An Analysis on the Rush Strategies of the Real-Time Strategy Game

リアルタイム・ストラテジー・ゲームにおける Rush 戦略の分析

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筑波大学大学院 システム情報工学研究科 知能機能システム専攻

Teguh Budianto

Graduate School of Systems and Information Engineering, University of Tsukuba

(指導教員: 宇津呂武仁, 古賀弘樹, 星野准一)

Real-Time Strategy is a game genre which requires good strategy decision by the players. How the players perform the strategy affects the final result of the game. In this research, we analyse rush strategies in a Real-Time Strategy game: StarCraft II. We collect replays from an on-line StarCraft II game community. Using the game replays, our observation focus on the high-level players match between Zerg versus Protoss to find the winning condition of rush strategies both for the rushing side and defending side. We observe the typical winning pattern of each rush strategy in the observed games by watching the differences from the data. Finally, we propose the recommendation from our analysis based on several winning conditions in order to provide successful rush and successful defence.

1. Introduction

Real-Time Strategy (RTS) game is a popular on-line computer game genre played by two sides of players which fight each other. In the game, a player requires to collect resources which makes the player be able to build structures and train armies for the battle. Unfortunately, RTS game is difficult for some players who just started to play because it requires high-level strategy decision.

StarCraft II is an example of the famous RTS game (Buro & Churchill, 2012). In StarCraft II, performing good strategy decision is the most important key (Buro & Churchill, 2012) in order to maximize the winning opportunity. For example, players who usually have low APM (action per minutes, a metric often used to judge a player's skill), typically make a mistake on selecting which strategy they should apply and on executing the correct strategy with bad manner that makes the players lose in the game. These occurrences even happen on the game by a player who has higher APM than his opponent because of performing the same mistakes.

The players require to spend a lot of time to play this type of game in order improving their playing skill. This situation is sometimes just simply because the players do not have enough knowledge to improve it. An aspect which makes improving player skill challenging is that the RTS game provides dynamics environments to the players. Only the players who have many experience in the game that can understand these situations.

The most typical strategy in StarCraft II is the rush strategy which focuses on the speed and sudden attack to the opponent in the early of the game. This strategy is a kind of entry-level strategy played in StarCraft II, but it requires perfect timing and micro actions to increase winning opportunity. In StarCraft II, Not all the players can successfully win from their opponents by using rush strategy.

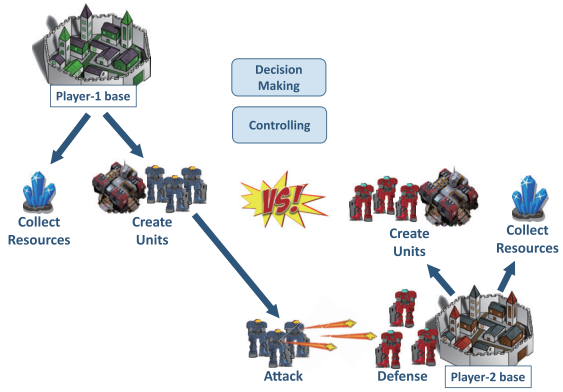

Figure 1: StarCraft II Overview

In this research, our aim is to recommend the beginner and losing players some better strategy and assist them to learn the strategy from the data. Our direct purposes in this examination is to find the typical pattern of successful rush and defense by watching the difference in the game. At the end, we provide the recommendation for the players by proposing the information of how the successful players won in the rush games.

2. The Real-time Strategy Game: StarCraft II

2.1 Overview

The most famous RTS game currently is StarCraft II developed by Blizzard Entertainment™ which can be played by two sides of players. The most common match in StarCraft II is the one-versus-one game match where the players

against each other in the game by building the structures and training armies. By training armies, each player can attack another player, and at the same time the player who is being attacked can defend those attacks. In order to do that, the players need to collect resources in the form of minerals and gases which can be spent to produce the units (see Figure 1). The units in StarCraft II, whether army or building, vary depending on the race in which each race has different unit types one to the others. There are 3 races in StarCraft II which can be chosen by the players; Terran, Zerg, and Protoss. Each race has different strength and weakness which makes each race unique and equally comparable.

