An Analytical Recommendation Shopping eHandmart

Hari K.C.[1], Bamdev Bhandari[2]

[1,2] *Department of Electronics and Computer Engineering, IOE, Pashchimanchal Campus, Tribhuvan University, Nepal*

Abstract

eHandmart" is an E-commerce platform recommendation system to eliminate the barriers between the buyers and sellers for buying and selling items. Data analysis of E-commerce is the main aim of this research. Conducting business along with utilizing the analytical data which will lead to growth rate in the near future while providing varieties of products or services people have demanded in the market. It focuses on the local market product, the customers(demands)and products/ services [supply]. It is a platform that allows a user to purchase the items based on the recommendation given by recommendation model. The training dataset are taken from the amazon data set and testing data are taken from the e commerce site locally running. The system performs well on the ecommerce data. Data analysis and recommendation task are carried out using collaborative filtering to give decision and recommendation to the customer. Collaborative filtering is achieved by K-means Clustering algorithm and Cosine similarity algorithm. The stakeholders related to this study are customer, supplier, local shop owner, ecommerce sites. The significance of this study is in local level where there are abundant local products available but not having suitable platform to sell those products to the customer.

Keywords: E-commerce, Data analytics, K-means clustering, Recommendation,

1. Introduction

eHandmart is a distribution channel of anything. It is a platform that allows a business owner to conduct business over the app for any types of businesses. eHandmart is a platform for local business owners, retailers, wholesalers, vendors, stores, shopkeepers and etc. If anyone running a business in a location, anyone can be e-store in our platform, so that many consumers will check the items of your e-store. Customers will purchase the items and give ratings to the items. Based on the ratings, the recommendation model give decision to the next customer to purchase the items. eHandmart will perform the following things:

1. Systematically record all the sales.
2. e-Scan: add to virtual e-store.
3. Shows customer's contacted or interacted.
4. Shows customer's preferences or the popular products
5. With the help of analytical data, business owners can forecast the business and follow up on the guidance to grow their business.
6. Being ''frequent shoppers'' have its own privilege.
7. Being able to join the events of the offering.
8. Product popularity based on the customer purchase.

The recommendation system designed is based on a new customer from the time he/she lands on the business's website for the first time to when he/she makes repeat purchases. A well-developed recommendation system will help businesses improve their shopper's experience on website and result in better customer acquisition and retention. The recommendation model is based on the collaborative filtering. It is based on customer's purchase history and ratings provided by other users who bought items similar items. When a new customer without any previous purchase history visits the e-commerce website for the first time, he/she is recommended the most popular products sold on the company's website. Once, he/she makes a purchase, the recommendation system updates and recommends other products based on the purchase history and ratings provided by other users on the website. The recommendation of other products is done using collaborative filtering techniques.

1.1. Problem statement:

*Corresponding author. Tel.: +977- 9846104162 ,

E-mail address: harikc@wrc.edu.np

There is a situation where ecommerce unable to attract customers and losing the sales is the main problem in recent e-commerce platform. Losing the sales means fall down of business. Current online e-commerce platform lacks varieties of product recommendation. Dozens of local shops products connected to eHand-Mart platform can be easily recommended to customers[2]. On that basis, customers will be able to get quality product in reasonable price.

1.2. Objectives

a) To give the opportunity for local shops to participate in e-commerce.
b) To provide recommendation on choosing the products by the rating of given item.

1.3. Features of eHandmart

a) Local Store owners are eligible to add the product and prices in website.
b) Store owners can go through the analysis and make the right decisions on running the business.
c) Suggestions/ Recommendation regarding the product.

1.4. Implication

This research project is effective in every Local market e-commerce site where local products can be added to the ecommerce and based on the rating given to the products, the recommendation is given to the customers to purchase the quality items.

2. Literature Review

There are many e-commerce systems available in the market being used in the different business sectors, and most commonly we find a software called Daraz, Sasto Deal. Daraz is a Chinese-owned online marketplace and logistics company that operates in South Asian markets. It was founded in 2012 by a German venture capital company, Rocket Internet. Daraz Group operates e-commerce platforms and logistics services in Bangladesh, Myanmar, Nepal, Pakistan, and Sri Lanka[10].

