Applying deep learning based methods for cold start problem in recommendation systems

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ABSTRACT

The huge and complex digital information overwhelms the human processing capabilities in a wide of information searching and e-commerce works. To handle with information overload, recommendation systems have been created to filter the information. Recommendation systems are usually classified into three categories as content-based (CB), collaborative filtering (CF) and hybrid approaches. However, these three methods encounter the challenge when facing the cold start (CS) problem in which new users have not rated a significant number of items, and cannot properly be linked with similar users. To solve the above problem, the purpose of this thesis is to develop a deep learning based recommendation system to deal with the CS item problem and predict the ratings to users. Firstly, in order to generate the cold start items rating, we used the item description as the auxiliary information. To reduce the computational complexity, the deep learning based method, denoising autoencoder (DAE), is used to extract the compact content vectors through reducing the dimension from the content vectors. With the compact content vector, ratings of CS items can be derived from similar ratings of non-CS items effectively. After getting the cold start item ratings, deep learning recommendation model is developed to predict all missing entries of the user-item matrix. We used the multi-layer perceptron (MLP) as the neural CF layer in the model. After the neural collaborative filtering model is trained, the missing entries in the useritem matrix can be predicted correctly and used for the following-up recommendation. According to experiments, the deep learning method DAE can compress the vectors effectively and also keep the compact vectors maintain the properties of the original vectors. In addition, the time for similarity calculations can be greatly reduced. On the other hand, adding the ratings of CS movies into the processed Netflix dataset can improve the training effect of the neural collaborative filtering model and help to reduce the prediction error between real ratings and predictive ratings.