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A framework for Health Services Recommender System

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Abstract: With the rapid growth of health disease in the country, recommendation for health services is taken a vital role in public sector. Medical system providing 24/7 help system and providing health services. Recommender system is a key factor to identify the services and receiving the better services in today's scenario.

I. INTRODUCTION

Recommender system is differing from expert system which is rule base but recommendation is a prediction of perfect health services. In this paper author mention the various techniques and framework for health services recommender system. Different sector there are different service provider it is a today's need of services. For health services the human being can't understand which one is better it may be bias in the critical situation of health problem.

1) Introduction: Recommendation is suggestion or proposal as to the best services basically it one put forward authorities services.

II. TYPES OF RECOMMENDER SYSTEM

Collaborative, Content Based, Demographic, Utility based, Knowledge based, Hybrid recommender system. In health services recommender system framework which recommendation system for predicting the health services are analyzing by researcher.

Two factors are co related to each other like patient dataset and services dataset. Services which are provide doctors in different location. Patient exactly knows the area of services and where the better treatment is receiving from doctors. But before that the patient economic condition where patient accommodates that much cost for services.

Recommender System Health Services factors:-

1) Patient (Dataset)
2) Hospital
3) Services of Hospital
4) Feedback of patient
5) Filtering Technique
6) Prediction
7) Recommendation

Patient dataset which is related to their age group children, adult, Older. Recommendation is process on dataset of hospital services and patients which are correlated to each other. In recommendation following process is takes place.

III. KNOWLEDGE SOURCE

In recommender system suggest new item (Patient Data item) or to predict the utility of a certain item for a particular patient data item on the previous linking's and the options of the other likeminded user.

Collaborative Filtering for health Recommendation: - In a typical collaborative

filtering is a list of patient item users P_i which is $P_i = (p_1,p_2,p_3 \ldots p_n)$

And the list of hospital services S= (s1,s2,s3,….,sn). Each patient user has a list of services item which the patient has expressed his/her opinions about. Options can be explicitly given by the user as rating score, generally within a certain numerical scale. In this dataset the null items set are founded .There patient who belongs the services are called active user Pi € Sn for whom the task of collaborative filtering algorithm is to find item likeliness that can be of two forms.

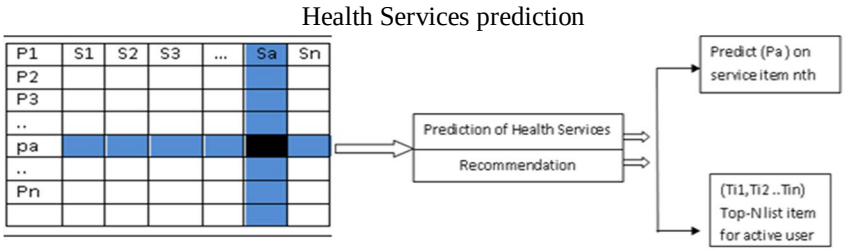

Figure 1 The collaborative filtering process for Health Srvice.

Prediction: - Predication is a numerical value $P_{n,a}$ which express prediction likeliness of Patient item S_n € Sp_a for the active Patient P_n. This prediction value is within the same scale (e.g from 1 to 5) as options value provided by user patient p_a.

Recommendation: - It is a list of items S_n € P that the active patient user will like the most. Here we note that the recommended list must be on item which is not already taken health services by the active patient user i.e. Sa ∩ Sp_a = ∅ this interface of CF algorithm is also known as Top-N recommendation.

Figure 1 shows the schematic diagram of the collaborative health service filtering process.CF algorithm represent the entire m X n patient user

Item data as a rating matrix. *M. Each entry n $_{a,}$ s_n* in *M* represent the preference score (rating) of the n th patient user on the S_n th health services. Each individual rating is a within scale and it can as well be 0 indicates that the patient user has not yet rating for the health services. Researcher has applied the collaborative filtering algorithm that can be divided into two main categories.

1) Memory–based collaborative filtering algorithm.

2) Model–based collaborative filtering algorithm.