In May 2018, Daraz Group was acquired by the Chinese e-commerce company Alibaba Group. Daraz was founded as a fashion retailer in Pakistan in 2012 but changed to a general marketplace strategy and business model in 2015 when it also launched operations in Bangladesh and Myanmar. In September 2015, Daraz secured EUR50 million in its Series B funding in order to expand operations in Bangladesh, Myanmar, and Pakistan. CDC Group, a state-owned

invested €20 million alongside a €30 million investment from Daraz's existing majority shareholder, Asia Internet Holdings. In July 2016, Daraz Group acquired Kaymu, a consumer-to-consumer online marketplace in South Asia, and with the acquisition, it began operations in Nepal and Sri Lanka. In May 2018, Daraz Group announced that it had been acquired by Alibaba Group for an undisclosed amount. This move comes about two years after Alibaba's acquisition of Lazada Group, which was also a startup by Rocket Internet Group in the South-East Asian market[6]. Alibaba Group also runs Singapore's Redmart and owns stakes in Japan's Rakuten and Indonesia's Tokopedia. Daraz Group's five markets (Bangladesh, Myanmar, Nepal, Pakistan and Sri Lanka) cover more than 460 million people of which 60% are under the age of 35. In order to digitize the logistics ecosystem and to improve the delivery standards, Daraz has built its own logistics company, DEX, in all of its five markets. Sasto Deal is one of Nepal's biggest online shopping websites. With internet users on the high rise, Nepal is moving towards a digital revolution. Shoppers no longer have to wait in traffic, bargain for discounts and spend hours looking for the products and services that they want. All it takes is a few clicks and a few seconds to locate the product and to place an order(s) at Sasto Deal[11]. Home deliveries are mostly free inside Kathmandu valley and a small surcharge is added for orders outside the valley. Returns and exchanges are guaranteed within the specified time period. We find it enthralling to see shoppers from every nook and corner of Nepal placing their orders at Sasto Deal. Meanwhile, savvy business owners have found it exceedingly easy to feature their products on our website. At absolutely zero marketing cost, businesses can reach millions of customers. That's the power of e commerce. Recommendation system are of various types such as collaborative, content based and hybrid models. This research project is based on the collaborative filtering recommendation. There are number of research carried in this field. The authors of the research paper [1] provide the quality recommendation products matching the users and product. Similarly, the researcher [8] provides the understanding of the correlation between the different links in the network which will further used for the formation of clusters.

3. Methodology

3.1. System Architecture

The eHandmart recommendation system should be written in an object-oriented language with strong GUI links and a simple, accessible network API. The system flow looks like this:

Figure 1: System Architecture

In the system, new customers, local shops and products are added. The system admin performs these tasks in the ecommerce website. If the local shops are note registered, they will not be able to participate in the eHandmart website. The data are collected from the customer about the product every time the customer purchase the product. The similarity of the various products is calculated. The ratings of product are predicted. The rating of items in website can be viewed by new customer. Based on the ratings, the recommendation of the products is provided which includes low-cost products and reasonable products.

3.2. Tools and Techniques

Python is a widely-used general-purpose, high-level programming language. It was created by Guido van Rossum in 1991 and further developed by the Python Software Foundation. It was designed with an emphasis on code readability, and its syntax allows programmers to express their concepts in fewer lines of code. Python is for recommendation model coding. Vue is a JavaScript framework for building user interfaces. Its core part is focused mainly on the view layer and it is very easy to understand. As Vue is basically built for frontend development, we are going to deal with a lot of HTML, JavaScript and CSS files. Training dataset are collected from Amazon dataset and testing dataset are collected from local shop registered in website.

