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Film Recommendation System with Social-Union Algorithm

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ABSTRACT

A Recommendation System applies several classic Collaborative Filtering (CF) methods. Some CF methods are combined with social networks, for instance Fusing ESR, Social Regularization, and Trust-Aware. Nonetheless, these three methods are not able to be developed if they are integrated with other types of implicit or explicit relationships. Their selection of parameter weights is not optimal enough when it combines preferences between users from the two types of relationships into one. Usually, a group of friends will be similar in terms of interest and preference for an item. The similarities between users will increase the accuracy of the prediction results. The selection of parameter weights can be done manually or automatically through the calculation of global and local density coefficients so the determination of parameter weights will be optimal. Therefore, the Social-Union (SU) method proposed in this research use that method to overcome the problems from previous research. The result of this research is a website that applies the Social-Union method and let the user get recommendations that depend on the value of the parameter *a*.

1. Introduction

The rapid growth of internet users currently encourages sites provider (for instance, IMDb, NetFlix, and Flixster) to sell or rent the film to develop an accurate recommendation system (SR) to recommend the right films for their customers among the many choices available [1]. The presence of SR is not only helping customers to pick a film but also proven to have increased the site's revenue. The development of SR currently applies the classic Collaborative Filtering (CF) method which is only limited to processing rating data provided by the user so that it can predict the preference of films from users to video. CF is successfully applied when the number of ratings is filled in a larger dataset, but the accuracy of the functionality is of concern when there are several events, such as a large amount of data is available, but only a few users rank it, causing sparsity and cold-start user, namely a new user that just recently joined a site or subscription. Subramaniyaswamy et al explained that this problem may be solved if CF is combined with the concept of social networks [2].

Social Network (SN) consists of several users who relate to each other both implicitly (e.g. giving each other a rating for an item) or explicitly (e.g. add as a friend) which is generally represented with a graph, user or item as a graph point (i.e. node) and between the relations represented with the side of the graph (i.e. edge). Furthermore, the application of SN address several CF issues explained in the previous paragraph. Firstly, based on the explicit relationship data between users, rating data processing alone is no longer the main process so that sparsity events can be minimized. Secondly, for cold-start users, their network of friends can be utilized so that SR can recommend an item based on the preferences or interests of the cold-start user's friends. On the other hand, the combination of SN and CF is proven to increase the accuracy in producing recommendations.

Zhang et al [3] demonstrate several CF methods that integrate SN, such as Fusing ESR, Social Regularization, and Trust-Aware have been proposed in previous research. Nevertheless, these methods are limited to processing data in terms of ranking and friendship, and cannot be developed by combining other types of implicit or explicit relationships. Moreover, the selection of parameter weights is not optimal when it comes to combining the similarities of preferences between users of the two types of relationships into one

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unified unit. Therefore, the Social-Union (SU) method is proposed to cover the weaknesses of these methods. SU has similarities in combining similar preferences between users that are so dynamic that it allows the processing of implicit or explicit types of relationships in them.

In the work of Alhijawi and Kilani [4], it is clearly explained that the application of preference similarity between users will improve the accuracy of the recommendation system. This method may improve the accuracy because accounts who are friends to each other will have similarities in terms of interest and preferences for films. Furthermore, the selection of weight parameters may be done manually or automatically, the coefficient of global and local density coefficients for each user so that the determination of the parameter weight values will be as optimal as possible. The test result in previous research [3], [5]–[8] also shows that the SU method has a lower error rate (MAE) in comparison with other methods. The films available in this recommendation system will be arranged in the form of film groups grouped by its genre to form a film library.

2. Methods

In this research, we calculate the similarity between users based on ratings using Cosine Similarity [9], calculating the similarity between users based on friendship using Friend TNS Similarity [10], Logistics Sigmoid function [11] to change the similarity value back into the interval [0,1], and merging the two bases using the SU algorithm with a manual parameter, namely: 0.25, 0.5, 0.75 and 1. Moreover, we implement the SU algorithm with an auto parameter from books, journals, and the internet. The flowchart and use-case diagram for the film recommendation system is shown in Figure 1 and Figure 2, respectively. Furthermore, The proposed method that will be carried out in this research refers to the waterfall method with the following stages:

a. Analysis: At this stage, the reference material will be collected, then a process analysis will be carried out regarding the calculation of the average rating given from each user. The calculation of the similarity between users based on ratings using Cosine Similarity, calculation of similarities between users based on friendship using FriendTNS Similarity, Sigmoid Logistics function for changing the similarity value back into the interval [0,1], combining the two bases using the SU algorithm with parameter a Manual and using the SU algorithm with parameter a-Auto into the recommendation system. The value of a-Manual was used in the experimental analysis including the values (i.e. 0.25,0.5,0.75 and 1). Furthermore, an analysis of system requirements will be carried out both functional using use cases and non-functional recommendation systems using PIECES.
b. System Design: In this stage, a user interface is designed with the help of Balsamiq Mockups 3 tools and MySQL for the Database.
c. Coding: In this stage, the design is translated into a programming language that can be understood by computers. The coding process in this study uses HTML version 5, CSS, PHP version 7, and MySQL version 10.0.29.
d. Testing: In this stage, the recommendation system accuracy rate will be calculated by calculating the combination of the two bases (i.e. similarities between users based on ratings and similarities between users based on friendship using the SU algorithm in terms of the MAE value) as well as doing 3 tests with different conditions based on the Manual parameter value, namely: 0.25,0.5,0.75 and 1, as well as the a-Auto parameter.
e. Results Analysis: In this process, a discussion is carried out in the form of an analysis of the output of the recommendation system testing. The results of the analysis obtained are used to determine whether the recommendation results by calculating the parameter value using a-Manual, namely: 0.25,0.5,0.75 and 1 are better than the a-Auto parameter value in terms of the MAE value.
f. Conclusion Making: In this process, conclusions are drawn from the analysis of the results that have been carried out by comparing the MAE of SU value using the a-Manual parameter, namely: 0.25,0.5,0.75 and 1 with SU using the a-Auto parameter.
g. Process Analysis: The work process of the website application and the implementation of the SU Method in the Film Library Recommendation System can be described in the form of a flowchart as shown in Figure 1. Moreover, the software modeling in this research is illustrated with a use-case diagram as shown in Figure 2.

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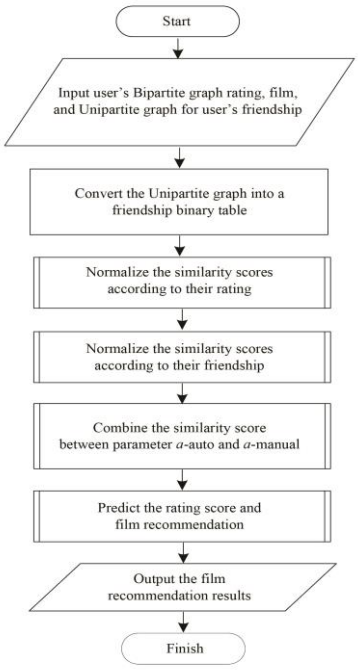

Fig 1. The flowchart for the film recommendation system with the SU algorithm.