Memory –based collaborative filtering algorithm which utilize the entire patient user item data base to generate a prediction. These systems employ statistical techniques to find a set of patient users, known as a neighbors, that have a history of agreeing with the target user means they either rate different health services similarity or they to similar set of health services. Once the neighborhood of patient user is formed the system is use different algorithm to combine the preferences of neighbors to produce a prediction or top-N recommendation for active user. The technique also known as nearest-neighbor or user-based collaborative filtering is used in recommendation technique.

Model–based collaborative filtering algorithm: - Model based CF algorithm provide item recommendation by first developing a model of user ratings. Algorithm in this taken an expected value of prediction which CF filtering techniques. The model base learning algorithms are Bayesian network, clustering and rule-based approaches.

Researcher design the Recommendation Health services framework with the help of item based collaborative filtering.

IV. ITEM BASED COLLABORATIVE FILTERING FOR RECOMMENDATION HEALTH SERVICES

Recommendation system of health services

Patient Data: - In this framework researcher use patient dataset for analyzing the feedback which they are taken health services from different hospitals. The total number of hospital in Sangli city 636 which is categories general physician, general surgeon, appendix, gynecologist & obstetrician, pediatricians, ontology, cataract surgeon, ENT surgeon , neurology , oncology , orthopedics, urology in Sangli city.

Total services 35 in which researcher selected Services are breast screening, cardiology, critical care, diagnostic imaging, x ray, sono-graphy, depillar test, MRI, endoscope, gastroenterology, CBCS Test, Blood test , Urine Test, Saliva Test Thyroid test , BMI Test , Uric Acid test . Here researcher mentions total 17 services for recommendation.

A. Data Set

Patient user dataset are taken from different part of Sangli city which is 345 patients which is categories in Children, Adolescents, Adult and Older. For this purpose we introduced a variable that determines what percentage of data is used as training and test data was used as test set. The data set x=0.8 would indicate 80 % of the data will be used as training set and 20% of the data will be used as test set. The data set will be converted into user-item matrix. *M* is mention that will be 276 rows which is patient dataset and 13 columns which are health services. 276X 13 matrix for data set of recommendation health services. Researcher also considers another factor into consideration, sparsity level of data sets. For the data matrix *M*. This is defined as

$1-\frac{nonzero\ entries}{total\ entries}$

The sparsity level of the Patient data set is, therefore $1-220/_{276X13} = 0.9362$
Throughout the paper we term this data set as health services.

B. Evaluation Metrics

Recommender system for health services research has used several types of measures for evaluating the quality of a recommender system. They can be mainly categories into two classes.

1) Statistical accuracy metrics
2) Decision support accuracy metrics

Statistical accuracy metrics: - It evaluates the accuracy of a system by comparing the numerical recommendation scores against the actual user rating for patient user item pair in the test dataset. Mean Absolute Error (MAE) between rating and predictions is a widely used metric. MAE is a measure of the deviation of recommendations from their true patient user –specific values of services. For each rating-prediction pair <P_n…S_n> this metric treats the absolute error between them i.e.
| P_n-S_n| equality. The MAE is computed by first summing this absolute error of the a_{th} corresponding rating-prediction pairs then computing the average.

$$\text{MAE} = \frac{\sum_{n=1}^{a} Pn-Sn}{a}$$

The lower the MAE, the more accurately the recommendation engine predicts user rating. Root Mean Square Error (RMSE) and correlation are also used as statistical accuracy metric.
Decision support accuracy metrics:- It evaluate how effective a prediction engine is a helping a user select high quality item from the patient set of all items. These metrics assume the prediction process as a binary operation-either items as are predicted (good) or not (bad). With this observation, whether an item has a prediction of 1.5 or 2.5 on a five-point scale is irrelevant if the user only chooses to consider predictions of 4 or higher. The most commonly used decision support accuracy metrics are reversal rate, weighted error.