3.3. Flowcharts

System admin has the responsibility to add the local shop, consumer and manage them. These data are added to the system database.
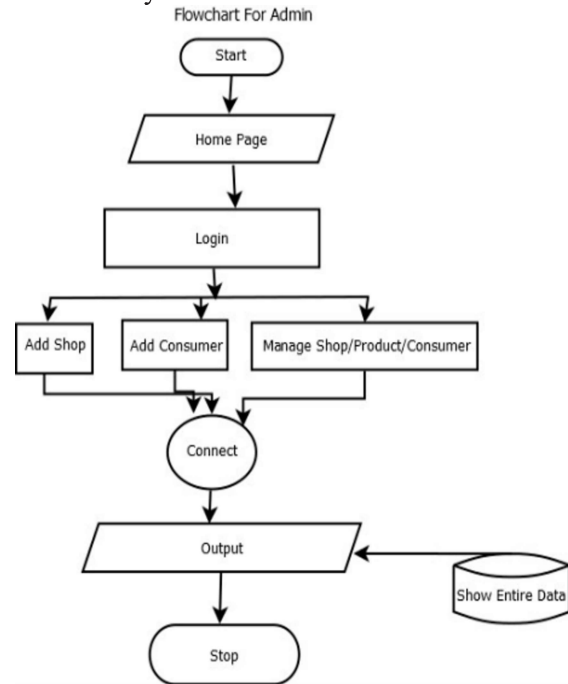

Figure 2: System admin flowchart

The shop needs to be registered first in the system. Then, the shop can add the items in the website.
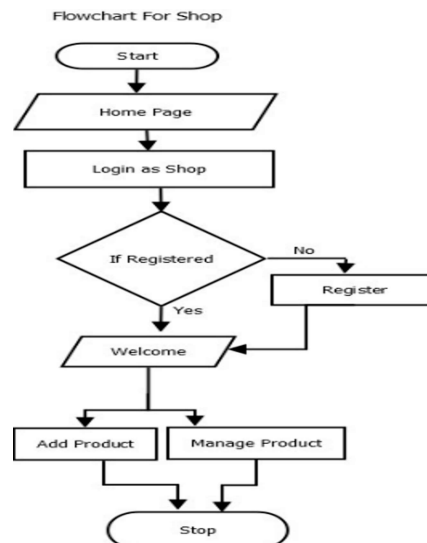

Figure 3: Local Shop flowchart

If the customer is already registered then the customer can buy the items from the website. If not registered then need to registered. The system admin performs the verification of registration of the customer. After purchasing the items, the customer makes the payment. He can give the rating of the items as well and also take different rewards.
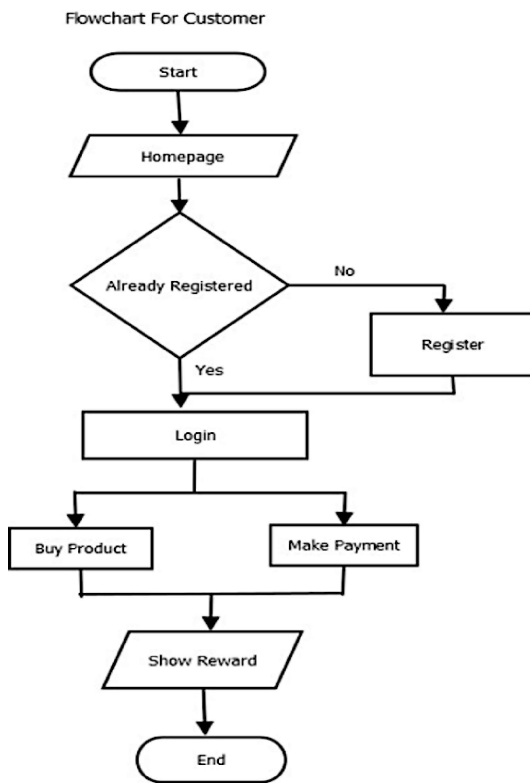
Flowchart For Customer

Figure 4: Customer flowchart

The similarity of the products are measured and the neighborhood products are evaluated and selected. Then ratings of the products are predicted. Based on the ratings, the products are recommended to the customer [9]. The similarity is measured by using Cosine similarity.

$$Cosine\left(u, v\right) = \frac{\sum_{i \in I_{uv}} r_{ui} r_{vi}}{\sqrt{\sum_{u \in I_u} r_{ui}^2} \sqrt{\sum_{u \in I_v} r_{vi}^2}} \quad (1)$$

where I_u and I_v denote the sets of items rated by users u and v, respectively, and I_{uv} denotes the set of items commonly rated by both u and v. and r_{vi} are the ratings values on item i given by users u and v, respectively. The similarity algorithm is as follows:

> For each item in product catalog
>> For each customer C Who purchased I1
>> For each item I2 purchased by
>>> Customer C
> Record that a customer purchased I1 and I2
> For each item I2,

