Student Crowdfunding and Recommendation System

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Publication Info

Article history:
Received : 21 February 2020
Accepted : 23 May 2020

Keywords:
Recommendation System, Crowdfunding, Filtering, Content-Based System, Item-Based Collaborative System, User-Based Collaborative System.

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Abstract

There has consistently been a need of a stage where understudies can share their projects and popularize it. This paper focuses at not only providing this platform but also help publishing projects developed by students. This project will allow students to put their projects up and get recommended with similar kinds of projects from other students to reduce duplication of efforts. As it will enable understudies and industry work force to coincide on one platform, the project will get exposure and contributions from the industry. Functionality of financing a project will be given which will help in deployment and ubiquity of the venture. Considering the various trends in the Machine learning branch, Item-based Collaborative system, and Content-Based Collaborative system can be used to build a recommendation system.

1. INTRODUCTION

Crowdfunding is the way toward subsidizing an endeavor or venture by raising modest quantities of money from a large number of individuals. The practice is frequently used by inventors, entrepreneurs, artists, movie producers and charities. A Student or Entrepreneurial individual seeks the capital necessary to implement their ideas or projects by appealing to the global investing public. We are living in the large information period, where tremendous measures of information are gathered every day, that makes the way toward locating a relative data is taking a great deal of time and endeavors. Considering recommendation system as one of the most important feature of the user-friendly platforms. From e-commerce to online advertisement, recommender systems are today unavoidable in our daily online journeys. After examining what the user likes, is interested in, factors like previous searches, a recommender system can bring all these things together to find the best suitable item for the user through various computations [1]. Implementing a recommender system in this platform makes it quite efficient or also be away to stand out significantly from competitors. At present, Student crowdfunding is in the need of the hour and hence, we are trying to build a project to help students overcome various barriers.

In this paper, we propose a platform which is very much reliable for students and investors. A student can upload a project on the platform, which can be viewed and rated by other users. Student can get financial benefits as well as they can collaborate their project with like-minded users. Furthermore, instead of just considering the basic method for recommendations we have used multiple methods to make a hybrid recommendation system.

2. ARCHITECTURE

The architecture of the hybrid recommender system is shown in the Figure 1. When a user logs in to the platform, the activities of the user are stored in the database. These activities includes the projects which the user has viewed

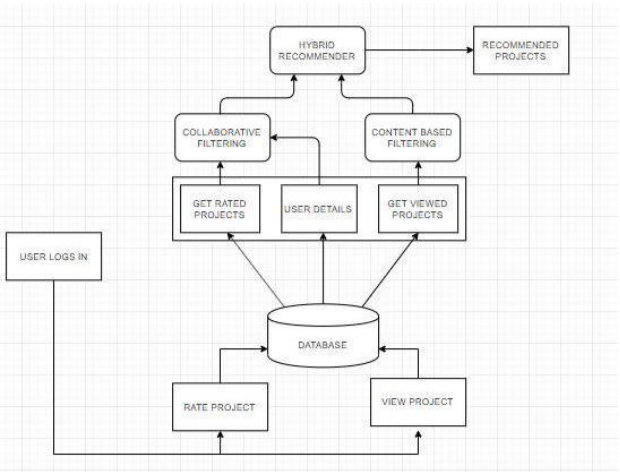

Figure 1: Architecture

and the ratings of projects given by the user. This database helps to improve the recommendations for the user. Hybrid recommender encompasses of the content based filtering and collaborative filtering. The platform associates with the web user. While interacting with the web user it recommends projects to the user dependent on the previous rating of the user. This method of recommendation is termed as Collaborative based filtering which uses ratings and other details of the user. In content based filtering when a user clicks or opens a project, the algorithm performs various calculations to find similar projects to that of the selected item. To perform this operation kNN algorithm is used.

3. LITERATURE REVIEW

The absence of semantic factors in recommender system and distinctive recommender procedures that are being utilized in the websites along with the types of recommender system have been studied and described in this paper. Possible solutions to flaws present in the recommender system are also suggested. It mainly focuses on graph algorithm to improve the recommendation system [2]. Along with the implementation of a recommender system, prediction of unknown ratings, recommendation of top K items can also be implemented. Resemblance of two items can be calculated by the computation of similarity matrix [3].

KNN is a classification algorithm in machine learning which can be used in recommender system as it gives the most similar data points to the selected item. Considering the disadvantages of the KNN like increase in error rate when user changes ratings or the performance issues when size of dataset is increased are covered in "Improved KNN algorithm". It comprises of KNN and baseline algorithm is based on collaborative filtering. Using baseline algorithm, the errors caused by rating can be reduced which will help us to obtain more similar items [4]. The data pre-processing is an important step as it decides the accuracy of the recommendation system. Well pre-processed data gives higher the accuracy as compared to the less pre-processed data. The emotional factors of the users when they rate a certain item should also be taken into consideration. Users rating deviation of all item are calculated. Then the adjustment and normalization of every rating is done and the user-rating matrix is formed. Based on matrix resemblance can be calculated between users [5].

Considering the previous actions of a user like rating an item and comparing it with item attributes to generate similar items can be done with the implementation of Content-Based approach rather than collaborative approach.

