华南理工大学

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The Experiment Report of Machine Learning

SCHOOL: SCHOOL OF SOFTWARE ENGINEERING

SUBJECT: SOFTWARE ENGINEERING

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Recommender System Based on Matrix Decomposition

Abstract—using matrix Decomposition to achieve a recommender system.

I. INTRODUCTION

As we know, Matrix Decomposition is a metod of model-based collaborative filtering,it is the most common algorithm used to solve the recommender system problem.And we can also use the SGD or ALS algorithm to achieve our matrix decomposition. In our experiment,we choose the Alternating Least Square(ALS) to complete this experiment, and the process details will be given in the following several parts.

II. METHODS AND THEORY

We get the data and split them into five training sets and five testing sets, and initialize original scoring matrix and fill 0 for null values. Then we need determine the loss function and the hyperparameter learning rate and the penalty factor. After this, we use ALS to optimization and update user factor matrix and item factor matrix. Every iterations, we compute the loss in validation test and judge if it is converge. Finally, we get the score prediction matrix by multiplying the user factor matrix and the transpose of the item factor matrix.

III. EXPERIMENT

A . dataset:

We utilize MovieLens-100k dataset,and it is consisting 1000 comments from 943 users out of 1682 movies. At least , each user comments 20 vedios.Users and movies are numbered consecutively from number 1 respectly,and also, the data is sorted randomly.we use u1.base/u1.test to u5.base to u5.test which are splitted with the proportion of 80% and 20%.

B . implementation:

First, initialize original scoring matrix and fill 0 for null values. Then we need determine the loss function and the hyperparameter learning rate and the penalty factor. After this, we use ALS to optimization and update user factor matrix and item factor matrix. Every iterations, we compute the loss in validation test and judge if it is converge. Finally, we get the score prediction matrix by multiplying the user factor matrix and the transpose of the item factor matrix.

C . method:

1.Read the data set and divide it (or use u1.base / u1.test to u5.base / u5.test directly). Populate the original scoring matrix against the raw data, and fill 0 for null values.

2.Initialize the user factor matrix and the item (movie) factor matrix , where is the number of potential features.

3.Determine the loss function and the hyperparameter learning rate and the penalty factor .

4.Use alternate least squares optimization method to decompose the sparse user score matrix, get the user factor matrix and item (movie) factor matrix:

4.1 With fixd item factor matrix, find the loss partial derivative of each row (column) of the user factor matrices, ask the partial derivative to be zero and update the user factor matrices.

4.2 With fixd user factor matrix, find the loss partial derivative of each row (column) of the item factor matrices, ask the partial derivative to be zero and update the item

4.3 Calculate the on the validation set, comparing with the of the previous iteration to determine if it has converged.

5.Repeat step 4. several times, get a satisfactory user factor matrix and an item factor matrix , Draw a curve with varying iterations.

6.The final score prediction matrix is obtained by multiplying the user factor matrix and the transpose of the item factor matrix .

D , comparision:

In fact in this experiment we can use ALS algorithm and also SGD algorithm.

The differences between these two methods are:

ALS is easier to parallelize than SGD.

ALS converges faster than ALS.

SGD has less storage complexing than ALS.

SGD has less computational complexing than ALS.

E . result:

Our parameters after testing are :