In RTS game like StarCraft II, the game requires good decision making and controlling skill to be able to compete in the match. The game not only requires the speed but also the strategy in the whole level of actions including attacking, defending, resource collecting and creating units. The players should consider all the information and situations in the game before performing some actions because their decisions will affect to the whole game condition. At this situation, how the game environment proceed is based on both players action and reaction.

2.2 Rush strategy in StarCraft II

Any type of RTS game has the probability to use rush strategy in order to defeat the opponent as early as possible starting from the beginning of the game. Rushing is a battle strategy which focus on the speed and sudden attack which usually can be done before the opponent be ready enough preparing the defense. The players who rush may sacrifice the option to enlarge their base, and upgrading to advance technology because they spend a lot of resources to prepare army and building for rushing.

3. Resource and Data set

3.1 The resource of game logs of StarCraft II

We collect 9,222 the StarCraft II one-versus-one game replays from `spawningtool.com`[*1]. To make the standardization of our examination, we only use the game replays from latest game update; *StarCraft II: Legacy of The Void (LOTV)* because the previous game versions have different building and army characteristics. By using SC2Reader[*2], we extract all the replay files into human-readable log files in order to classify the game logs based on our needs. The game logs are distributed in 6 game matches; Terran versus Terran, Zerg versus Zerg, Protoss versus Protoss, Terran versus Zerg, Terran versus Protoss, and Zerg versus Protoss. Table 1 shows replay distribution in all race matches.

3.2 Data set for analysis

From the 9,222 collected resources, we only use the data from the game between Zerg vs. Protoss. StarCraft II divides their players into several leagues into Bronze, Silver, Gold, Platinum, Diamond, Master and Grandmaster where Bronze is the lower league and Grandmaster is the highest one. We assume that the leagues in StarCraft II represents the different skills of players. Because we want to know how successful strategy performing by the players, our examination on the rush strategy focus on the Zerg vs. Protoss game only from above Platinum league; Platinum, Diamond, Master and Grandmaster. We divide these data into two parts; the game within 7 minutes and the game over 7 minutes (see Table 2).

Table 1: Game logs collected

Game type	Number of game logs
Terran vs. Terran	1,018
Zerg vs. Zerg	1,160
Protoss vs. Protoss	685
Terran vs. Zerg	2,508
Terran vs. Protoss	1,938
Zerg vs. Protoss	1,938
Total	9,222

Table 2: Number of Zerg vs. Protoss games above Platinum league for the games within 7 minutes and over 7 minutes

Zerg vs. Protoss above Platinum	Number of game logs
within 7 minutes	52
over 7 minutes	928
Total	980

4. Analysis of The Games with Rush Strategy

4.1 Statistics of winning and losing

In this study, our examination on the data is limited to the total 52 games within 7 minutes. We received an assistance from a player in Diamond league to do this analysis. We observed the rush existence of rush in these 52 games and create the statistics of winning and losing for each race who did rushing strategy (see Table 3). There are only 51 games where rush strategy exists. In the remaining 1 game both players didn't perform any rush strategy where their battle happened somewhere in the middle of the terrain. Zerg players are the players who mostly won in the game when they perform rush strategy comparing to Protoss players.

