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Amazon Product Recommendation System using SVD Algorithm

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Abstract:- Amazon is the world's largest retailer by revenue and business. Nearly a third of Amazon's sales come from referrals, accounting for $470 billion of the company's ecommerce revenue in 2021. The program is called recommenders and uses machine learning to select specific features from larger data sets. When there is a lot of filtering, the suggested ideas are often based on what the user has interacted with, purchased, viewed, etc. Matches other similar products. The recommendation engine recommends a product based on this understanding of the user. This is how Amazon's product recommendation engine works. The recommendation engine filters products based on product functionality and user characteristics (for example, find other users who are similar to you and have purchased the product you are looking at or will buy). Amazon's recommendations use different filters to recommend products. Amazon uses various artificial intelligence algorithms to power all aspects of the platform. To enable smart product search on the Internet, the company also uses a proprietary technology called A9. Amazon recently updated its A9 algorithm, now called the A10 algorithm. The update changes many aspects of the product's functionality, shifting the focus of the product to the buyer's behaviour.

Machine learning algorithms in recommendations generally fall into two groups: contextual methods and collaborative filtering. Affiliate marketing is the most common way to make online recommendations. It is "collaborative" because it predicts a customer's preferences based on other customers. A better way would be to recommend the product based on the relationship between the products and not on the customer's consistency. Through user interaction, Amazon.com visitors are matched with other customers with similar purchasing history and personalized recommendations are provided. Come and see. There are many ways to create a unified consensus model. Machine learning algorithms such as SVD and Top-k are used to find the most popular products.

Keywords:- *Recommendation System, Filtering Techniques, Artificial Intelligent Algorithms, A9 Algorithm, A10 Algorithm, Content-Based Filtering, Collaborative Filtering, SVD, Top-K.*

I. INTRODUCTION

Product recommendation is a solution that provides instant product information to customers. It is a powerful data filter based on algorithms, artificial intelligence, machine learning and other data analysis methods. It involves collecting, storing, analyzing and filtering customer data to deliver personalized and relevant products to customers. Appropriate products that meet your customers' needs, tastes and preferences. Quality data is needed to show detailed individual plans. But most importantly, you need the right tools to understand your customer profile and business needs.

Recommendations are the most popular among ecommerce companies like Amazon. These recommendations are valid only if they are based on the user's behavior and preferences. The collaborative filter system is at the heart of Amazon's recommendations and is used to make recommendations based on user behavior and preferences. During this process, Amazon analyzes a lot of information, such as: A customer's purchasing history, viewing habits, and ratings. The goal is to identify users' patterns and trends. The KNN algorithm is a supervised machine learning algorithm used to solve classification and retrieval problems. The system includes user ID, product ID, rating, etc. using factors obtained an RMSE value of 0.9941 for this model.

In short, recommending products to users based on their behavior is not an easy task and there is a lot of user data. This review shows that Amazon's product recommendations are created using a supervised learning process. The RMSE value of this system is 0.9941. Finding similar users and their purchasing behavior based on reviews will help us find the top k products recommended by a particular user. This will increase the company's revenue and give satisfaction to the customers as it will recommend popular products based on customer's preferences.

II. LITERATURE SURVEY

Many studies have been conducted in favor of the product. Previous works have used collaborative filtering in various applications based on user-user and project interaction [1]. Recommendations using the collaboration filter include videos, articles, and product recommendations.

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In [2] the author talks about a system that will help users find movies of their choice. The idea behind using interactive techniques in this research paper is to find videos that match users' interests among the millions of videos available on online platforms today.

In [3] the authors describe their proposed consensus as A Priori. It is a universal product convention that encourages people (especially customers) to actively share product knowledge as they use it.

III. METHODOLOGY

This research was designed to build models using Google collaboration and Jupyter Notebook. The modeling steps are shown below. The first step is to get the dataset from the Kaggle website; Afterwards, the data is processed first, including data cleaning and quality work; Then, the data retrieval process and only users who have commented 50 or more. Store data is divided into two: training data and test data. Use SVD to train the model. The table below shows some information about Amazon seller profiles and their analytics. Data from Kaggle.com.

	userID	productID	ratings	timestamp
0	AKM1MP6P0OYPR	0132793040	5.0	1365811200
1	A2CX7LUOHB2NDG	0321732944	5.0	1341100800
2	A2NWSAGRHCP8N5	0439886341	1.0	1367193600
3	A2WNBOD3WNDNKT	0439886341	3.0	1374451200
4	A1GI0U4ZRJA8WN	0439886341	1.0	1334707200
...	...	...	...	...
7824477	A2YZI3C9MOHC0L	BT008UKTMW	5.0	1396569600
7824478	A322MDK0M89RHN	BT008UKTMW	5.0	1313366400
7824479	A1MH90R0ADMIK0	BT008UKTMW	4.0	1404172800
7824480	A10M2KEFPEQDHN	BT008UKTMW	4.0	1297555200
7824481	A2G81TMIOIDEQQ	BT008V9J9U	5.0	1312675200

7824482 rows × 4 columns

Fig 1: Amazon Sales Data

Data can be cleaned, visualized, and reduced in size using machine learning and is best suited for single-value parsing algorithms. The value of the value parsing algorithm is used to reduce the size of the data. Using SVD, we obtained the RMSE value of 0.9696. After parameter transformation, the RMSE value was obtained as 0.858.

