

An Adaptive Doctor Recommendation System using Data Mining Techniques

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Abstract – To find the specialty-counterpart, diagnosis-accurate, skill-superb and cost-effective doctors is not an easy job for the patients. In this paper, we describe a recommender framework to find the best doctors in accordance with patients' requirements. In the proposed system, first it considers only those doctors whose profile match with patients' requirements. Second, the best doctors will be recommended out of previously obtained doctors based on parameters such as patients' feedbacks, education qualification and cost. Our paper will suggest a doctor recommendation system that uses data mining techniques, which can be used in those countries that have huge uneven distribution of medical resources.

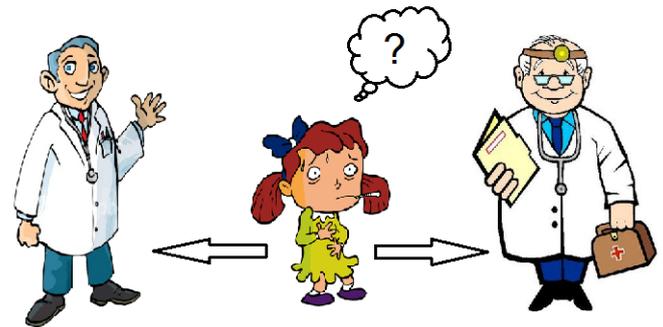


Fig -1: Patients' struggles to make decision without sufficient medical knowledge and experiences

Key Words: doctors, recommendation system, sentiment mining, relevance module, quality module.

1. INTRODUCTION

The massive amount of digital information is present on the internet. This information is unevenly distributed. So there is need for intelligent recommender system more than ever before. Recommender system is the one that filters vital information out of massive unevenly distributed information according to users' preferences and interests.

Lack of knowledge and relevant experiences make the people difficult in taking decisions regarding appropriate doctors for their treatments. In such situations, people make decisions based on other people recommendation, internet and advertisements. This causes unnecessary waste of money and time. People end up unsatisfied as shown in the Fig. 1.

Our recommendation system will overcome the problems faced by people in finding the appropriate doctors. This paper will provide the recommendation system that suggests the best doctors using data mining techniques. The best doctors are the one who understand the patients' problems, care for them, respect them regardless of who they are and treat the diseases properly.

Our system will suggest the best doctors by considering the facts such as patients' feedbacks about the doctors, education qualifications, availability and cost.

In this paper, we propose a recommendation system that consists of the two main parts, one is relevance model and other is quality model. The quality model is based on data mining techniques such as clustering, sentiment – mining. Clustering is used to group the best doctors out of the given list of doctors. Sentiment mining will be performed on the comments given by the patients' in the feedback form.

The remainder of the paper is organized as follows. Section 2 provides various related research that deal with expert finding problems. Section 3 develops doctor recommendation system, consisting of relevance model and quality model. Section 4 demonstrates the final product in a computer for user to operate our recommendation system. This paper concludes in Section 5.

2. RELATED RESEARCH

Hongxun Jiang and Wei Xn proposed an integrated doctor recommendation system that incorporates the relevance module, quality module based on web-mining and also provided the information regarding the drawbacks of the traditional procedures which was followed by the patients to find the appropriate patients. Relevance module is used to compute relevance between patients' requirements and doctor profile. Quality module is used to analyze the best doctor qualities [1]. Ashish Jha, the physician provides top ten qualities through which the best doctors can be measured. He also proves that only education qualification shouldn't be considered as a criterion for the prediction. He focused mainly qualities

such as empathy, good listener, humble etc. [2]. Stanford CoreNLP provides various sentiment tools to perform sentiment mining. This tool is mainly based on recursive neural network which is built on top of grammatical structures. The tool is well trained on dataset called Sentiment Treebank [3]. Practo, a healthcare website that helps the customers to find the appropriate doctor in a given region. It provides the detailed information such as input and output data format which are to be considered in building the recommender system [4].

3. THE PROPOSED SYSTEM

The proposed doctor recommendation system consists of mainly two parts, one is relevance analysis module and another one is quality analysis module. The main components of the proposed system are shown in the Fig. 2.

