



International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Website: www.ijircce.com

Vol. 5, Issue 3, March 2017

Review on TV Channel Program Recommendation Techniques

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ABSTRACT: The number of channels and TV shows are increasing day by day and it is very hard for the user to select a required TV show among many. The recommendation systems for recommending TV programs to users according to their profile, are used. Recommendation systems are proved to help users to access their favourite items, increase channel's TRP. This paper gives review about the various TV program recommendation systems, which uses face detection, Bayesian model, big data and filtering algorithms like content based and collaborative filtering algorithm. Data mining algorithm plays an important role in recommender systems.

KEYWORDS: TV program; Recommendation; Face Detection; Bayesian model; Data mining

I. INTRODUCTION

Recommender systems are software tools and techniques providing suggestions of relevant items to user. Such as what product to buy, which movie to watch etc. With the evolution of TV programs, the need of recommender systems for TV has increased substantially. Then it is understandable that in this work we consider recommender systems for TV programs as the current volume of television shows offered by TV channels makes hard for viewers to select relevant content. Traditional television content search tools, e.g. printed or electronic TV guides, do not efficiently meet the viewers' current information requirements. Different recommendation techniques are used, which helps the user to choose their favourite. There are many recommendation systems for recommending TV shows available now. Four techniques are referred and analysis is done on each one of them. The section II of this paper consists of four sub-parts each part explains about one technique. First part about face detection technique, second part about Bayesian modelling, third about big data and Hadoop, fourth part is about collaborative and content based filtering techniques. Section III consists of analysis and section IV concludes the paper.

II. RELATED WORK

1) Face detection

Simon et. al [1] have defined a face module which is a face detection, tracking and recognition system based on a prototype developed for automatic video indexing. It creates a profile for each and every viewer. This helps personalized recommendation of programs. The profile of the viewer updated frequently when they are watching the TV, it uses facial recognition to check their interest for a particular program. If the viewer shows interest for a program that will be added to their profile, else it will not be added. The architecture of this system consists of a camera mounted on top of the TV and a handheld tablet which acts as a remote and all the recommendations are shown on this tablet only. The face detection and sensing are all done on the first stage called face module this uses skin colour regions. The Expression module uses support vector machine to assess how far the expression deviates from the neutral. The action module is for upper body movement for estimating the concentration of the viewer. The Interest estimation module uses Conditional Random Field [CRF] algorithm to combine the outputs from the modules and the tablet and it calculates the viewer's interest for a particular program and recommends it next time. So this technique has only a restricted scope, so can't be used everywhere.

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$$P(\mathbf{y}|\mathbf{x}) = \sum_{\mathbf{h}} P(\mathbf{y}|\mathbf{h}, \mathbf{x})P(\mathbf{h}|\mathbf{x})$$

$\mathbf{x} = x_1, \dots, x_n$ Sequence of observations

$\mathbf{y} = y_1, \dots, y_n$ Sequence of labels

\mathbf{h} is set of latent variables inserted between \mathbf{x} & \mathbf{y} using chain rule property

2) Bayesian Model

Zhenzhen et. al[2] proposes a technique using Bayesian algorithm. They have used the advantage of Bayesian probability model to mine the massive program text information to extract users' hobby and feature information to recommend users their favourite program. The intelligent recommendation system they have defined consists of 4 parts. Data acquisition, Data filtering, Building of model and Prediction of result. Data acquisition is done by acquiring user preference information from web crawlers and program information from set-top box. This data is stored in a database and then the Bayesian data mining model is used to analyse those data and predictions are done so that the accurate results are sent to the viewer.

The Bayesian model is built on the basis of probability theory and has a solid mathematical and theoretical basis it has good intelligibility and logic capacities. It classifies the users' information and program information into 3 kinds of subnets and 4 nodal points with building corresponding topology network. The construction model consists of following steps which includes Expression of the nodal variables. The construction of the topology network, the intelligent recommendation algorithm of programs. As this technique uses Data mining algorithm like Bayesian algorithm, it is efficient and predicts the required program precisely. It needs more input of the viewer to calculate the predictions. Fig 2.1 explains the working flow of Bayesian model.

