Application Of SVD in Recommendation System

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***Abstract*—This paper gives the information about the working of Recommendation Systems which is used in different aspects like movies, shopping, etc. Here SVD is used for Collaborative recommendation which is the most efficient method . Here we took the reviews of the users and found the movies they can like and noted.**

***Index Terms*— Collaborative filtering, Content based filtering, Rating prediction, Large scale recommendation systems**

I. Introduction

Recommender systems are used in a variety of areas, with commonly used examples in the form of playlist generator for videos and misic services, product recommenders and content providers for online stores and social media. These systems are functioned using a single input, like music, or multiple inputs in platforms like news, books, and search queries. There are also popular recommender systems for topics like restaurants and online dating. Recommender systems have also been developed to explore research articles and experts, and financial services.

A recommender system is an intelligent system that predicts the rating and preferences of users on products. The primary application of recommender systems is finding a relationship between user and products to maximize the user-product engagement. The major application of recommender systems is in suggesting related video or music for generating a playlist for the user when they are engaged with a related item.

There are five types of Recommendation techniques. They are:

1) Collaborative Recommendations

1.1) Memory based Algorithms

1.1.1) User based Approaches

1.1.2) Item based Approaches

1.2) Model based Algorithms

2) Content based Recommendations

3) Demographic Recommendations

4) Utility based Recommendations

5) Knowledge based Recommendations

2.Literature Review

Collaborative recommendation is one of the important and most efficient technologies. It takes the ratings of system or recommendations of objects to recognize commonalities among users based on their ratings, and generate recommendations based on comparisons between users. A user profile in a collaborative system consists of items and their ratings. In some cases, ratings may be binary or real-valued indicating degree of preference. Some of the most important systems using are GroupLens (Net Perceptions), Ringo (Firefly) etc.

Memory-based Algorithms:

These are algorithms, which make predictions based on the entire collection of previously rated items by the users. That is, the value of the unknown rating for a user and an item is

usually computed as an aggregate of the ratings of some other users for the same item.

Model-based Algorithms:

Model-based algorithms use the collection of ratings as a training dataset to learn a model, which is then used to make rating predictions. The model-based approaches are often time-consuming to build and update, and cannot cover a user range as diverse as the memory approaches

Singular Value Decomposition (SVD), is a best method getting popular in the field of data science and machine learning. This popularity is because of its application in developing recommender systems. There are a lot of online user-centric applications such as video players, music players, e-commerce applications, etc., where users are recommended with further items to continue.

The Singular Value Decomposition (SVD), a method from linear algebra that has been generally used as a dimensionality reduction technique in machine learning. SVD is a matrix factorisation technique, which reduces the number of features of a dataset by reducing the space dimension from N-dimension to K-dimension (where K<N). In the context of the recommender system, the SVD is used as a collaborative filtering technique. It uses a matrix structure where each row represents a user, and each column represents an item. The elements of this matrix are the ratings that are given to items by users.

The factorisation of this matrix is done by the singular value decomposition. It finds factors of matrices from the factorization of a high-level (user-item-rating) matrix. The singular value decomposition is a method of decomposing a matrix into three other matrices as given below:

X=USV'

Where X is a m x n utility matrix, U is a m x r orthogonal left singular matrix, which represents the relationship between users and latent factors, S is a r x r diagonal matrix, which describes the strength of each latent factor and V is a r x n diagonal right singular matrix, which indicates the similarity between items and latent factors. The latent factors here are the characteristics of the items, for example, the genre of the music. The SVD decreases the dimension of the utility matrix X by extracting its latent factors. It maps each user and each item into a r-dimensional latent space. This mapping facilitates a clear representation of relationships between users and items.

3.DATASET

Here we are taking the past data of the user like ratings. This data is called as Latent features. We are taking around 10 million ratings from the users. We further classifying them by making matrices of having movie ID, movie name.

We should enter the name of the movie we would like to watch. Then we will get 10 similar movies as recommendations

4.METHODS

The methods used here are:

1) SVD

2)Similarity

3)Rating prediction

1)SVD:

It is a method of dimensionality reduction. It is used to factorize the matrix.

X=USV'

X= a "m x n" utility matrix. which represents the relationship between users and latent factors?

U= a "m x r" orthogonal left singular matrix.

S= a "r x r" diagonal matrix, which describes the strength of each latent factor.

V= a "r x n" diagonal right singular matrix, which indicates the similarity between items and latent factors.

2)Similarity:

This method is used to find the similar people of the user. Generally, we use cosine rule here. Because for nearest vectors the angle between them will be less. Higher the cosine value lowers the angle between them. Which means the both vectors are closer to each other.

Sim (u1, u2) = (u1.u2)/llu1ll *llu2ll

Here,

u1&u2 = The vectors formed by the ratings of the users 1 & 2.

llu1ll = Magnitude of the vectors u1.

3)Rating prediction:

This method is used to predict the ratings. Because some times for some movies we don't give ratings because of maybe not seen that movie or doesn't give any ratings.

A=R; Q=U; P'=SV'

R=Q*P'

$$\hat{r}_{xi} = q_i \cdot p_x^T = \sum_f q_{if} \cdot p_{xf}$$

q_i = row i of Q

p_x = column x of P^T

5.RESULTS

Here we are getting the recommendations, mean absolute error, Recommendations:

It gives the best 10 similar movies for the movie we are searched for.

```
Enter The K value:50
Enter movie name: Toy Story
The Mean Absolute Error is
The recommendations for Toy
Toy Story (1995)
Wonderland (1997)
Arachnophobia (1990)
High Noon (1952)
Body Snatcher, The (1945)
Hoop Dreams (1994)
Devil Girl From Mars (1954)
Real Blonde, The (1997)
Nosferatu (Nosferatu, eine
Sleepers (1996)
```

Here we got recommendations for the movie “Toy Story (1995)”

And also, the mean absolute error as 0.1594.

In general, the mean absolute error must be less than 0.9 for efficient algorithm.

6.CONCLUSION

The main purpose of this report was to recommend movies to the users by taking the past data from the users. After taking the data of the users from the datasheet , in Matlab, we gave the recommendations.

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