

# A System Algorithm for Recommending User-Customized Games

So-hui Son<sup>1</sup>, Im-kyeong Lee<sup>2</sup>, Jun-ho Huh<sup>\*</sup>

## Abstract

Recently, game companies are having difficulties in exactly figuring out the right consumer groups for their games. To solve this problem, a system algorithm which recommends user-customized games based on the user information entered has been proposed in this study. Game developers will be able to clearly determine the consumer group(s) of both on and off-line games through accumulated data while consumers can find the game they desire. It is expected that the gaming culture will advance further with the proposed algorithm.

**Key Words:** User-customized game, off-line game, consumer group.

## I. INTRODUCTION

Although the number of people who think that games are of some kind of hobby have increased, those who enjoy various types of games are still rare and the game developers are experiencing difficulties in targeting the right consumer groups for their games. This game recommendation algorithm was designed to deal with such a problem.

The proposed system algorithm is one that preferentially shows an optional game that would best suit user's taste after he/she agrees with the game selected based on the data entered by the game user. The user's selection is then converted into a data and provided to the game developers.

## II. RELATED WORK

Existing product recommendation systems are largely divided into Collaborative Filtering and Content Filtering systems, and currently, a number of researches are being conducted to improve these systems [1-5]. The former searches the customers that have a similar preference with the user to calculate the similarity in the products purchased

by these customers. For calculation, measurements of Pearson Correlation, Euclidean Algorithm or Cosine Distance are used [6]. The latter filters out the products or items which the user has used or assessed in the past. Thus, the recommendation systems are divided into the methods that search the neighborhood having a similar preference and use their purchase information for recommendation and other methods that recommend new products or items based on the user's past purchases or assessments

The approach taken by most recommendation systems starts under the assumption that these systems already know about customer's profile so that they calculate their similarity with a particular algorithm to group customers.

Collaborative Filtering method groups (cluster) other neighboring users first based on the information concerning the user, his/her purchase or product preference and then calculates the similarity between the products they have purchased or preferred for recommendation.

Collaborative Filtering is divided into a user-based method and an item-based method. Meanwhile, respective recommendation methods are divided into the methods that calculate similarity based on the user profile or item profile. The advantage this filtering technique is that the probability

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of estimation can be increased when much data is available, but if not, the problem of a ‘Cold-Start’ may occur [6-11].

Content-Based Filtering is a method that recommends the products that have similar characteristics with the products purchased in the past through profiling, which is a relatively important process. This can offset the disadvantage of the Collaborative Filtering when there are not much data available.

### III. A SYSTEM ALGORITHM FOR RECOMMENDING USER-CUSTOMIZE GAMES

In the Collaborative Filtering, matrices are used to calculate similarity, and to process these matrices much memories and higher processing speed are required as the number of products increases. In this study, a method that substitutes the support for the frequent item set with the ‘distance’ used to calculate similarity is used to allow faster similarity calculation instead of separate matrix calculation. The most similar frequent item sets with customer’s item search will be matched through the apriori algorithm and all the results obtained from pre-processed product supports and frequent item sets are stored in the database to provide high-speed product recommendations.

Prior to system designing, a suitable algorithm type was researched along with its application method placing emphasis on authors' design intent which is to find the games that would possibly fit to user's taste. Such a research lays a foundation for authors' design intent. As a result, both collaborative filtering and content-based algorithms were considered to be the most suitable for the design intent.

As in [Fig. 1], the content-based filtering carries out filtering process based on the selected category(s) for the data pre-categorized with a certain standard. This filtering method is used for the recommendation system designed in this study to perform filtering based on the user's choice of category(s). In this case, the data are of pre-categorized games.

On the other hand, the collaborative filtering finds a resulting value that would suit user's preference based on the choice of another user who has a similar user information with an actual user [Fig. 2]. In this study this method is used to extract a user-preferable game from the resulting values obtained through content-based filtering.