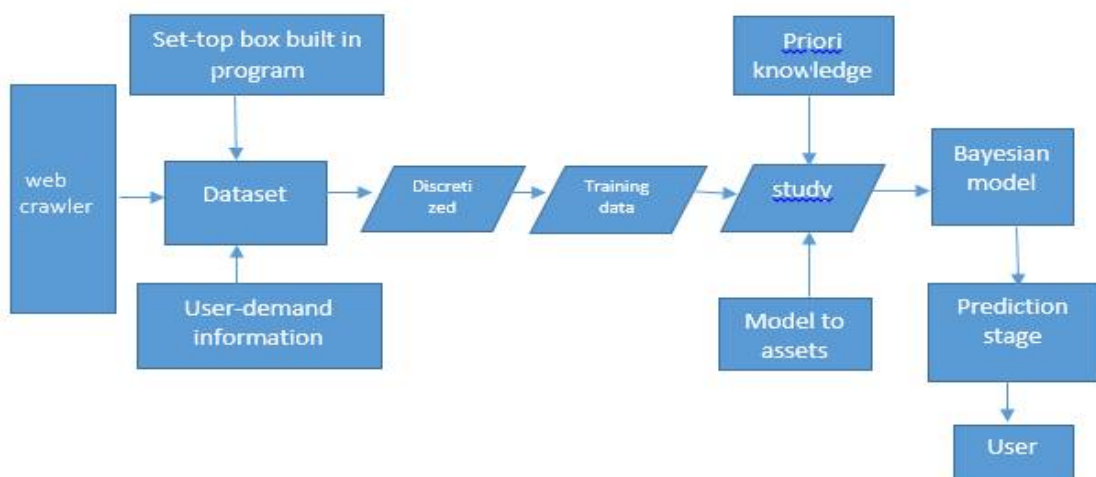


Fig 2.1 Flowchart of Bayesian model



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$$U_{ij} = r^{-1} (WH_{ij}) / \sqrt{\sum_{UHk \in pa(T_{Hi})} W_{Hik}}$$

U_{ij} - Weight between the hobby terms and the users

W_{Hij} - Love of user j to the hobby term T_{Hi}

U - User set

H - Hobby set

T_{Hi} - Hobby Term of user i

K - No. of Programs user interested in

W_{Hik} - Weight of user's interest to the program K

3) Big Data

Mengyi et. al[3] proposes a technique in which the ratings are analysed, the system used is based on Hadoop framework which can analyse the massive text data from the network and set-up box. To apply big data technology into TV program recommendation, there are 4 features; Program ratings, TV ratings, Program type and Program broadcast time.

A) TV programing analysis:

Downloading TV programs list data using web crawlers we can get the required data. Using data analysis software can help us to analyse the TV programs data and obtain the result as highest ratings, play time and program types. The main purpose of analysing the program data is to dig-out hidden values like the rating of a program was more during the weekend.

B) Program broadcast time analysis:

Any program's rating depends on its broadcast time for example rating for a show is lowest at midnight of a day. Thus analysing time of broadcast by data mining is very important where broadcast time is independent variable and ratings are dependent variables. We choose a sample from database and get a rule from the sample and verify other samples using data mining algorithm. So when we get the period of high rating, it can be used by the companies for advertisements.

C) TV rating analysis:

It is essential to operate horizontal comparison analysis. If we analyse only one TV station the content of program is single. Thus comparing ratings with other TV station gives us a wider view. Number of variables should be fixed before analysing program ratings on different TV stations.

e.g.: we select the 5 most popular TV programs, now only highest rating on Saturday is analysed. Hence we get a clear analysis of the rating between TV programs, as we have fixed a variable.

D) Program type analysis:

In this case we collect data that affects the content like story line, directors or famous actors and for news channels we screen out the sensitive words and invalid entries and keywords of hot news are obtained by data visualization.

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The advantage of this technique is that it uses Big data analysis so large amount of information can be stored and can be mined using algorithms. It needs lots of input to predict the required program.

