Exploiting MMORPG Log Data toward Efficient RMT Player Detection

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ABSTRACT

To detect players who are engaged in real-money trading (RMT) in massively multi-player online role-playing games (MMORPGs), behavior of players was analyzed using log data of a commercial MMORPG. A closed test evaluated the effectiveness of several player-wise statistics derived from the log data in detecting RMT players.

Categories and Subject Descriptors

J.4 [**Social and Behavioral Sciences**]: Economics; K.4.2 [**Computers and Society**]: Social Issues; I.5.2 [**Pattern Recognition**]: Design Methodology

General Terms

Experimentation, Management

Keywords

RMT, MMORPG, online game, log data

1. INTRODUCTION

Real-money trading (RMT) is an economic activity in which people exchange property in a virtual world, such as currency, items, and even characters, for real currency. RMT occurs in various online services including online games, social network services, and auction networks [1, 3].

There are two opposing attitudes of online game operators toward RMT. One regards RMT as a natural act of players and seeks ways of bringing out the merit of it, such as accelerating personal trades between users and cutting down costs for setting up a physical store. In contrast, the other sees RMT as the cause of problems and prohibits it in their games. The attitude is based on the type and design of each game. Most of the massively multi-player online role-playing games (MMORPGs) in Japan prohibit RMT, because it causes several problems. The most critical influence is on economic balance. Dealing with huge amounts of currency for RMT causes inflation in the virtual world and harms the ability of general players to purchase commodities. RMT players often directly harm other general players by, for example, occupying specific locations for obtaining currency and items, killing other general players to steal their property, and even plundering their characters. RMT players also tend to do dishonest actions, such as cheating the game and using bots. These problems discourage general players, who may end up quiting the game. They also prevent new players from joining the game.

To keep the virtual world sound and fun, MMORPG operators have been taking strong actions against RMT players. First, they explore the players whose actions suggest RMT activity (henceforth, *RMT suspects*) using decoy characters and/or referring to reports from general players. Then, they investigate whether each RMT suspect is an RMT player by analyzing his or her past actions recorded in the log data. Once a player is determined to be an RMT player, the account is banned.

Most players act honestly in the virtual world. Thus, to avoid false accusation, manual investigation of RMT players by MMORPG operators is indispensable. However, the whole procedure is quite time-consuming. To support them in dealing with RMT, we have been addressing the task of extracting RMT suspects. In this paper, we propose several statistics derived from real log data of an MMORPG that are useful for differentiating RMT players from general players.

2. RELATED WORK

Several studies have utilized the real log data for digital game research. In [4], players were classified on the basis of action sequences, while statistics derived from certain volume of log data were used for the similar task in [5]. Some studies made an attempt to detect bots using the frequency of actions [6] and the magnitude of traffic burstiness [2].

The task of detecting RMT players can be regarded as a subtype of player classification. To our best knowledge, however, the statistical characteristics of RMT players have not been explored.

3. DETECTION OF RMT SUSPECTS

The number of RMT players is not given in advance. We therefore extract RMT suspects from all the players as follows.

Step 1: Sort all players using a certain statistics

Step 2: Extract the most suspicious N players.

The goal of this task is to minimize the number of extracted RMT suspects, i.e., N, retaining all RMT players inside of the extracts. Practically, the value for N is gradually incremented according to the human-labor available for succeeding manual investigation.

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Table 1: Mean Values of Statistics

Type	n	TAC	AT	TCC	TCH
Seller	10	254.4	55.8	1.3	12,209.2
Collector	4	745.5	138.3	46.8	23,247.0
Earner	15	106,137.8	16,772.5	11.0	13,438.7
Others	971	75,008.8	3,718.0	951.0	3,111.0

3.1 Data

In this study, we use the commercial MMORPG "Uncharted Waters Online" as a sample game. Real log data of the game and a list of RMT players were provided by the MMORPG operator. The list of RMT players contains the following three types of players.

Sellers (10 players): sell virtual property to other players for real currency.

Earners (15 players): acquire virtual property by effectively repeating specific actions in the virtual world.

Collectors (4 players): convey virtual property from earners to sellers.

These RMT players were identified by the operators through a manual analysis of the log data from August 30 to September 13, 2009. The identical log data was provided. It comprises 330 million action records and 8.8 million utterance records of 16,054 players.

3.2 Statistical Characteristics of Each Player

To characterize each player, we derived the following four types of statistics from both types of data.

Total action count (TAC): The total number of action records.

Activity time (AT): The amount of minutes in which at least one action is taken.

Total chat count (TCC): The total number of utterances recorded.

Total currency handled (TCH): The amount of virtual currency handled in the period, calculated by summing the absolute values of currency increase and decrease.

RMT players are assumed to handle huge amounts of currency. In fact, all of the 29 identified RMT players were ranked in the top 1,000 for TCH. We therefore chose this statistics as the primary element for narrowing down RMT suspects. Table 1 shows the mean values of the above statistics for each type of player. From the table, we made the following findings.

- RMT players deal with a huge volume of virtual currency (TCH)
- Most of the RMT players are silent (TCC)
- Sellers and collectors take actions less frequently (TAC)
- While earners spend five times more than general players, the frequency of their actions is low (TAC, AT)

3.3 Extracting RMT Suspects

We then evaluated the effectiveness of the proposed statistics in extracting RMT suspects. In addition to the four types of statistics, TCH/TAC, TCH/AT, and TCH/TCC were also examined. Note that this evaluation is a closed test as the data is referred to for identifying the statistics.

For each of the seven types of statistics, 1,000 players were first sorted in descending order on the basis of the statistics. Then, RMT suspects were extracted by taking the top N of the players. In this experiment, we manually determined N so that all of the 29 known RMT players were thoroughly classified as RMT suspects, leaving its estimation to our future work. Thus, the smaller the N is, the better the statistics is. Table 2 shows the values of N for each statistics. The table indicates that different statistics achieved the best results for each type of RMT player. When targeting sellers and collectors, TCH/TAC and TCH/AT that reflect the earning efficiency identified a relatively small number of players. In contrast, AT performed the best for detecting earners.

Table 2: The Number of Extracted RMT Suspects

Statistics	Seller	Collector	Earner	All
n	10	4	15	29
TCH	639	452	80	639
TAC	998	889	360	998
TCC	1,000	1,000	1,000	1,000
AT	990	891	**48**	990
TCH/TAC	**72**	133	419	419
TCH/TCC	226	347	349	**349**
TCH/AT	81	**123**	643	643

4. CONCLUSION AND FUTURE WORK

To reduce the human labor required to investigate RMT players, we explored the statistics that minimize the number of RMT suspects. This paper described the statistics derived from log data and reported on several behavior of RMT players. The evaluation showed that using the appropriate statistics or combination of statistics for each type of RMT player achieved the best results.

Our future work includes three avenues. Even the best statistics we proposed output a number of players. Therefore, a more effective statistics should be explored. The robustness of the statistics is also considered, as RMT players may fool operators by changing their characters frequently. Once an effective statistics is extracted from short-term log data, it should be great help in identifying RMT suspects. We also plan to apply the statistics to other game titles.

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