1) Framework Procedure: In Recommender system for Health services following step will be taken

a) Framework Steps: - We will stare framework by first dividing the data set into a training and test portion. Before starting the development evaluation of memory based collaborative algorithm research find the nearest n- neighborhood data item. From the sensitivity plots researcher fixed optimum values of these parameters and used them for the development. To determine the parameter sensitivity, researcher work only with the training data and further subdivided it into a training and test portion and carried on our development on them. For conducted a 10-fold cross validation of our development by randomly choosing different training and test sets each time and taking the average of the MAE values.

b) Benchmark User-Based System- To compare the performance of item-based prediction researcher also entered the training ratings set into a collaborative filtering recommendation engine that employs the *Pearson nearest neighbor algorithm (User-User).* For this purpose researcher will developing a flexible prediction engine which is implements user-based CF algorithm. Pearson nearest neighbor algorithm (User-User) which considering every possible neighbor to form optimal neighborhoods.

C. Framework Analysis

1) Framework Development Result: Development of framework for recommender health services researcher will applying item-based collaborative filtering techniques for generating predictions. Result of developing system is divided into two parts quality result and performance result. Accessing the quality of recommendation researcher first determined the sensitivity of some parameters before running the main development. These parameters include the neighborhood size, the value of the training/test ratio and effect of different similarity measures. For determine the sensitivity of various parameter researchers focused only on the training data set and further divided into training and a test portion and used to learn the parameters.

2) Effect of similarity Algorithm: In the framework of recommender system for health services researcher is using a cosine similarity algorithm. Two items such as patient and health services are represent as a two vectors in an m-dimensional user-space. The similarity between them is measured by computing the cosine of the angle between these two vectors. In the m X n matrix

$$sim\ (i,j) = \cos(i\ ,j) = \frac{i\ .j}{||i||2*||j||2}$$

With the help of cosine similarity researcher find the predictive value where training data set and test data set are used to compute Mean Absolute Error (MAE). Researcher will be observing from the results that offsetting the user average for cosine similarity for the rest of researcher development.

3) *Sensitivity of Training/ Test Ratio:* Researcher will be finding of sensitivity of density of the data set between test and training ratio. For the two prediction generation techniques-basic weighted sum and regression based approach where both the results will be shown for prediction
4) *Experiments with neighborhood size:* Researcher will be viewing the size of the neighborhood which will be significance impact on the prediction quality. Researcher determines the sensitivity parameter, we performed a developing where it will found that varying the number of neighbors will be used and computed MAE. Researcher will be keep in a mind that may be size of neighborhood does affect the quality of prediction. The two methods showed the different types of sensitivity.
5) *Quality Development:* Researcher will be finding out the quality with the help of applying recommender system techniques. Item-based algorithm will be providing better quality than the user-based algorithms at all sparsity levels. Regression based algorithm will be perform better with very sparse data set. Researcher will be take care of add more data quality goes down. Researcher will be believed this happened as the regression model suffers from data over fitting at high density levels.
6) *Performance Result:* Item based similarity is more static and allows computing the item neighborhood. This pre computing of the model has certain performance benefits. To make the system even more scalable into the sensitivity of model size and then researcher will looking the impact of model size on the response tie and throughput.
7) *Recommendation:* Researcher will evaluating of the item-item collaborative filtering with this researcher will be observe that item-item schema will provides better quality of prediction than user-user (k-nearest neighbor) schema. Researcher observes that the improvement in quality will be consistent over different neighborhood size and training/test ratio. Item neighborhood is fairly static which will be potentially pre-computed, which result will be very high line performance. Researcher will used in framework as model based approach for a small subset items and produce responsibly good prediction quality. Therefore the item challenges of recommender systems for e-commerce quality of prediction and high performance.

V. CONCLUSION

Recommender systems are a powerful new technology for Health services from user database (Patient). These system help user (Patient) find services items which are more beneficial and proper. Hence it helps patient to receiving proper services and which is better for patient health. Recommender system is anxious by the huge volume of user data in existing corporate database, and also more stressed of user data available on the Web. In this paper author play a role of researcher and design the framework of recommender system of health services. Author represents in this paper the development of recommender system through item-item collaborative model base system. Prediction is main role of recommendation , but performance and quality is differ to system author place in this paper that prediction is core but the quality and performance is also take a important part.CF-based algorithm to scale to large as well as small data sets and at the same time produce high-quality recommendations.