The similarity between two users c and c' is considered as two vectors in the m dimensional user-space. The similarity between them is denoted by $sim(c, c')$ is given by

$$k = 1 / \sum_{c' \in C'} |sim(c, c')|$$

$$r_{c,s} = k \sum_{c' \in C'} sim(c, c') \times r_{c',s}$$

$$sim(c, c') = cos(c, c') = \frac{c \cdot c'}{\|c\| * \|c'\|}$$

$r_{c,s}$ - Rating of user c for the program s

C' - Top most k similar neighbours of user c

$r_{c',s}$ - rating for item s by user c'

$$sim(i, j) = \frac{\sum_{u \in U} (R_{u,i} - \bar{R}_u)(R_{u,j} - \bar{R}_u)}{\sqrt{\sum_{u \in U} (R_{u,i} - \bar{R}_u)^2} \sqrt{\sum_{u \in U} (R_{u,j} - \bar{R}_u)^2}}$$

To overcome the biased rating of the user, we find the average rating of a user (u). This average rating (\bar{R}_u) is

$$P_{u,i} = \frac{\sum_{\text{all similar items, } N} (s_{i,N} * R_{u,N})}{\sum_{\text{all similar items, } N} (|s_{i,N}|)}$$

reduced from all the rating of the user 'u'

4) PERSONALIZED RECOMMENDATION

Jiangshan et. al [4] defines a technique that automatically matches user's interests. General methods used are ACF(Automatic collaborative filtering) or hybrid strategy of content based and collaborative filtering. Personalized system can be achieved by implicit or explicit feedback. Personalized TV program recommendation system architecture has 4 modules: User profiling module, Program representation module, CF module and Recommendation module. The advantage of using this is it uses both implicit and explicit feedback and the recommendation is more accurate and precise.

A) Representation of TV program:

It is done by representing programs in categories or genres. Classification should be broad and deep. Meta data is the description of the program which can be in any form like integer for duration of the program, string for the name of the program which then helps in comparing the similarities of the TV program based on the keyword. TV program hierarchy can be divided into layers of genres, which is alone not enough for



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recommendation, for more precise results we extract TV event description from the web page of the TV station.

B) User profiling:

It has both fixed and variable part. For profiling fixed part is helpful and analysis is done, it is then compared with existing users. Here an attribute of interest (m) is compared with existing user profiles $U(m)$. This system uses precise matching mechanism to find similar attribute as program profile. These attributes are vague and uncertain so fuzzy set theory is used.

C) Mechanism of recommendation:

Two algorithms which are used here are content based filtering and collaborative filtering. The content based filtering has 3 components; user profile, content description and procedure to find the relation between them. Limitation of this algorithm is that it will be inaccurate with less description. The collaborative filtering is more efficient and accurate as it compares target user with another user, the problem arises when neighbour users are inactive or less active.

D) Evaluation mechanism:

A feedback mechanism is used to improve recommendation payoff for recall and precision occurs where recall is number of recommendation and precision denotes success. Quality of the system can be evaluated by F1:

$$F1 = \frac{2 \times \text{recall} \times \text{precision}}{\text{recall} + \text{precision}}$$

The advantage is that it uses both explicit and implicit feedback and recommendation is more accurate and precise.

The disadvantage is that it requires large number of users to participate and provide feedback and if the user groups are inactive then the number of recommendations will be reduced.

IV. ANALYSIS

Thus we have referred 4 different types of TV Program Recommendation techniques. The problem with these techniques is that, it all requires large number of users participation and their feedbacks. Some might not be interested in giving feedback, some may deliberately give wrong feedback. If efficient data mining algorithm is used then we can recommend programs precisely with the available data somehow. Among the 4 techniques, collaborative filtering algorithm has more advantage over other algorithms. In future we will work to construct a more precise and accurate recommendation technique.

V. CONCLUSION

We have seen the success of recommender system in E-commerce, the same idea can be applied to the TV program recommendation. Only challenge is to make a platform where users can share their profile and provide feedback, similar to E-commerce websites. In this literature review (LR) we have classified and analyzed 4 different recommendation systems. There are lots of recommendation techniques available. They are costly and difficult to analyze the data sometimes, chances are less for viewers to like all the recommended programs, the prediction is based on probability only. Still the algorithms can be improved by using good statistics and efficient use of the data. These



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recommendation reduces the burden of the user to select a required program among many available options, and it helps the cable provider to recommend accurate information to the viewer.

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