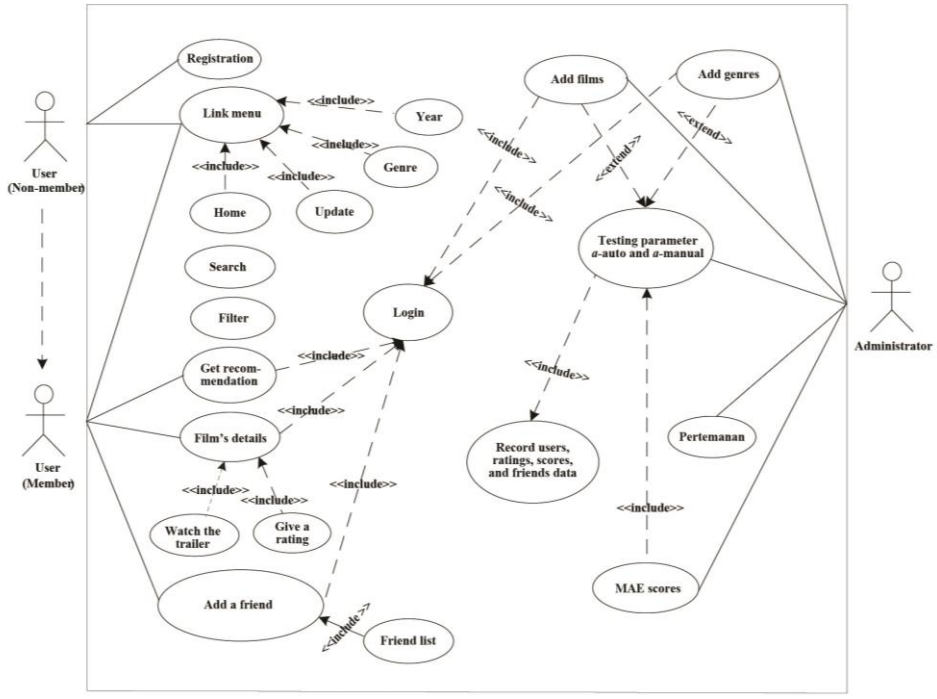

Fig 2. Use-case diagram

3. Result and Discussion

When running the SU Method Implementation application on the Film Library Recommendation System for the first time, the first page that will be shown is the home page and followed up by the login page. The home page will show the information about the latest releases and filters to filter the film. To see films available in this film library recommendation system, the user must sign in at the login page. If the user has not entered the system yet, the user must first perform a registration process by clicking the register link which can be

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accessed by clicking the login button, after that, clicking the 'click here' link so that the system will display the registration page as shown in the Image A in figure 3. After register and login, user may access the update page as shown in Image B in figure 3. Moreover, if the user wants to add a friend, the user may click the add friends link so that the system will display the add-friend page as shown in the Image C in Figure 3. If the user is the administrator who wants to manage the data in the system, the user may access the administrator part of the system from the administrator's login page. The initial view of the administrator section of the system is the login page is as shown in the Image D in Figure 3.

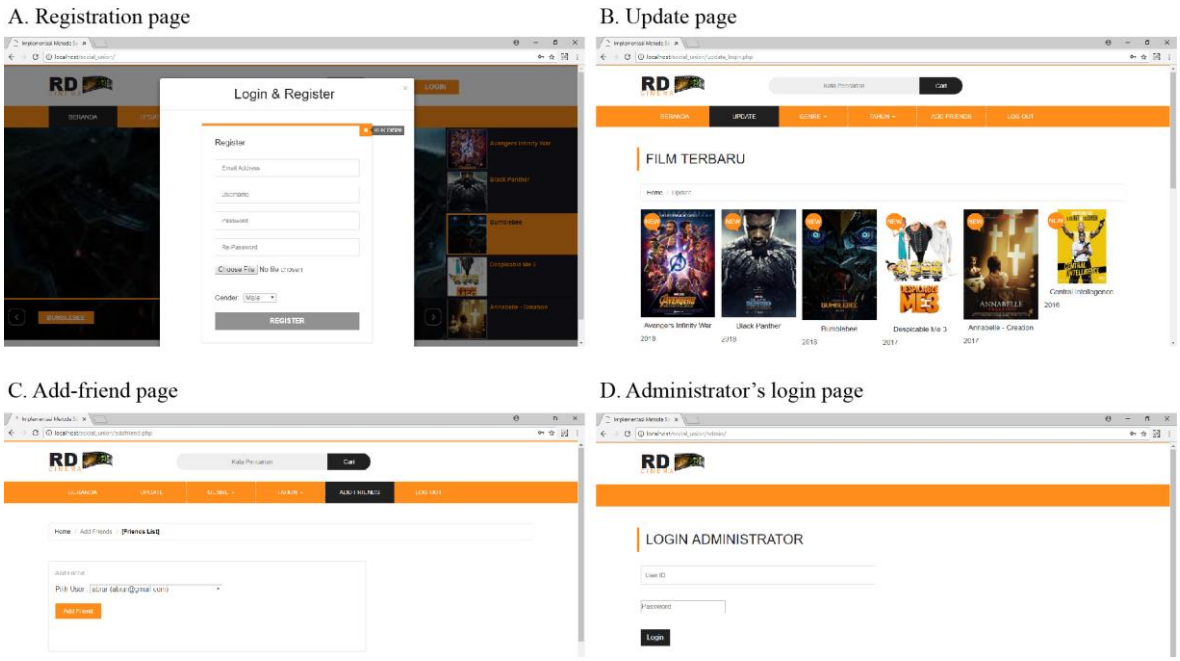

Fig 3. Registration page, update page, add-friend page, and the administrator's login page

Users must enter valid administrator credentials to enter the administrator pages of the system. If the login process is successful, the system will display the administrator home page after login as shown in Image E in Figure 4. Moreover, by clicking the genre link, the administrator may access the genre list page as shown in the Image F in Figure 4. Furthermore, the administrator may add more genres by clicking the add-genre button above the genre table. In the genre list page, the administrator may add a new genre into the system and click the save button to save it. On the other hand, if the administrator wants to add more data for a new genre, the administrator may click the add-new-genre link. Therefore, the system will display the add-genre page as shown in Image G in Figure 4. Moreover, if the administrator wants to change the existing genre data, the administrator may click the edit button. Therefore, the system will display the edit-genre page as shown in Image H in Figure 4.