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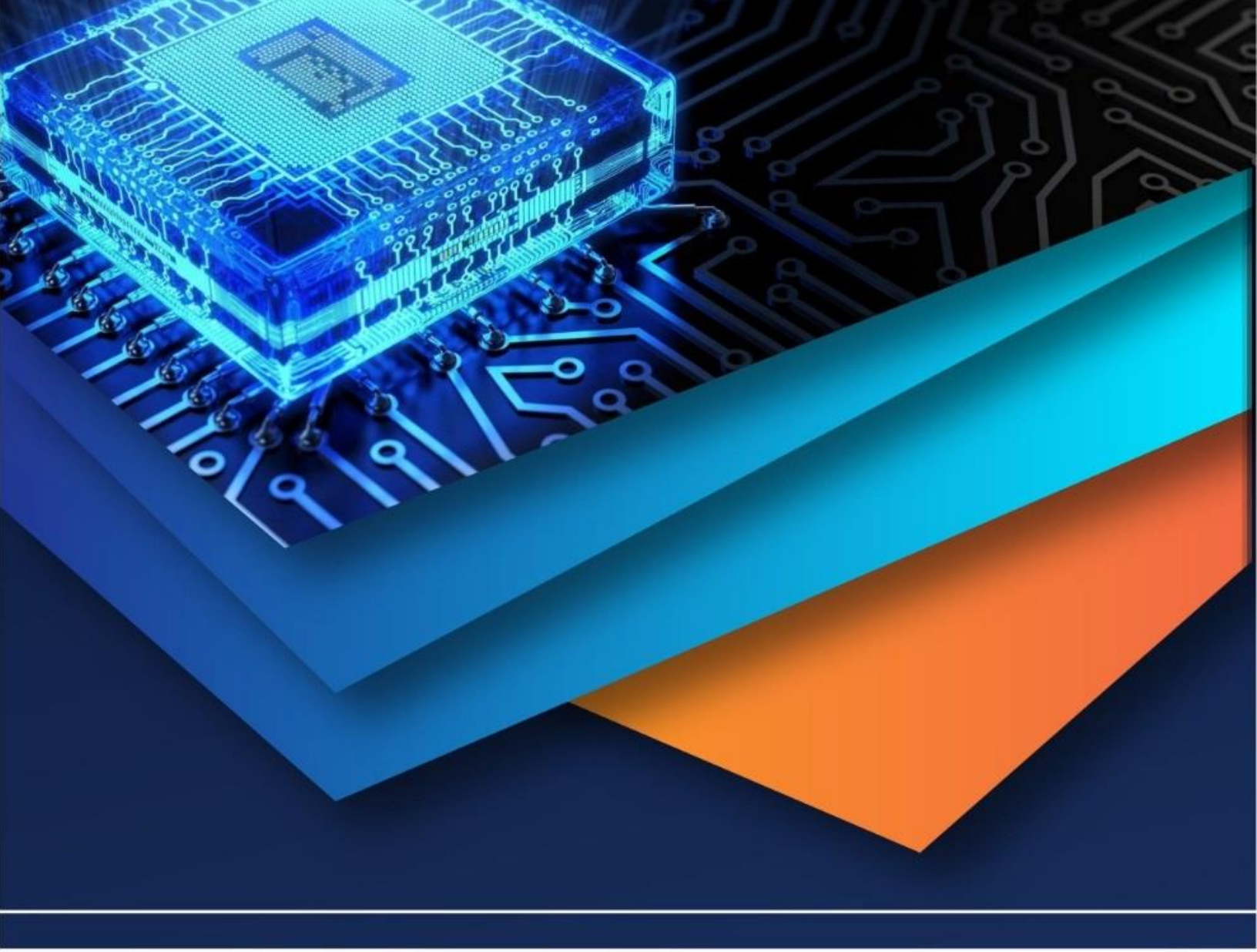

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