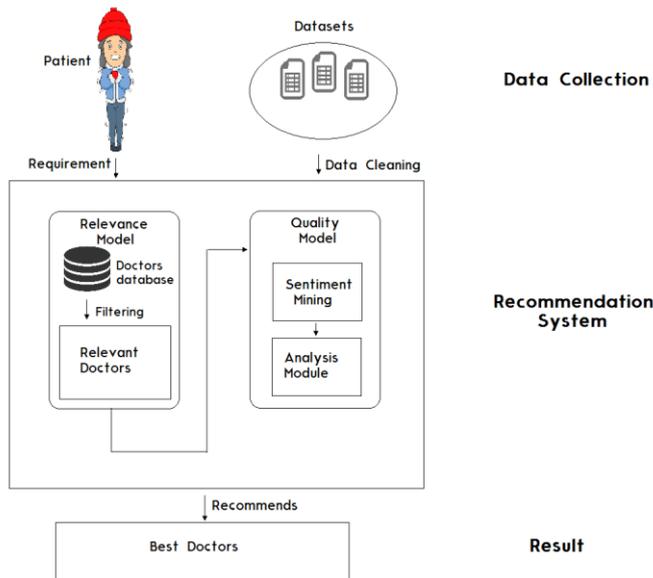


Fig -2: The Proposed System

From the Fig. 2, the proposed system can be divided into 3 steps as follows.

Step 1: Data Collection. This phase mainly collects information about doctor profile, patient feedbacks about the doctors and patients' requirements.

Step 2: Recommendation System. This system is mainly made up of two modules one is relevance analysis module and other one is quality analysis module.

Step 3: Result. The result contains list of best doctors which are arranged in decreasing order.

The details are described in the following subsections.

3.1 Data Collection

The data collection phase consists of two phases. In first phase, the information about doctors profile and patient feedback form will be collected from various input sources such csv or excel formats. Once the input data is collected, data cleaning operation will be performed. Data cleaning is

a method used to remove the unwanted or corrupted data from input dataset. The resultant data obtained after data cleaning step will be passed onto the recommendation system phase for storage purpose. The system will be dynamically updated with the new data whenever a user provides a new feedback about the doctor or a new doctor is added to the existing system.

In second phase, end user is going to specify the requirements such as location, disease, availability and cost. The requirements given by the patients' will be considered as input to the recommendation system. The result of the system will be relevant to these requirements.

3.2 Recommendation System

The recommendation system phase consists of two phases. First phase is relevance analysis model. In this phase, the list of doctors who are relevant to the requirements of the patients' will be filtered out from doctors' database and passed onto the quality model as input.

Second phase is quality analysis model. In this phase, there are two submodules. First submodule is sentiment mining. Sentiment mining is the method used to find the polarity such as positive, negative and neutral of the sentence. In this system sentiment mining will be performed on patients' comments about the doctors. The output of this submodule will be passed onto the analysis submodule. In analysis submodule, the overall analysis of the patients' feedback form will be performed. The parameters that considered for overall analysis are feedback form, education qualification and cost. The second phase will produce the list of best doctors for the given patient requirements.

The rating for each doctor is calculated as follows:

$$Fi = \left(\sum QiAi + C \right) \% \alpha$$

Where Fi denotes feedback result for each doctor obtained by quality analysis for one patient, C denotes the value obtained by sentiment mining, Qi denotes value for each question, Ai denotes the value given by the patient for each question, α is a constant.

$$\bar{F} = (\sum_{i=1}^n Fi) / n$$

Where \bar{F} denotes the mean feedback result obtained for a doctor by considering n patients.

$$Ti = (\bar{F} + Ei) \% \alpha$$

Where Ti denotes the total ratings for each doctor, Ei denotes education background value.

3.3 Result

The result contains list of best doctors which are arranged in decreasing order.

4. THE FINAL PRODUCT

To demonstrate user interactions with the doctor recommendation system, this paper proposed a product that has been implemented with its computing server and its website oriented client.

Server side performs majority of computing burden. The system is initialized with the information of doctors and patient feedback forms by the admin initially and it is also updated dynamically with the new data whenever a user provides a new feedback about the doctor or a new doctor is added to the existing system.

The main modules of the recommendation system will run on the server side. When the end user provides a new feedback about the doctor, the quality analysis module performs analysis over the feedback form and stored onto the database. Once the system receives the requirements from the end user, the relevance module and the quality module will run on server side to produce the best doctors. The quality analysis module will also consider educational qualification, availability and cost as analysis parameters along with previously computed and stored feedback analyzed result.

On client side, user interface is very simple. The interface contains a search option to specify the requirements such as location and disease. When the user specifies the requirements he/she will get the list of best doctors in decreasing order of ratings. End users can also filter the results based on availability and cost of the doctors. Fig. 3. represents the user interfaces of the final product.

5. CONCLUSION AND FUTURE WORK

In this paper, a recommender framework is proposed for recommending the best doctors based on the patients' requirements. This framework overcomes the drawbacks of traditional approaches by considering both the relevance and quality analysis methods for producing a list of doctors.

This system can be enhanced in future by implementing the system in cloud for wide range accessibility, a mobile oriented interface can be developed and it can also be implemented in big data context. Also, limitations can be investigated in the future.



Fig -3: The User Interfaces of the Final Product

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