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User Profile Enrichment with Correlative Item Contents and User Context

[1]Einasfadil Abdullah, [1]Huda NajiNawaf and [2]Ghaidaa A. Bilal
University of Kufa, Najaf, Iraq
University of Babylon, Babylon, Iraq

Abstract: Mostly, the personalized services meet the satisfaction of users with the same services under the same context. However, although these services have the same context may be different according to needs of users. Depending on environment around them each user is different from other in terms of their preferences. In this study, a user profile framework was enriched with user context and a set of ranked item features that selected with respect to how significant and how much information could extract from those features. The user profile features were chosen based on maximum weight sum model. In addition, the correlation among the selected features was calculated to leverage the relationships of the user profile's constituents. As a result, the proposed user profile gives weighted features can be exploited for prediction purposes in future for several applications for instance; recommendation system.

Key words: User profile, content ofitems, user context, weighted features, prediction purposes

INTRODUCTION

Generally, in recommendation system the profile is a structured representation of user interests, adopted to recommend new interesting items. The information filtering system demands the creation of a user model, then a user profile. In particular, the recommendation process in content based recommendation system relies on comparing the attributes of the user profile against the attributes of a content item, hence building the user profile raised of researchers interest due to its importance on the accuracy of recommender. Recommender systems can be defined as the programs which try to suggest the most relevant items (products or services) for target users (individuals or businesses) by guessing their preferences of items (Bobadilla *et al*., 2013). The aim of developing recommender systems is to reduce information overloaded by retrieving the most relevant information and services from a huge amount of data, there by providing personalized services. The most important feature of a recommender system is its ability to guess a user's preferences and interests by analyzing the behavior of users. The most important feature of a recommender system is its ability to guess a user's preferences and interests by analyzing the behavior of users which can be represented by that profile (Resnick and Varian, 1997). Consequently, the user profile should be constrained with the user's interests, In this study construct user profile enrichment three genres, actors, and directors interest by users and correlative relationship between them.

Literature review: Systems depended on content analysis, must arrange for each information of items which isa record or collection of records representing important characteristics of thatitem. In simple cases, the profile consists of some characteristics of the itemthat are easily discovered not only need to build vectors describing items, need to build vectors with the same components that describe the user's preferences (Rajaraman and Ullman, 2011). A recommendation system proposed in Sung they analyzed the relationships between user ratings of movie and user profile such as age, gender and gener of movies.

While recommender systemrepresented by Said *et al*. (2011) extract contextualinformation of usersthat extended the classicalinformation of users definition (such that age, gender) by describing the user in a given aspect or context only home and cinema which a movie was seen. Recommender system services provider are proposed in Ikawa used actor and keyword information of the users movies, they also time of the day the users watch movies, they used the ratio of the number of times a user watched a movie with a certain feature (such as actor, keyword) to the number of times the feature is observed in all the movies.

MATERIALS AND METHODS

User profile framework: The main framework of a user profile is formed in terms of the extracted information from different lines: the movies that the user most liked and the context that the user usually prefers to watch certain movies.

Corresponding Author: Einasfadil Abdullah, University of Kufa, Najaf, Iraq

Data gathering layer: In this research, the Dataset LDOS_CoMoDa (Kosir *et al*., 2011; Odic *et al*., 2013) was used for gathering the significant fields for constructing the users' profiles. Basically, itis designed for context-aware personalization in which set of user context fields. The user contexts are presented with 12 features whereas, the dataset has 30 features; 12, 11 and 7 features for context, movie contents and user information, respectively. The issue of filling the missing values fields in the selected dataset was solved through applying the mean on.

Feature selection: Selecting the most appropriate features to reflect the user taste has depended on computing the ranking for all the movies features and the user context.

Item content based user profile: The first part of the user profile was constructed in terms of item features. The selection of item features depended on how significant and how much information could extract from those features. Their ranking was calculated with respect to the Information gain in which actor 1-3, director, gener 1-3 features which relate to movie contents were the most valuable features to consider the user behavior.