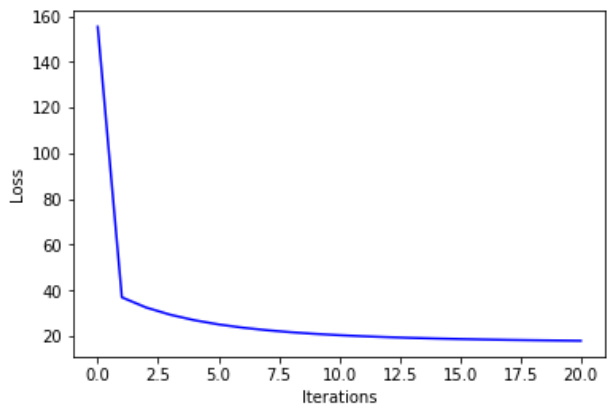
The number of potential features K=50

Learning rate alpha=0.002

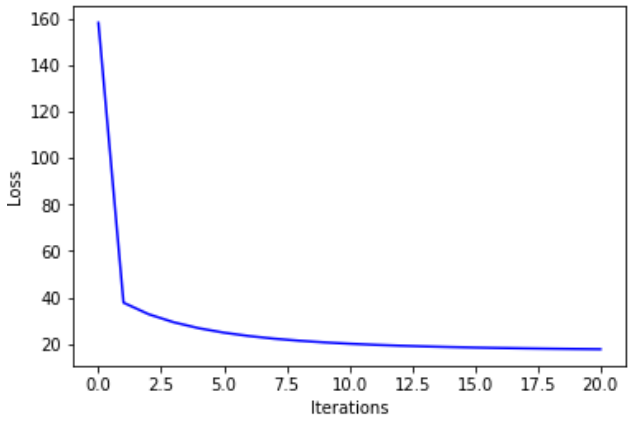
beta=0.02

Finally, we get five loss-iterations graph pointing to the result that the loss converges after the optimization. Here are the graphs.

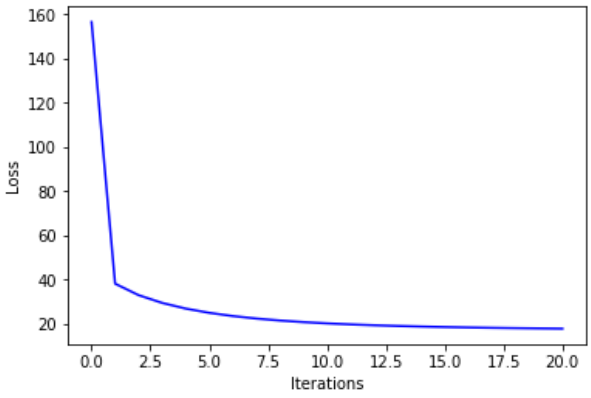
u1.base&u1.test



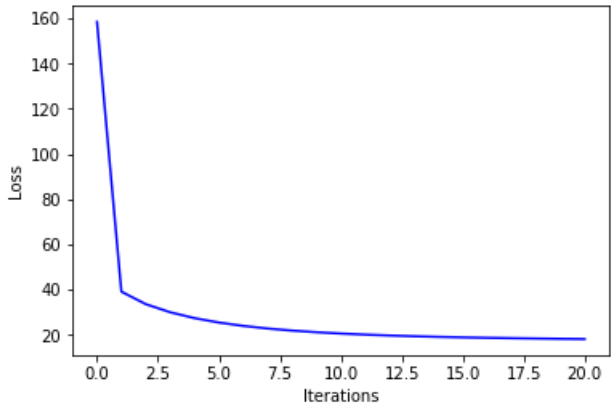
u2.base&u2.test



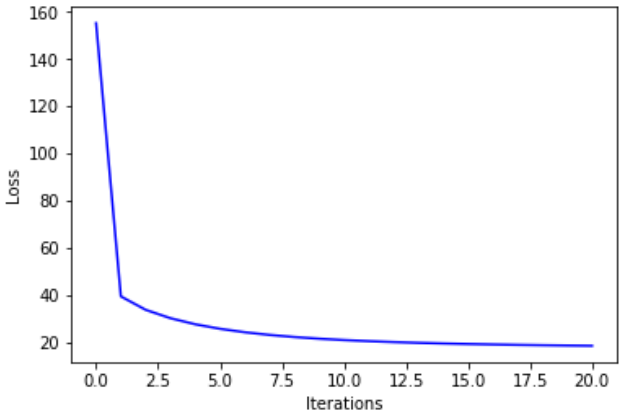
u3.base&u3.test



u4.base&u4.test



u5.base&u5.test



IV. CONCLUSION

By this experiment, all of us really learn too much knowledge about Recommender System, and after the application of the Alternating Least Square method, we can understand the algorithm deeply.

The ALS algorithm really works in the matrix decomposition, and when we choose the suitable parameters, we can see the ALS algorithm converges fast!

The shortage of us is that we don't try another algorithm SGD because of the time,and we will attempt our best to achieve the other method when we are spare.

Cooperation in one team is very important too.