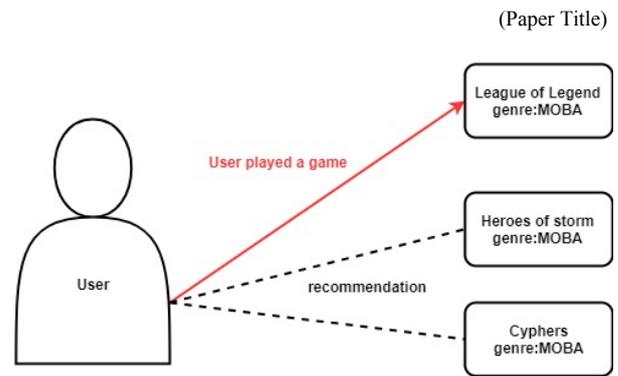


Fig.1. Content-based Filtering Algorithm

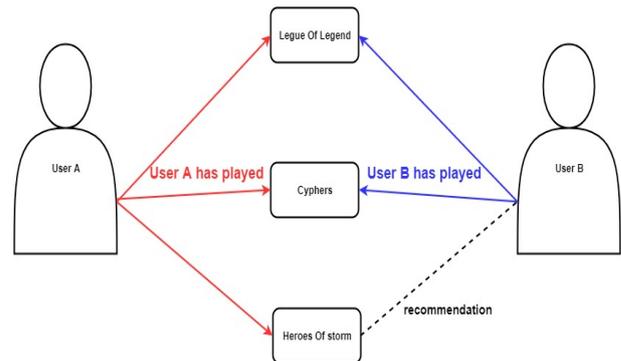


Fig.2. Collaborative Filtering Algorithm

This system algorithm allows quite efficient recommendation for the users who seek games that meet their tastes and price ranges.

Although there already exist various recommendation programs in the game industry, the majority of them simply make a recommendation based on the advertisement of a game store or the sales record so that they lack reliability. Also, as not many types of games are included in the resulting values offered to the users, they cannot find right games for them. Fig. 3 is the system algorithm proposed.

It is anticipated that the recommendation system with the proposed algorithm will be able to have a very positive response as it can cover the weakness of existing recommendation systems.

Moreover, the proposed system will be able to contribute to future game designing practice and development by accumulating consumer responses and relevant behaviors against resulting values as reference data.

The user first enters his/her basic information on a provided web and responds to the first requirement necessary for recommendation in advance by accepting/unaccepting the term 'priority recommendation'. He/she then move to a selection window to select his/her requirements for the games he/she prefers to receive recommendations. After completing all of these processes, the system initiates the recommendation process.

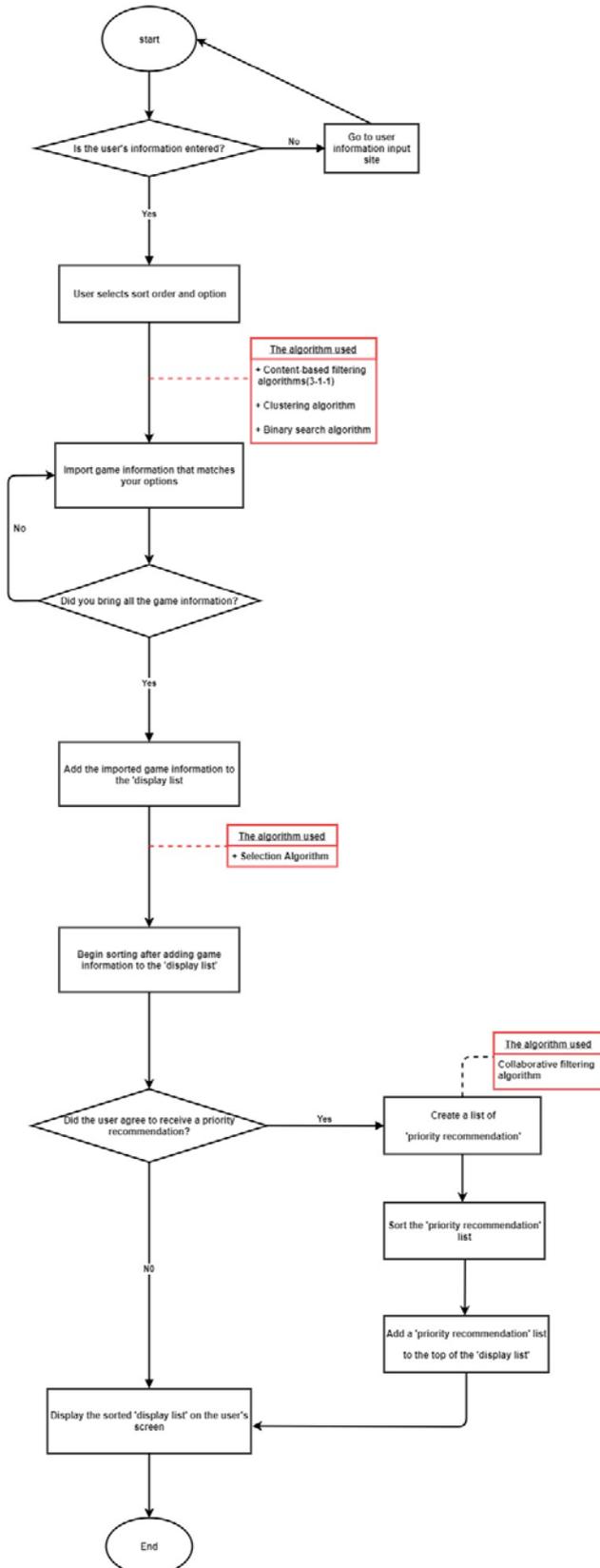


Fig.3. A system algorithm for recommending user customized games.