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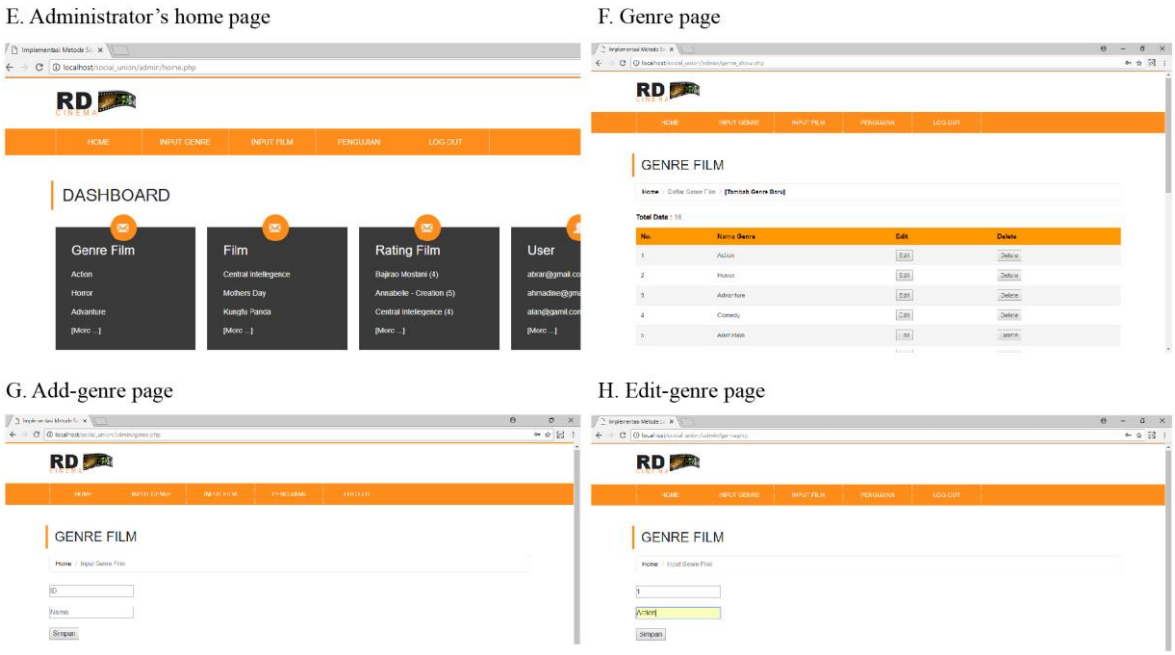

Fig 4. Administrator's home page, genre page, add-genre page, and edit-genre page

Meanwhile, if the administrator wants to add a new film data, the administrator user may click the film-list link, so the system will display the film-list page as shown in the Image I in Figure 5. Moreover, if the administrator wants to enter a new film data, then the administrator user may click the input-new-film link, so the system will display the input-new-film page as shown in the Image J in Figure 5. On the other hand, at the administrator's home page there is also a dashboard that contains information about details of film genres, films, film ratings, and users. To display this information, the administrator user may click the "more" link contained in each section of the information. The display of the detailed film rating data is as shown in Image K in Figure 5. Furthermore, the user's details may be seen in Image L in Figure 5.