Compute the similarity between I1 and I2. Neighborhood selection is performed by top k technique which select the k nearest items where k denotes the number of items. Rating prediction is done by using weighted sum formula. The equation of the weighted sum formula is

$$\widetilde{r_{ui}} = \frac{\sum_{j \in N_i^u} Sim_{ij} * r_{uj}}{\sum_{j \in N_i^u} |Sim_{ij}|} \quad (2)$$

where N_i^U is the set of neighbor (top k- items) that are most similar to item i and have been rated by the user (u , j) is an item that belongs to $N_i U$ and Sim_{ij} is the similarity value between items i and j.
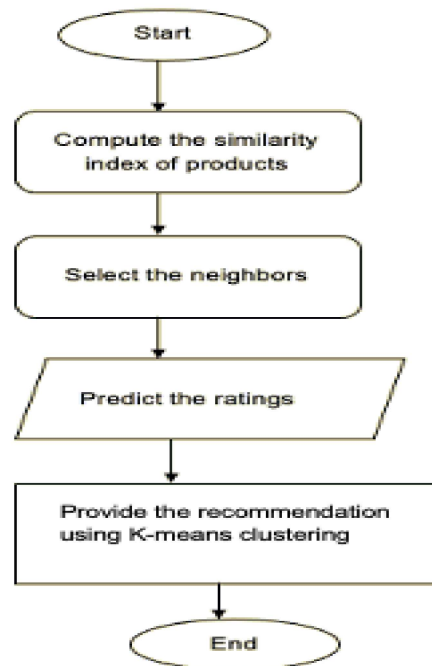
Figure 5: Recommendation Flowchart

The recommendations can be generated on the basis of item-item similarity[1]. The similarity of products is computed with cosine similarity. Then, On the basis of ratings, clusters are then identified. K-means clustering is an iterative algorithm that divides the unlabeled dataset into k different clusters in such a way that each dataset belongs only one group that has similar properties. The optimum value of K is chosen. It aims to partition a set of observations into a number of clusters (K).

4. Result and Analysis

The development of eHandMart ecommerce website is developed. Some products and seller information have been updated. The task done are:

a) The design of ecommerce website eHandMart

b) The development of ecommerce website eHand-Mart.

c)   Register products in the eHandMart.

d) Data of product and local shops are collected.

4.1. Website design and development
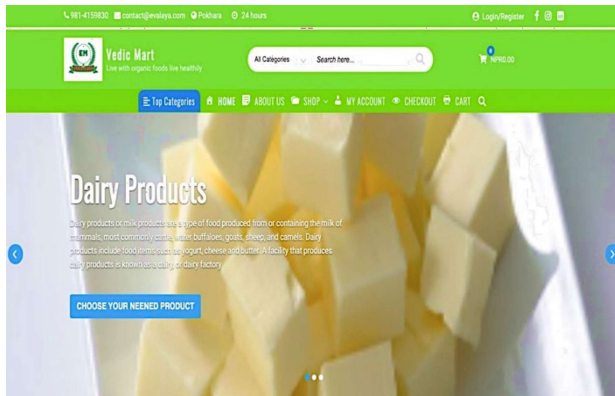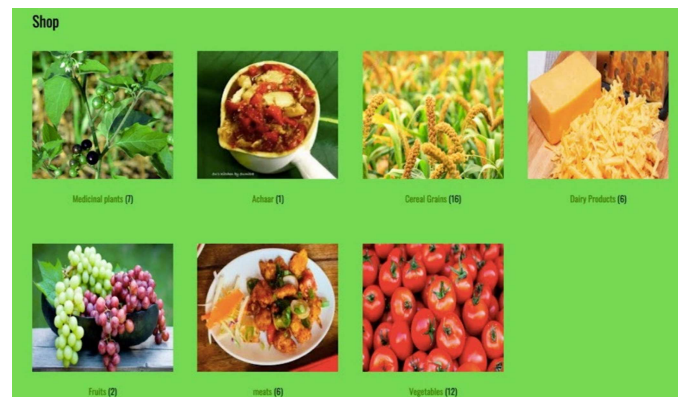
Figure 6: Website Pages

