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

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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 analyze rush strategies in a Real-Time Strategy game: StarCraft II. Using StarCraft II 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 defense.

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 12]. In StarCraft-II, performing good strategy decision is the most important key [Buro 12] 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.

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. In the end, we provide the recommendation for the players by proposing the information of how the successful players won in the rush games.

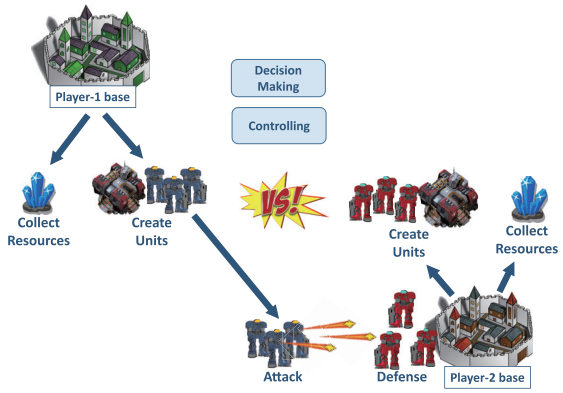

Figure 1: StarCraft-II Overview

2. The Real-time Strategy Game: StarCraft-II

2.1 Overview

StarCraft-II is a famous RTS game developed by Blizzard Entertainment™ which The most common match in StarCraft-II is the one-versus-one game. The players require to collect resources, build structures and train armies in order to win the battle in StarCraft-II. Moreover, the game also requires good decision making and controlling skill to be able to compete in the match (see Figure 1). 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.

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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

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 containing the race pairwise matches. 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 the 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 difference of players skills. Because we want to know how successful strategy performing by the players, our examination on the rush strategy only focus on the Zerg vs. Protoss game from above Platinum league; Platinum, Diamond, Master and Grandmaster. We examined total 980 Zerg vs. Protoss games and classified the games based on time and rush existence into four categories (see Table 2).

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

Table 2: Number of Zerg vs. Protoss games above Platinum league

Zerg vs. Protoss above Platinum	# game logs
rush and finish within 7 minutes	51
non-rush and finish within 7 minutes	1
rush and continue over 7 minutes	192
non-rush over 7 minutes	736
Total	980

Table 3: Winning and losing number in Protoss vs. Zerg games

(a) Games within 7 minutes (all 51 games)

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

(b) Games over 7 minutes (randomly selected 50 samples)

Race	Rush&Win	Rush&Lose
Protoss	11	9
Zerg	15	15

4. Analysis of The Games with Rush Strategy Finishing within 7 Minutes

4.1 Statistics of winning and losing

Our examination to Zerg vs. Protoss games within 7 minutes is limited to 52 games where rush exists in 51 games and do not exist in 1 remaining game (see Table 2). In performing this analysis, we received an assistance from a StarCraft-II player in the Diamond league. We analyzed rush strategy in these 51 games and created the statistics of winning and losing for each race who did rushing strategy (see Table 3(a)). Zerg players are the players who mostly won in the rush game within 7 minutes when they perform rushing strategy comparing to Protoss players. In the 1 remaining game, both players did not perform any rush strategy where their battle happened somewhere in the middle of the terrain.

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 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 work for each rushing type.

4.3 Recommendation for winning

Our examination on the rush games within 7 minutes leads us on finding the typical pattern on the rush strategy

Table 4: Winning condition in Zerg rush games finishing before 7 minutes

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

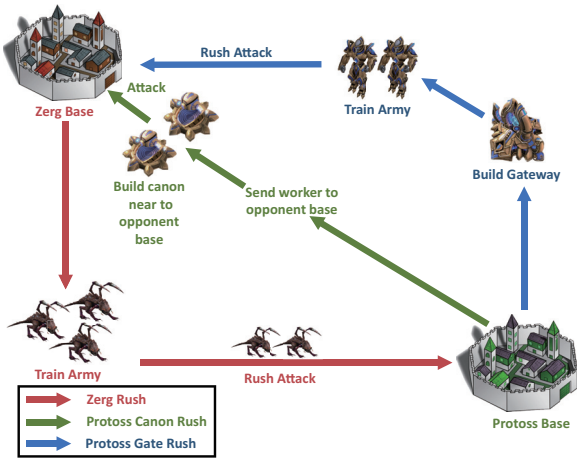

Figure 2: Rush Strategy in StarCraft-II

in Zerg vs. Protoss game by looking for the reason 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 6. We provide the recommendation for each condition to the players who lose in the rush games within 7 minutes. The recommendation we created comes from the choices of strategy details in the rush games. We recommend to the players using this information because our assumption is the details of rush strategy have strong correlation to winning and losing in the games within 7 minutes. Table 4 shows the statistics of winning and losing condition in Zerg rush games. On the other hand, Table 6 shows the winning and losing condition in the Protoss rush games.

5. Analysis of The Games with Rush Strategy Continuing over 7 Minutes

There are 192 games which rush previously exist and continues over 7 minutes in the Zerg vs. Protoss games among the total data we collected. Comparing to the rush games within 7 minutes, we have around four times rush continuation to the rush games over 7 minutes. The distribution of these 192 rush games which continue over 7 minutes shows in Table 5. Our analysis to the games which rush strategy previously exist and continue over 7 minutes uses the total 50 games out of these 192 rush games. We analyzed rush strategy in the 50 games and created the statistics of winning and losing for each race who did rushing strategy (see Table 3(b)). Table 3(b) shows the winning and losing result after rush continuation almost comparable for both races. However these winning and losing conditions in the games over 7 minutes do not have any strong relation to rush strategy previously exist in the beginning of the games.

Table 5: Rush strategy distribution in the games over 7 minutes

Rushing side	Number of game logs
Zerg rush	114
Protoss rush	75
Both rush	3
Total	192

6. Related Work

There are a large volume of published studies describing game predictions and analysis in StarCraft RTS game. [Avontuur 13] 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 13] 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 [Weber 09, Park 12]. [Weber 09] determine constructed opponent

Table 6: Winning condition in Protoss rush games finishing before 7 minutes

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

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 12] 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 opponents by sending a scout. Other prior work focuses to find the final outcome of the StarCraft game. [Ruíz-Granados 15] uses the information in the replay files to develop a model that can predict the winner of StarCraft match at the specific time. A paper very related to our work is [Oh 17], where authors present a method to identify rush strategy from StarCraft-II game logs. 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-II.

7. 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 winning probability in the rushing game. We collected thousands game replays from a StarCraft-II community website in order to achieve our aims. Our observation to the games is mainly divided into the rush games within 7 minutes and the rush games over 7 minutes. Using these data, we observed typical pattern in the rush game by watching the differences in the data to provide successful rush action strategy. In the case of rush games within 7 minutes, the recommendation to the players who lose in the games is produced based on the strong correlation of the details of rush strategy to winning and losing condition. In contrast these winning and losing conditions do not have strong relation to the existence of rush strategy in the games over 7 minutes.

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