Applying SVD on Item-based Filtering - Numerical Methods Project 4

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1 Introduction

Collaborative filtering is a widely used technique in recommendation systems to predict the interests of a user by collecting preferences from many users. In this project, we implemented collaborative filtering using Singular Value Decomposition (SVD) on a movie rating dataset.

2 Data Preprocessing

With using Json library functions the dataset filtered to include only reviewers who have rated at least 20 movies. Then, from this data a matrix that contains users and their ratings to the movies obtained.

3 Matrix Normalization

To prepare the data for SVD, ratings matrix normalized by applying these given operations. Firstly column average for each column appended to the that columns matrix cells that have 0 (zero) values. Then, row average subtracted from each cell at that row. Obtained matrix is the normalized version of ratings matrix.

4 SVD Decomposition

SVD decomposition applied on the normalized matrix to obtain the matrices U, S, and V. To obtain these values with SVD decomposition, QR algorithm used to calculate eigenvalues and their corresponding eigenvectors. Then, V S and U matrices obtained with the eigenvalues and eigenvectors.

5 Dimensionality Reduction

To reduce the dimensionality of the data, we kept only the top k singular values and corresponding columns and rows of U and V matrices. In short matrices S ,U and V.T became k x k, m x k and k x n. This operation applied for different k values. This reduced the size of the matrices and improved computational efficiency.

6 Prediction Generation

Reduced matrices used to generate predictions for user-item pairs. By calculating similarities between items and users, we predicted the rating that a user would give to a particular item.

7 Discussion

Because of the large document sizes and computer discapabilities these operations applied on small datas. Around 200 reviews used for this project. After step 7, I could not get a proper result due to the problems I had in prediction and errors.

8 Results

Performance of our recommendation system evaulated by using Mean Absolute Error (MAE) and plotted the MAE values for different values of k. The results demonstrated that collaborative filtering approach effectively predicts user preferences.

9 Conclusion

In conclusion, collaborative filtering with Singular Value Decomposition proved to be a powerful technique for recommendation systems. Accurate forecasts and provided personalized suggestions made by utilizing the relationships between people and objects.

10 References

Manolis G. Vozalis and Konstantinos G. Margaritis Parallel Distributed Processing Laboratory Department of Applied Informatics, University of Macedonia Egnatia 156, P.O. 1591, 54006, Thessaloniki, Greece E-mail: mans,kmarg@uom.gr URL: http://macedonia.uom.gr/mans,kmarg Proceedings of the 2005 5th International Conference on Intelligent Systems Design and Applications (ISDA'05)

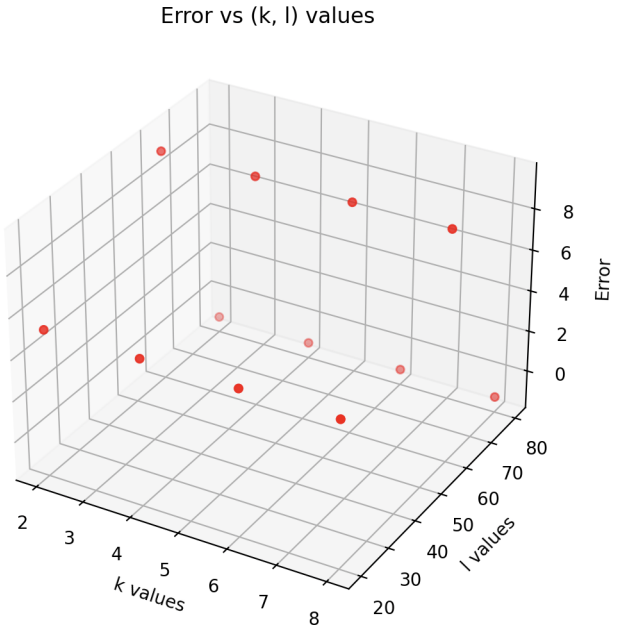

Figure 1: *
MAE GRAPH for different k and l values

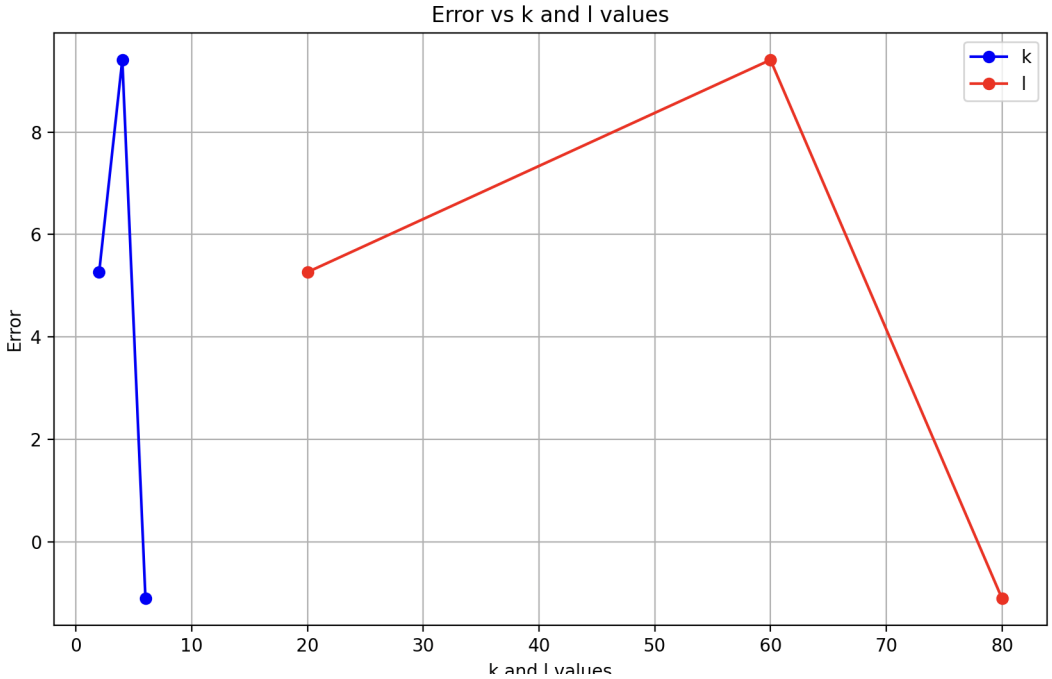

Figure 2: *
MAE GRAPH for different k and l values