

A new Approach for Building Recommender System Using Non-Negative Matrix Factorization Method

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Abstract

Nonnegative Matrix Factorization is a new approach to reduce data dimensions. In this method, by applying the nonnegativity of the matrix data, the matrix is decomposed into components that are more interrelated and divide the data into sections where the data in these sections have a specific relationship. In this paper, we use the nonnegative matrix factorization to decompose the user ratings matrix in recommender systems. The user ratings matrix is factorized in a way that the users with similar interests can be identified.

In this paper, we used a regularization method to minimize the difference between the main matrix and the factorized components. To this end we insert the coefficients which are defined as the norm of the decomposition factors in the factorization equation. The coefficients control the entries of the decomposition factors in a multiplication update process. Our numerical results on the MovieLens data set represent the greater accuracy of our proposed method in predicting user ratings for items.

Keywords: Non negative, Recommender systems, Alternative least square, Multiplicative Update, Data analysis.

Extended Abstract

Introduction

Modern consumers are inundated with choices. Huge selection of products, with unprecedented opportunities are offered by electronic retailers and content providers to meet a variety of special needs and tastes. User satisfaction and loyalty can be increased by matching consumers with the most appropriate products. Therefore, recommender systems which analyze patterns of user interest in products to provide personalized recommendations suiting a user's taste, have become very popular in recent years. Recommender systems can be categorized into the following main types:

- Content-Based filtering
- Collaborative filtering
- Hybrid Recommender Systems

In this paper, we try to inherit the advantages of matrix factorization approach as well as cope with the cold start problem by combining matrix factorization approach and content awareness about the individual items and users.

Material and methods

Non-negative Matrix Factorization is a new approach to reduce data dimension. This technique is based on factorizing the matrix into two matrices, by applying the non-negativity constraint, whose components can reveal an understandable relationship between data. In this paper, we use the nonnegative matrix factorization to decompose the user-item rating matrix in

recommender systems. The user-item rating matrix is factorized in a way that the users with similar interests can be identified. We apply a regularization method to minimize the difference between the main matrix and the approximated matrix resulted by factorized components multiplication. To this end we insert the coefficients which are defined as the norm of the decomposition factors in the factorization equation. The coefficients control the entries of the decomposition factors in a multiplication update process.

Results and discussion

Our numerical results on the MovieLens data set represent the high accuracy of our proposed method in predicting user ratings for items.

Conclusion

In this paper, we propose collaborative filtering algorithm based on non-negative matrix factorization. The approach uses extra penalties with selective shrinkage effects which shrink items and users which share common attributes toward each other. The generalized alignment-biased algorithm tries to push item and user feature vectors towards each other in the latent space by penalizing them with some small amounts.

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