4. METHODOLOGY

4.1. Content based Filtering

Content based filtering filters the projects based on its domains. A supervised learning algorithm (k-Nearest Neighbor) is used for classification and regression. When a user clicks on an item k-NN algorithm computes the distance between the selected item and remaining items to find the most similar 'k' items which can be recommended to the user. To compute the similarity between two vectors co-sine distance is formulated. Co-sine distance calculates the similarity between two items below figure represents the formula to calculate co-sine distance.

$$\text{similarity} = \cos(\theta) = \frac{\mathbf{A} \cdot \mathbf{B}}{\|\mathbf{A}\|\|\mathbf{B}\|} = \frac{\sum_{i=1}^{n} A_i B_i}{\sqrt{\sum_{i=1}^{n} A_i^2}\sqrt{\sum_{i=1}^{n} B_i^2}}, \quad (1)$$

'A' and 'B' are the two vectors in which the similarity is being calculated. The outcome of this calculation ranges from -1 to 1. Where '-1' being the least similar item and '1' being the most similar item. For e.g. Project A belongs to domain Machine Learning and Big Data and Project B also belongs to the same domains, then the cosine distance between both the Projects will be '1' or close to '1'.

4.2. Collaborative Filtering

Collaborative filtering is generally classified as User-based collaborative filtering and Item-based collaborative filtering.

4.2.1. User-based Collaborative filtering:

User based collaborative filtering generally computes the similarity score between two users. It finds similar users, and recommends items they viewed/rated that one hasn't. But this method has various disadvantages like:

- People are fickle, taste change
- Many more people than items
- Schilling attack

Considering these disadvantages we have implemented Item-based collaborative filtering which doesn't rely on the users' behavior.

4.2.2. Item-based Collaborative filtering:

Item based filtering is more powerful as compared to user-based filtering. Instead of basing recommendations on relationship between people or the behaviour of users, it establishes relationship between items based on user behaviour. It helps us to overcome all the disadvantages studied in the user based filtering. While implementing item based filtering a user-item matrix is formed. User-item matrix encodes individual preference of every users for the given items[6]. The following figure shows relation

2010-2019 S-JPSET : Vol. 12, Issue Supplementary-1, ISSN : 2229-7111 (Print) and ISSN : 2454-5767 (Online)

between users and items. As shown in the Table 1, User A has not rated item I1 and I4 while he has rated I2, I3 and I5.

As, we are interested in item-based collaborative filtering we will calculate the relationships between columns i.e. items. By doing a correlation score between any two columns will give us a correlation score for a selected item pair. The similarity coefficient in the matrix between various items is formulated with the help of pearson-correlation. Following diagram shows the formula to calculate Person-correlation coefficient. Where rxy is in range of '-1' and '1'. When the value of rxy is close to -1 it shows that the variables x and y are negatively related, on the other hand when the value of rxy is close to 1 it shows that that the variables x and y are positively related.

$$r_{XY} = \frac{\sum_{i=1}^{n}(X_i - \overline{X})(Y_i - \overline{Y})}{\sqrt{\sum_{i=1}^{n}(X_i - \overline{X})^2}\sqrt{\sum_{i=1}^{n}(Y_i - \overline{Y})^2}} \quad (2)$$

As shown in the Table 2 the similarity between items is more stable. Which enables us to calculate the similarity prediction between two items with only a table lookup for the similarity values. This gives us a correlation score between every pair of projects where at least one user rated both the projects.

5. ANALYSIS AND EVALUATION METRICS

Accuracy is one of the most essential part of recommender system. The estimation was made possible by finding out the projects that got rated highly by a user, and comparing them with the output of the recommender system. The results are displayed in Table 3.

Table 1. User Item Matrix

		ITEM				
		I1	I2	I3	I4	I5
USER	A	NA	3	5	NA	2
	B	4	NA	NA	1	2
	C	5	NA	3	5	1
	D	NA	3	2	NA	5
	E	4	NA	1	5	5

Table 2. Item-Item Matrix

		ITEM				
		I1	I2	I3	I4	I5
ITEM	I1	1				
	I2		1			
	I3			1		
	I4				1	
	I5					1

Table 3: The accuracy result of proposed RS

Precision %	Recall %	F1%	MAE	RMSE
38	46	41	0.92	1.18

5.1. Recall

Recall means the ratio of the good projects recommended divided to the total count of good projects. Recall is calculated using the formula:

$$\text{Recall} = \frac{True\ Positive}{True\ Positive + False\ Negative} \quad (3)$$

5.2. Precision

Precision is the ratio of the good projects recommended divided to the total count of all the recommendations. The formula used to determine the precision is as follows:

$$\text{Precision} = \frac{True\ Positive}{True\ Positive + False\ Positive} \quad (4)$$

5.3. F1 Score

The F1 score or the F measure is the harmonic mean between precision and recall and is calculated using the formula:

$$F1 = 2 \times \frac{Precision * Recall}{Precision + Recall} \quad (5)$$

5.4. Mean Absolute Error (MAE) and Root Mean Squared error(RMSE)

These are two of the most well-known measurements used to quantify accuracy for continuous factors. In our case the predicted ratings are considered as continuous factor. The RMSE will never be less than MAE. The formulas for MAE and RMSE are given below:

Where y_j is set of predicted rating and $\hat{y}_j$ is actual rating set.

$$\text{MAE} = \frac{1}{n}\sum_{j=1}^{n}|y_j - \hat{y}_j| \quad (6)$$

$$\text{RMSE} = \sqrt{\frac{1}{n}\sum_{j=1}^{n}(y_j - \hat{y}_j)^2} \quad (7)$$

6. CONCLUSION

Considering the current need of recommendation system, which helps to reduce the search time and helps user to find desired projects easily. We have implemented two types of recommendation system viz. Content based and Item-based collaborative filtering. They can yield appropriate results due to high efficiency and simplicity it calculations. The successful integration of recommendation system and micro architecture services is done.

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2010-2019 S-JPSET : Vol. 12, Issue Supplementary-1, ISSN : 2229-7111 (Print) and ISSN : 2454-5767 (Online)