**Online Doctor Recommendation with Convolutional Neural Network and Sparse Inputs**

**Published year :** 15 October 2020

**Author : Yongjie Yan ,1,2 Guang Yu ,1 and Xiangbin Yan3**

**Link to the paper :** [**https://sci-hub.se/10.1155/2020/8826557**](https://sci-hub.se/10.1155/2020/8826557)

**Summary** :

Online medical consultation which diagnose higher level medical conditions. Problems solved : the data of each online medical platform in the website are not interoperable, the quality of the platform doctors is uneven, the questions cannot be answered within a limited time, and the condition could be easily misdiagnosed according to the one-sided description.

**Model used** :

Probabilistic Matrix Factorization integrated with the Convolutional Neural Networks (PMF- CNN)

* CNN was previously just used for images , but it has been recently discovered CNN works really well and has good results with recommendation system.
* CNN is used to automatically obtain the deep-seated features in the review information given by the users , and the influence of word order and context information on the extracted potential interest features of users can be considered simultaneously to generate a better potential feature representation.
* Particularly when the user reviews matrix is sparse, the use of CNN is helpful to understand the review information in a profound way and generate a better potential model.
* They have used the depth Stacked Denoising Autoencoders (SDAE) to enter through the review information related to the value of doctors
* The proposed model - integrates the relevant information of patients’ reviews and doctors’ professional knowledge and uses it to predict the patients’ preference for the corresponding doctor and gives the specific modelling process.

Diagram

Description automatically generated

We introduce our CNN model to extract the sequential reviews of patients and doctors. At last, we utilize the sequential features as side information in the feature based collaborative filtering framework to make the final prediction.

**Approach** :

1. **Problem Definition** : Given N patients and M doctors , the rating matrix , the rating (I,j) is the rating given by patient i to doctor j. Although the data might be sparse – the goal is to make recommendation based on the sparse ratings.
2. **Dataset** : They developed a website called Haodf.com that includes data from public hospitals. When doctors register and open medical services, they need to submit professional title certificates, qualification certificates, and so on. Haodf also has special departments to verify the authenticity of doctors’ information, so doctors are all true. Haodf collected 3856035 real votes, comments, and thank-you letters from 194.65 million patients in 605066 doctors outpatient clinics in 9823 public hospitals across the country.
3. **Doctor Recommendation Model** : I/P : triple ( u,i,x) where u=user , i=doctor set , z=review information set.We initialize the parameters by SDAE - the optimal user characteristics and doctor characteristics are obtained; the potential feature vectors are obtained by Frequency–Inverse Document Frequency (TF- IDF) and learning reviews information through CNN net- work. Then, by fusing the review feature, the feature of the reasonable doctor ranking is obtained and the score of the doctor is predicted.**Model Used** : PMF-CNN ( Probabilistic matrix factorization Convolutional Neural Network )
4. **Evaluation** : The Mean Average Precision (MAP) and the Normalized Discounted Cumulative Gain (NDCG) are used as evaluation indexes to evaluate the performance of recommendation algorithm.

**Evaluation Results** :

Table

Description automatically generated