

A Personalized Scoring Method for Rental Property Search Considering the Surrounding Environment

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Abstract—Nowadays, a growing number of people use real estate and housing information websites to search for rental properties. However, it is difficult to specify searching conditions according to specific individual needs, such as community safety and barrier-free environment. In this study, we propose a personalized scoring method that takes into account the surrounding environment and can appropriately evaluate properties to match the target user’s age, gender, hobbies, and preferences. We also conducted a preliminary experiment to compare the ranking of the proposed method and the baseline methods based on nDCG@5, we found that the proposed method achieved the best performance.

Keywords—rental property, recommendation system, personalization, surrounding environment analysis

I. INTRODUCTION

Many users use real estate and housing information websites to search for rental properties. Conventional real estate and housing information sites provide users with the services of searching properties based on criteria, such as rent, size, age, layout, and the distance from the nearest train station [1]. However, it is difficult to specify search conditions according to specific individual needs, such as community safety and accessibility. In the existing studies, Suwa et al. proposed a method for quantitative and intuitive comparison and evaluation of noise and daylighting using IoT devices [2]. Motomura et al. proposed a method for searching and ranking rental properties based on user evaluation features [3]. However, these approaches did not consider the surrounding environment of the house and the user characteristics. In this study, we propose a personalized scoring method for rental properties based on the consideration of the surrounding environment that takes into account the family structure including age and gender, as well as their interests and preferences.

The remainder of this paper is structured as follows. In Section 2, we introduce the proposed personalized scoring method for rental properties. Afterward, in Section 3, we describe the details of the preliminary experiment. Finally, in Section 4, we conclude this study and discuss future works.

II. PERSONALIZED SCORING METHOD

We introduce the proposed method in this section.

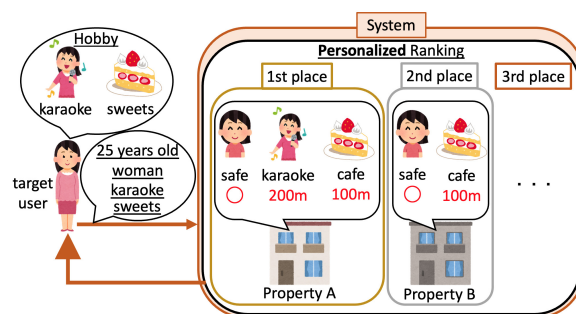


Fig. 1. The overview of the personalized scoring method considering various preferences.

A. Overview of the Proposed Method

An overview of our proposed method is shown in Figure 1. In the case of a female (who likes karaoke and sweets), the proposed system can recommend properties based on a personalized score ranking that takes into account “security, karaoke, cafe” and other evaluation items considered essential to the target user among all evaluation items of rental property. In the case of a couple in their 70s (gateball and chess enthusiasts), it is possible to create a ranking based on the personalized score that can recommend barrier-free properties located near a community center or park.

B. Implementation of Personalized Scoring Method for Rental Properties

In this study, we are going to address the following four main issues in order to implement personalized scoring.

- **Data Collection**

Data on publicly available rental properties, map information and reviews of stores and spots (Google Maps), public safety information (local governments, SNS), barrier-free information (Ministry of Land, Infrastructure, Transport and Tourism, SNS), etc. are collected and stored in the database with location information.

- **Detection of important evaluation items based on the user information**

The important evaluation items are determined based on the target user's age, gender, tastes, and preferences. Next, we use the trained Word2Vec model [4] to obtain the vectors of hobbies and surrounding facilities from the collected data and calculate the similarity. For instance, for a 25-year-old female who likes karaoke and sweets, the important evaluation items are security as the surrounding environment, and distance from karaoke stores and cafes as surrounding facilities.

- **Determination of important evaluation items based on family structure**

In the case of a multigenerational home, we calculate each important evaluation item of each person. However, for safety-related evaluation items, such as security and barrier-free access, we will consider the importance of the evaluation items instead of the average of them.

- **Implementation of Personalized Scoring method**

Scores of rental properties are calculated for each of the above-mentioned critical evaluation items, and the scores are integrated considering the importance of each evaluation item.

III. PRELIMINARY EXPERIMENT

We conducted a preliminary experiment to discuss the effectiveness of the proposed method by comparing the conventional simple ranking with the ranking based on the Personalized Scoring method (proposed method).

A. Experimental Details

- **Target Rental Property Data**
10 Properties for Rent in Nakagyo-ku, Kyoto (1K, Bathroom/Toilet)
- **Subjects**
12 University Students in their 20s
- **Evaluation Items**
Rent, Living Space, Convenience of Transportation, Convenience of Shopping, Surroundings Related to Hobbies

B. Calculation Method for Each Evaluation Item

- **Rent**
The score of the evaluation item regarding the rent of the property below the upper rent limit (set by subjects) is set as 100, and if the rent is above the upper limit, it ranges from 0 to 100 (Upper limit + 30% or more: Score 0).
- **Living Space**
The score of the evaluation item regarding the living space (which is wider than the requirement) is set to 100, and if it is below the lower limit, it is set in the range of 0 to 100 ($0m^2$: Score 0).
- **Transportation Convenience**
Depending on the walking distance to the nearest train station and bus stop, scores for the evaluation items range from 0 to 100 (50 for train station, 50 for bus stop) (1000m (train station)/500m (bus stop): Score 0).
- **Shopping Convenience**
Scores of this evaluation item are set in the range of 0 to

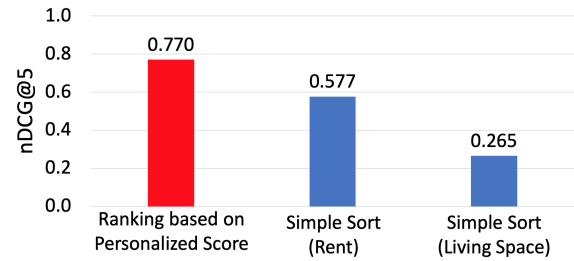


Fig. 2. Comparison of the ranking between the proposed method and baseline methods based on nDCG@5.

100 depending on the walking distance to the nearest convenience store and supermarket (50 for convenience store, 50 for supermarket) (500m (convenience store)/1000m (supermarket): Score 0).

- **Surroundings Related to Hobbies**

According to the walking distance to the nearest spot related to the subject's hobbies, set evaluation item scores in the range of 0 to 50 (1000m: Score 0).

The sum of these five evaluation item scores is applied as the personalized score of the rental property.

C. Experimental Results

Figure 2 shows the comparison of ranking accuracy between the proposed method and the baseline method based on nDCG@5. (Before the experiment, each subject was asked to rank 10 rental properties in which they would like to live, and it was used as the ground truth). We noticed that the nDCG@5 of personalized ranking for the proposed method is the highest.

IV. CONCLUSION

We proposed a personalized scoring system that takes into account the surrounding environment of rental properties. The personalized scoring method (proposed) achieved better results than the baseline method. The experimental results demonstrate the effectiveness of a personalized scoring method that takes into account multiple evaluation items (e.g., hobbies and nearby related facilities). In the future, we are going to add new evaluation items and improve the calculation method of each evaluation item.

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