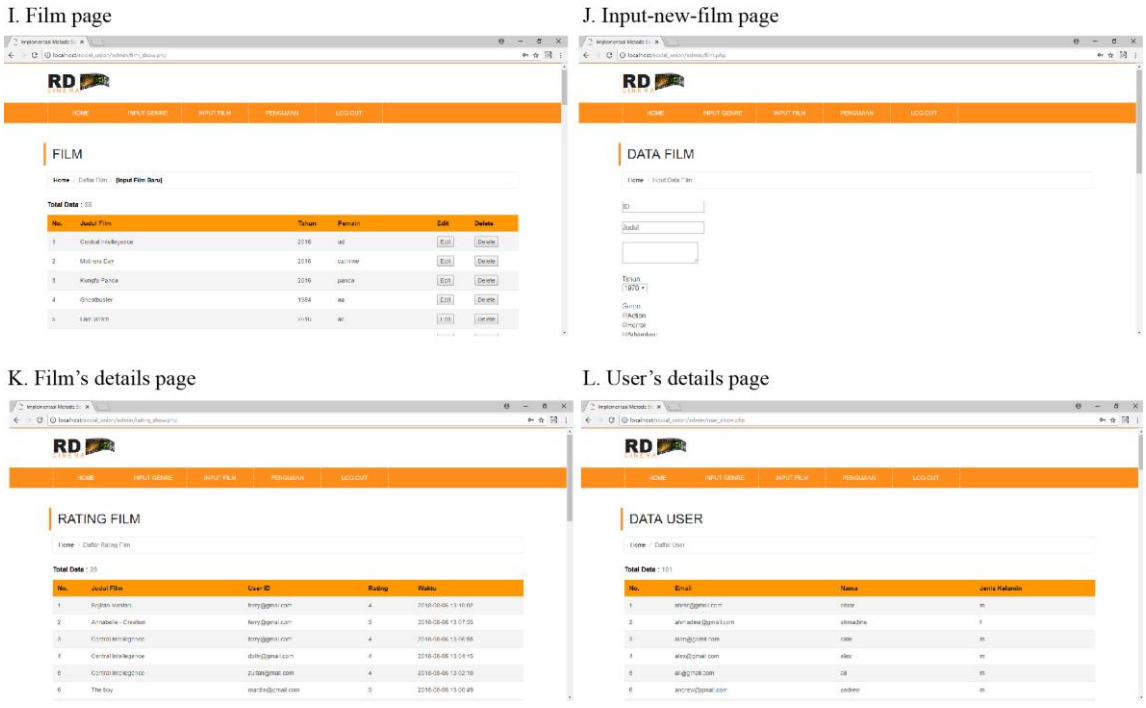

Fig 5. Administrator's home page, genre page, add-genre page, and edit-genre page

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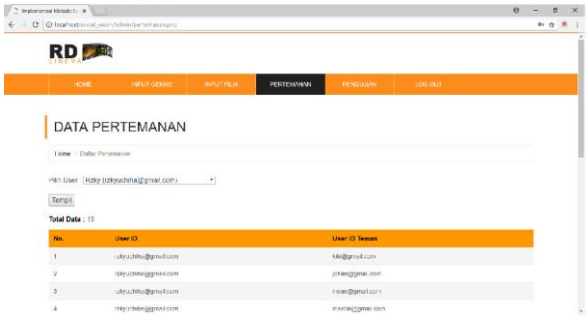
Additionally, administrators may also browse the friendships that users have made, as shown in Image M in Figure 6. On the other hand, the administrator may test the SU method by clicking the testing link so the system will display the testing page as shown in Image N in Figure 6.

M. Friendship page



N. Testing page

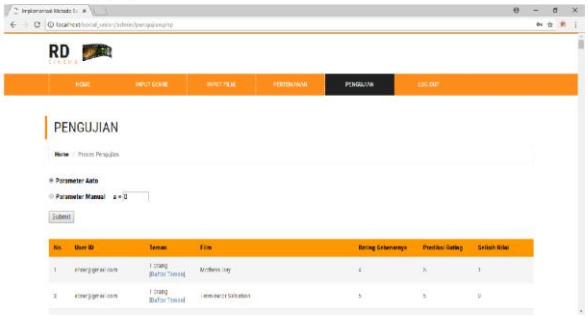


Fig 6. Friendship page and testing page

Furthermore, The administrator may enter the α parameter and choose the user who needs to be tested, then clicks the submit button so the system will run the SU method and compare the results obtained with the rating value data stored in the database. The test results are using 90 films, 16 genres, 106 users, 0 friendship records, and 319 rating records summarized in Table 1.

Table 1.
Test result

Test	MAE Value
Parameter $\boldsymbol{\alpha}$-auto	0,215205298
Parameter α-manual = 0.25	0,214629139
Parameter α-manual = 0.5	0,215
Parameter α-manual = 0.75	0,215364238
Parameter α-manual = 1	0,215456954

4. Conclusions

The evaluation with the Mean Absolute Error method measuring the error level of the Social-Union method using the a-auto and a-manual parameters. a-auto is yielding a lower accuracy level than the ones using the *a*-manual parameter. Furthermore, a smaller a-manual parameter value implies a better recommendation result. Moreover, the software created in this research successfully provides recommendation information to the user according to the type of film that each user likes based on ratings and friendship data. Nevertheless, future research may apply the Social-Union method to improve the prediction accuracy with the auto parameter to predict a broad variety of problems other than film recommendation.

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