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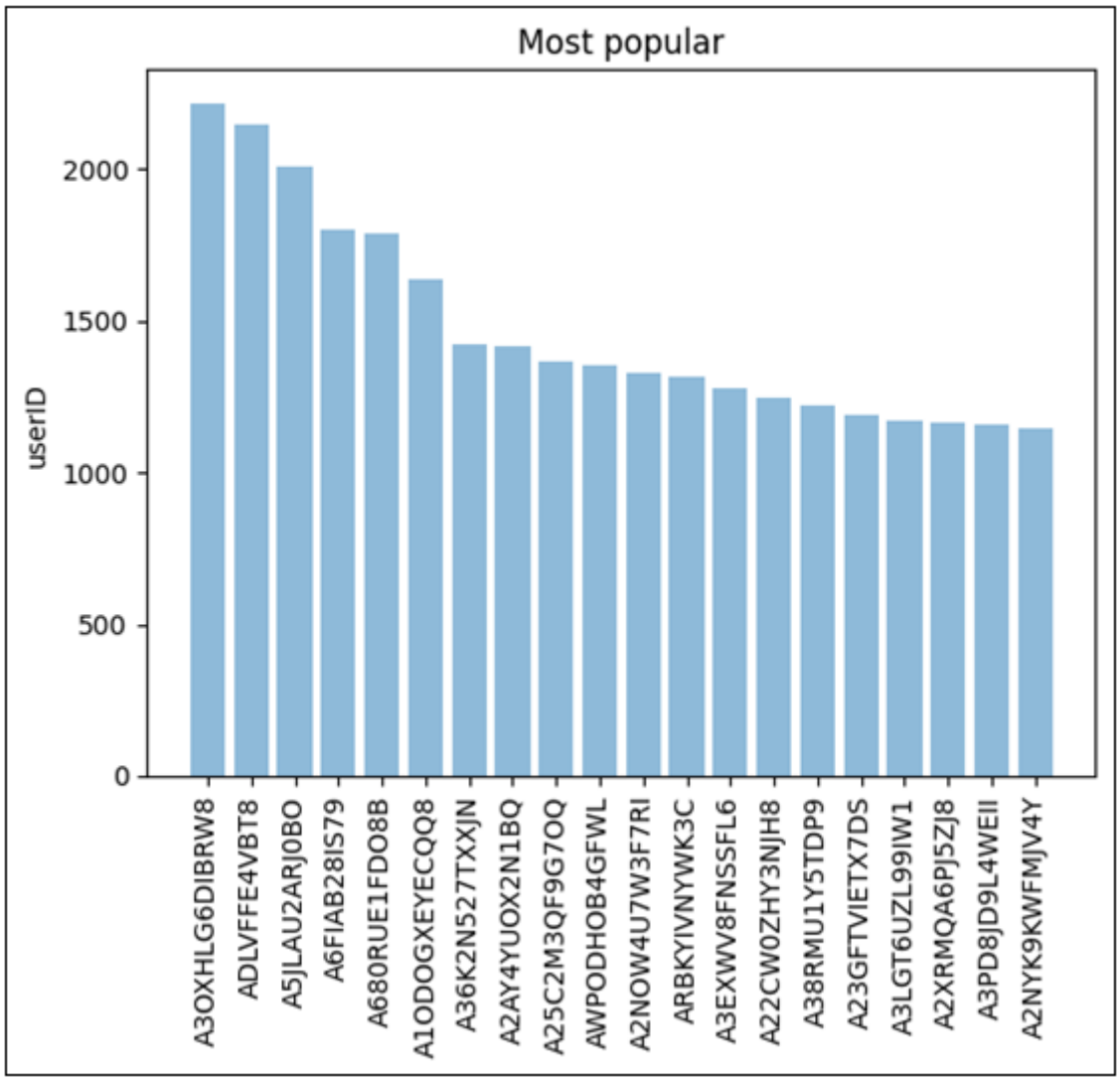

Fig 2: Graph Plotted Between Users and Ratings

IV. SVD

In SVD, rating is predicted as-

$$\hat{r}_{ui} = \mu + b_u + b_i + q_i^T p_u$$

Fig 3: Model used to estimate the score

If user u is known, then the bias b_u and the factors p_u are assumed to be zero. The same applies for item i with b_i and q_i.

To estimate all the unknown, we minimize the following regularized squared error:

$$\sum_{r_{ui} \in R_{\text{train}}} (r_{ui} - \hat{r}_{ui})^2 + \lambda \left(b_i^2 + b_u^2 + \|q_i\|^2 + \|p_u\|^2 \right)$$

Fig 4: Formula used for estimating unknowns

Below we will fix our hyperparameters –

- n_epochs : Number of iterations SGD algorithm
- lr_all : learning rate of all parameters
- reg_all : normalization time of all parameters

➢ *USING SVD:*

```
from surprise import SVD
from surprise.model_selection import train_test_split
trainset, testset = train_test_split(data, test_size=.3,random_state=0)
svd_model = SVD(n_factors=50,reg_all=0.02)
svd_model.fit(trainset)
test_pred = svd_model.test(testset)
from surprise.model_selection import GridSearchCV
param_grid = {'n_factors' : [5,10,15], "reg_all":[0.01,0.02]}
gs = GridSearchCV(SVD, param_grid, measures=['rmse'], cv=3,refit = True)
gs.fit(data)
gs.best_params
gs.test(testset)
```

Fig 5: Training the data using SVD

```
test_pred = svd_model.test(testset)
from surprise import SVD
accuracy.rmse(test_pred)

RMSE: 0.9602
0.9601516004178279
```

Fig 6: Accuracy of the model

➢ *After Correcting the Parameters:*

```
gs.test(testset)
accuracy.rmse(gs.test(testset))

RMSE: 0.8581
0.8581042971516701
```

Fig 7: Accuracy of the parameters improved model

V. CONCLUSION

The data we use in this analysis is provided by Kaggle and is based on the world where Amazon actually sells data. In this analysis, we performed data cleaning, data visualization and data reduction. We conclude that the recommendation of Amazon products can provide 0.858 RMSE with filtering and SVD (machine learning algorithm).

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