4.2 Rush strategies of Protoss and Zerg

There are 3 common types of rush strategy performing by Protoss and Zerg. Protoss side has the Gate Rush and Cannon Rush while Zerg has the Zerg Rush. Protoss Gate Rush uses the resources to build Gateway as quickly as possible and train some armies like Adept or Zealot to attack the opponent base. Other type of Protoss Rush is Protoss

Table 3: Winning and losing number in Protoss vs. Zerg game less than 7 minutes

Race	Rush&Win	Rush&Lose
Protoss	11	16
Zerg	20	4

∗1 http://www.spawningtool.com
∗2 https://github.com/GraylinKim/sc2reader

Table 4: Winning condition in Zerg rush games

Case	Zerg Rush Detail	Protoss Defense Detail	Recommendation to the loser	Rush Side Win	Rush Side Lose
1	Zerg attacked the Protoss base by using only slow Zergling, without upgrading the Zergling to be faster.	Protoss had wall in front of the entrance to protect their base.	Zerg need to upgrade Zergling to be faster and stronger in order to win.	0	4
2	Zerg attacked Protoss base by using fast Zergling.	Protoss did not have wall in front of the entrance to protect their base.	Protoss need to build wall, locate 1 or 2 Zealot and train Sentry (a flying army) to protect their base from Zergling and win from rush attack.	2	0
3	Zerg upgraded their Zergling to be much stronger and faster in order to destroy Zealot and destroy Protoss base.	Protoss built the wall and locate 1 or 2 Zealot (army) near the wall to prevent Zergling enter the base.	Protoss need to train Sentry to defend their base in order to survive from Zerg rush attack.	10	0
4	Zerg attacked Protoss base using fast Zergling and Baneling Bomber to destroy Protoss Zealot walling-off.	Protoss prepared the walling-off and locate 1 or 2 Zealot (army) near the wall to prevent Zergling enter the base.		8	0

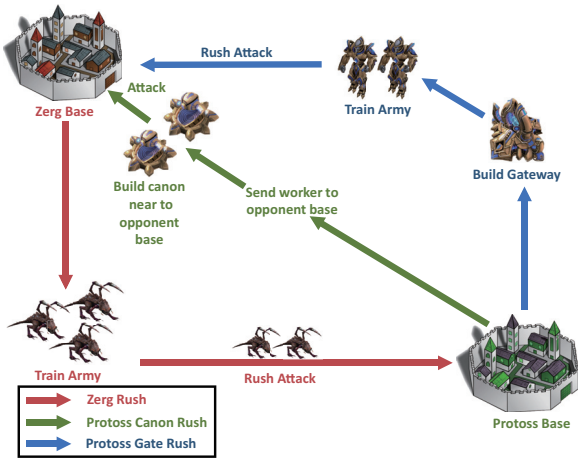

Figure 2: Rush Strategy in StarCraft II

Cannon Rush which uses the worker to build cannons (the building which can attack) near to opponent base and let the cannon destroy everything nearby. While in Zerg Rush, Zerg players focus on training group of armies like Zergling or Baneling as quickly as possible in the early of the game to attack opponent base. Figure 2 shows how rush strategies works for each rushing type.

4.3 Recommendation for winning

Our examination on the rush games leads us on finding the typical pattern on the rush strategy in Zerg vs. Protoss game by looking for the reason of why rush succeeded and why it failed. By watching the rush differences from the data, we separate our analysis and recommendation in the Table 4 and Table 5. Table 4 shows the statistics of winning condition in the Zerg rush games where Zerg was the race who performed rushing strategy and Protoss was the player who received rush. We provide the recommendation for each condition for the players who lose in the game.

In contrast, Table 5 shows the winning condition in the Protoss rush games where Protoss was the player who did rush and Zerg was the one who received rush. Since Protoss has two different rush strategies, we provide the recommendation based on every case we find in the games for each strategy.