The existing pre-categorized games will be subjected to filtering with a content-based filtering algorithm based on

the user's options selected. A binary search algorithm is used for input data comparisons. Start the sorting process starts after adding the filtered value(s) to a list titled 'Display List' by using a selection sorting algorithm. Acceptance/Unacceptance status is checked simultaneously with initiation of the sorting process.

If user's acceptance is confirmed, the system sorts out the search results that satisfied the users who had performed the searches similar to the actual user. A collaborative filtering algorithm is used for this process and the values resulting from the process are added to a 'Priority Recommendation' which should be placed at the top of the display list. Finally, the system ends after displaying a complete display list on screen. The processes of both types of filtering algorithms are explained below.

### 3.1. Process of Collaborative filtering process

Figure 4 shows a procedural process of collaborative filtering where the most suitable games are filtered based on the data of a user(s) having a similar information with the actual user.

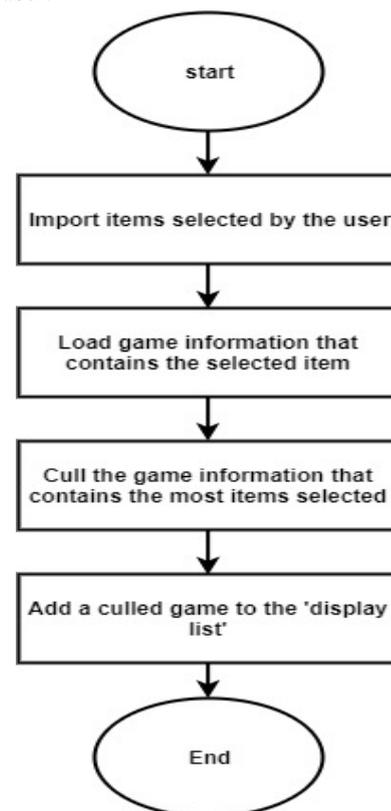


Fig.4. The process of a collaborative filtering algorithm.

### 3.2. Process of content-based filtering algorithm

Figure 5 is a flow chart of a content-based filtering algorithm where the games that have been considered to be most suitable after filtering the pre-categorized games are being added to a display list.

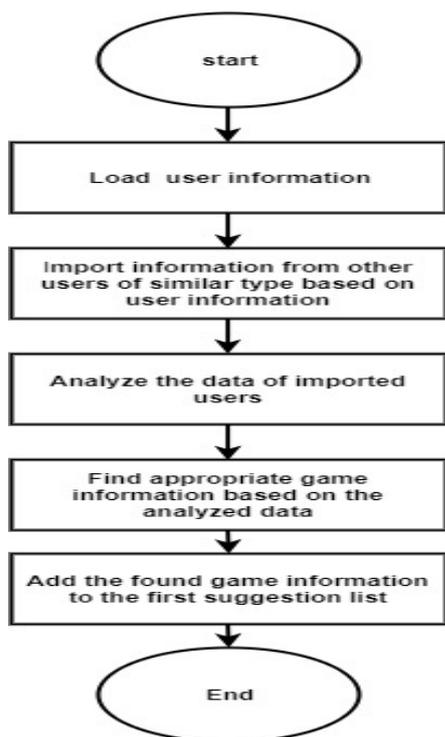


Fig.5. The process of content-based filtering algorithm.

### III. CONCLUSION AND FUTURE WORKS

The ultimate goal of this study is to make a contribution to the game industry. With the proposed system, consumers will be able to conveniently experience various games while the game developers can ascertain the consumer groups for their games and get support for future game development.

By achieving these activities easily with the proposed system, future games will re-emerge as a more popular and active culture. Since the content-based algorithms are used to develop such systems, the categorization(creation) of big data of(for) the massive number of games, as well as promotions for consumer attraction are essential.

Authors expect that more people will be able to enjoy the gaming culture and at the same time, it will become possible for the game developers to make various attempts. Finally, authors' future work will also include development of a 'Game Registration Service' the developers.

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The 4D Health Care Project Group of Catholic University of Pusan aims to cultivate the creative talent who have capabilities in developing 4D contents required for rehabilitation and health care of modern people. Both Department of Physical Therapy and Department of Software of this university are participating and operating the group jointly to perform the task.

The 4D Health Care refers to an advance health care technology which is used for the operation in a 4D-based mixed reality where human senses, cognition and experiences (1D) have been converged with both real and virtual information (3D) and the project group runs various curricular and extracurricular programs to train every participating student to acquire a 4D technology-based health care contents development skills.

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