I. INTRODUCTION

A game is a set of rules or policies by one or more people to carry out an action that will generate excitement for those who do it [1]. The game has two types of playing methods: Turn-Based and Real-Time [2], [3]. The Turn-Based is a way of playing where each player plays the game [4], where players must take turns and wait for their turn before playing again [5]–[7]. In contrast, Real-Time is one way of playing where the game is carried out continuously or simultaneously with other players, such as in [8]–[11].

There are several types of games that require players to focus on more than one point, such as real-time simulation games where the game runs directly without waiting and requires real-time resource management [12], [13]. In a strategy game that requires strategy design, resources, and individual management, players will find it challenging to make movements in the game [14], [15], [16].

Various techniques in machine learning, one of the branches of artificial intelligence (AI), are recently applied to the game area. Here, it plays a vital role in automatically making decisions and movements to run the game [17]. However, the use of AI implemented in the game has a predictable pattern to be deemed less effective. Hence, a unique AI is needed so that the game can run more interestingly.

ML can be a solution to the character movement patterns that can change. Machine Learning is a computer science that can learn according to the data it has. Deep reinforcement learning (DRL) is a new method combining deep learning and reinforcement learning (RL). It produces an algorithm that can continue to learn without deleting or forgetting previous memory so that it can be useful as assistance for players because it can continue to learn and adapt to the game that is done by the player himself.

DRL is a type of unsupervised learning that does not have training data. Instead, DRL will classify data based on the rewards obtained from the actions taken. Since DRL is unsupervised learning, the search for training data is not required before conducting training, making the training process more flexible. It also allows for continuous training as long as the player plays the game.

Continuous training allows the DRL model to continue learning indefinitely, which means infinite copying of player behavior. However, of course, the player behavior is not static. A player who is a human will also learn and improvise to continue to give his best in battle. This process will continue without stopping. Players and the AM will continue to improvise and evaluate to be better than before. In other words, the AM will grow up together with the players.

Therefore, in this research, DRL is exploited to develop an AM for a unique RTS game called Royale Heroes. The literature review will be provided in Section 2. Next, Section 3 gives the Royale Heroes design and implementation. Section 4 discusses the experimental results. Section 5 gives the conclusion.