5. Related Work

There are a large volume of published studies describing game predictions and analysis in StarCraft RTS game. Avontuur, Spronck, and Van Zaanen (2013) focusing their investigation on player model prediction to distinguish player leagues. They find that the important features from their model are based on visuospatial and motor skills of players. Their findings indicate that they can detect the player leagues in the early of the game. By knowing the level of the players in the early of the game, it can help AI or other human players to adapt with the level of their opponent. In accordance, Liu, Ballinger, and Louis (2013) investigates a player's game style in StarCraft II by applying several machine learning techniques to predict player's actions. Predicting the player actions can help human players to judge what strategy being used by the other players. Study about strategy prediction also has been introduced (Park, Cho, Lee, & Kim2, 2012; Weber & Mateas, 2009). Weber and Mateas (2009) determine constructed opponent buildings by using data mining techniques to predict the opponent strategy. Based on their works, the importance aspect of analyzing opponent buildings information can be a sign of different type of strategies. Park et al. (2012) predicts opponent strategy by using scouting algorithm and several machine learning approaches in order to achieve that purpose. They apply this approaches into an AI bot which recognizes the constructed building (build order) of oppo-

Table 5: Winning condition in Protoss rush games

Case	Protoss Rush Detail	Zerg Defense Detail	Recommendation to the loser	Rush Side Win	Rush Side Lose
1	Protoss attacked Zerg base using gate rush where Protoss built the gate building somewhere in the middle of Protoss and Zerg bases.	Zerg discovered the evidence of Protoss gates rush and prepared armies for defense destroying Protoss armies.	(1) Protoss builds Gateway building at the location where Protoss intends to build second base which is closed to the mineral fields to make an ambiguous situation to Zerg whether it could be second base or it could be rush strategy. But Protoss player should not build the second base in order to do rush strategy. This situation has a purpose to disturb Zerg's judgement. (2) Once Protoss players notice gates discovered by Zerg, Protoss must change the strategy and not finish the whole rush strategy. In this situation, Protoss have to just focus on attacking Zerg second base with whole rushing armies. Once the Zerg second base destroyed, Protoss should keep Adepts and kill as many as workers as possible and should return other armies to Protoss base. At last, Protoss changes the strategy from rush strategies to non-rush strategy.	0	13
2	Protoss attacked Zerg base using cannon rush.	Zerg discovered the evidence of Protoss canon rush and prepared armies for defense.	Once Protoss players notice the canons discovered by Zerg, Protoss must change the strategy and not finish the whole rush strategy. In the case of canon rush, Protoss player should finish the canon rush by attacking only Zerg's second base. After that, Protoss returns to his own base and change the strategy completely to non-rush strategy.	0	3
3	Protoss attacked Zerg base using gate rush where Protoss built the gate building somewhere in the middle of Protoss and Zerg bases.	Zerg sent a worker and overlord to Protoss base, but the worker was killed and the overlord did not discover the evidence of gates/ canon rush.	Zerg lets the Overlord to watch carefully and observe the rush evidence in Protoss base. If the Gateway building exists in Protoss base, that means the Protoss player intends to use Gate rush. Zerg needs to train armies in order to defend his own base.	9	0
4	Protoss attacked Zerg base using cannon rush.		Zerg lets the Overlord to watch carefully and observe the rush evidence in Protoss base. If a Forge building exist in Protoss base, that means the Protoss player intends to use Cannon rush. Zerg need to prepare army to defend Zerg base and build Spin Crawler, a building which can attack, in his own base.	2	0

nents by sending a scout. Other prior work focuses to find the final outcome of the StarCraft game. Ruíz-Granados (2015) uses the information in the replay files to develop a model that can predict the winner of StarCraft match at the specific time. But, these works do not provide how-to information for the players to build up their skill and ability in action strategy decision making. From these inspirations, we extend these works by exploring the study of winner of StarCraft game by focusing on the rush match. Our aim is to propose certain actions at some particular conditions of the match in order to help the player to gain more winning opportunity in StarCraft.

6. Conclusion

The purpose of current study is to propose the recommendation for each condition in the rush games and help the players who lose in the game to have high probability in the rushing game. We collected thousands game replays from a StarCraft II community website in order to achieve our aims. Using this data, we observed typical pattern in the rush game by watching the differences in the data to provide successful rush action strategy.

For further research, we aim to expand our observation to the game over 7 minutes to find the existence of rush in the game. We expect that we can obtain the evidence of how the players survive from rush battle for example by making strategy changing in RTS game.

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