaches to identify how the existing knowledge base can be expanded by creating better features and gathering more data.

### **3 Related works**

#### **3.1 ELO**

There have been a few developed ideas for matchmaking systems, looking through these we can begin to identify where current solutions thrive and fall short. One of the most common approaches has been to make use of the ELO system. The ELO system was created by Arpad Elo as a rating system to compare the skill levels of different players of a game. Originally created for chess, the ELO rating system has seen wide use within

video games to accurately define a player's skill level and match them against other players of a similar skill level. ELO has seen many drawbacks regarding its use in video games however, especially as the system is not robust enough to account for the continuous adding of complexities and features to video games. Hence, it can be seen why more complex and custom solutions to the problem of measuring players skill levels is required.

### **3.2 Machine-learning approaches**

There have been various studies with regards to matchmaking systems in many different genres. In the work done by Münnich (2015), various predictive models were trained on data retrieved from Battlefield 4 gameplay, the best models were then integrated into a matchmaking system. This system that was created did use data retrieved from completed Battlefield 4 games but seemed to lack in the sophistication of the features that were created and amount of retrieved data.

Another interesting approach taken by Do *et al.* (2021) was to predict match outcomes based on the experience players had with their respective classes chosen alone in the game League Of Legends. Obtaining an accuracy of 75.1%, it was definitely shown that such a feature is an important predictor of match outcome. In the context of a matchmaking system however, such an approach might not be possible as classes are traditionally chosen by the players after the algorithm has put the players into teams.

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