User context based user profile: Most literatures revealed that user context is quite weighty factors to analyze the user behavior. Hence, including the context of user in his profile may reflects significant information to make decision specifically with systems deal with users behaviors like recommender system. Information gain in addition to the literature verified the most important context features are location, day type and social which are affecting a user's choice for watching a movie. Generally, the initial user profile includes the following ten features:

$$User\_profile = [G_1, G_2\ G_3, A_1, A_2, A_3, D, C_1, C_2, C_3]$$

where, G, A, D and C stand for genres of movies, actors and context respectively. Indeed each genre consists of 24 sub-genres, hence one sub-genre has been chosen from each genre. Among of 2542 actors, only three actors have been elected. Additionally, one director of 815 directories is considered as one of the features in profile and finally three contexts have been picked of 13 sub-context distributed as follows: 3 for location, 7 for social and 3 for day type.

Weight sum model based feature's weights: There are strong correlations among the contents of movies of each other's from one hand and among the contents of movies and context from another hand which encourage inferring new features depending on other.Given the above extracted user profile, new profile has been built for each user based on viewing of movies in past. The weight sum values were calculatedfor each elected feature (content and context) in every movie in the user history as clarified in Eq. 1 (which are applied for every user and for each feature):

$$Su(xn) = \sum_{k=0}^{xn} Fu(j) \quad (1)$$

Where:

Su (xn) = The result vector of a feature frequencies
Fu = For certain feature
(j) = Theuser history viewing
k = After applying the equation on all the features and for all the users

The maximum value of each feature was selected to be represented in the user profile as a favorite feature. For the genre, actor features the highest three values were selected.

Features interrelatedness: To concrete the developed user profile andverification itsfit percentage, the correlation among the features themselves was calculated to guarantee the most favorite features are involved in the user profile. In addition, to what extent the profile reflects his taste to certain movie's genre, actors, director and in what context he would prefer to see a certain movie.

RESULTS AND DISCUSSION

Ten features were selectedfor constructing a user profilewhich theyare combination between movie content and user context:seven features are movies content (gener 1-3, actor1-3, director) and three features are user context (location, day type and social).

The next step was calculating the WSM for each feature and then it was very important for verifyingthe accuracy by finding the correlation relationship between gener 1-3 and actor 1-3 and director. After that a certain actors and director who are interacted with the genres types were selected on as the user preferences as shown in Table 1 and 2. The resultswere calculated in terms of the percentage of the relationship between the actors and directors with respect to the movies genres that mostly acting in as depicted in Table 3 and 4, worthy to mention, the percentages in Table 4 for genre feature relate to user 1 have been obtained by depending on actors and director feature shown in Table 3.

Table 1: Represents some genres prefer by users in userprofile

User id	Gener 1	Gener 2	Gener 3
U1	Horror	Fantasy	Saga
U2	Horror	Fantasy	Absurdist
U3	Dram	Horror	Slice_of_life

Table 2: Represent sample of preference for actors and directors in user profile

User id	Actor 1	Actor 2	Actor 3	Director
U1	Act 83	Act 349	Act 1523	Dir 679
U2	Act 710	Act 1404	Act 366	Dir 741
U3	Act 476	Act 1916	Act 1928	Dir 569

Table 3: Represents the percentage of interests actors and director with genre in data for user 1 in Table 2

Interests	Fantasy (%)	Horror (%)	Saga (%)
Act 83	50	50	0
Act 349	43	14	0
Act 1523	17	8	0
Director	0	33	33

Table 4: Represents the percentages of preference (P_P) in terms of gener for three users

User id	Gener 1	P_P (%)	Gener 2	P_P (%)	Gener 3	P_P (%)
U1	Horror	50	Fantasy	25	Saga	25
U2	Horror	66	Fantasy	17	Absurdist	17
U3	Dram	33	Horror	33	Slice_of_life	34

CONCLUSION

Improving the structure of user profile with item contents and user contextwas investigated in this study. Set of features was chosen to structure the profile framework based on their rank with respect to the information gain. In addition, the features were correlated with each other to guarantee a solid association among them. The results were shown encouraging outcomes to construct an enrichment user profile that treats with content based in which it may enhance the decisions making related with the user taste.

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