4.2. Analysis and Recommendation
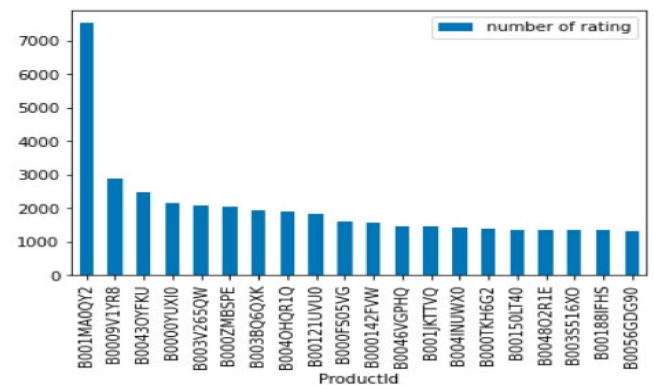
Figure 7: Training dataset rating frequencies

Figure 8: Product Descriptions

Figure 9: Top 24 predicted clusters

The system predicts the 24 clusters from the given dataset. The products similarity is identified using cosine similarity. There are some outliers present in the dataset. For example: there is a word "ft" which is not any item.
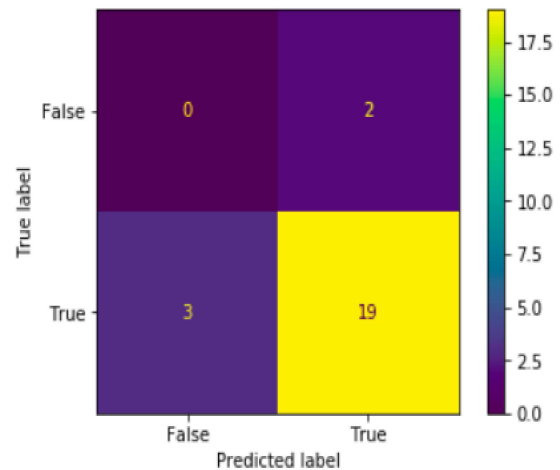
4.3. Confusion Matrix of top 24 clusters

Figure 10: Confusion Matrix

For the evaluation of the system, the confusion matrix is used. From above confusion matrix, the precision, recall, f-measure and accuracy are obtained.

```
The precison is 0.9047619047619048
The recall is 0.8636363636363636

The f1 score is  0.8837209302325582
The accuracy is  0.7916666666666666
```

4.4. Top 3 output clusters

4.5. Recommendation Result

```
show_recommendations("Meat") # recommendation for meat
```

```
Cluster1: Meat, Chicken, Goat
```

```
show_recommendations("cutting tool")  # recommendation for cutting tool
```

```
Cluster 3:cutting, saw,tool, blade,pliers,metal
```

Based on the given recommendation , the products in that cluster are identified and user select the product with reseonable price.

5. Conclusion

After the Cluster is identified based on user search, the recommendation system displays the items from the corresponding product clusters based on product descriptions. Likewise, the recommendation system will help the users to get a good recommendation to start with and after the buyers have a purchased history, the recommendation system can use the model based collaborative filtering technique.

In the future, the payment model can be incorporated for pre-payment in the system. Similarly, the mobile application can also be developed based on this recommendation model.

References

[1] Li and Lin, Chung-Yi Li and Shou-De Lin. Matching users and items across domains to improve the recommendation quality, *SIGKDD,* (2014) 801-810.

[2] Internet.com, Ecommerce Webopedia, http://ecommerce.internet.com/resources/lbrary/pay solutions.

[3] The university of Texas at Arlington, eBusiness Alliance,http://www2.uta.edu/ecomm/resources/glossaryComplete.asp.

[4] William W. Fisher. III, Intellectual Property in Cyberspace, Linking, Framing, Meta Tags and Caching Intelligent Property in Cyberspace, http://cyber.law.harvard.edu/property00/metatags/main.html

[5] Software & Information Industry Association, Summary of Benefits - Uniform Computer Information Transactions Act, (2000) http://www.siia.net/sharedcontent/govt/issues/ucita/summary.html.

[6] http://ecommerce.internet.com/resources/library/paysolutions.

[7] Zhang and Yu, Jiawei Zhang and Philip S Yu. Community detection for emerging networks, *SDM. SIAM* (2015).

[8] Cao et al., Bokai C., Xiangnan K., and Philip S.Y. Collective prediction of multiple types of links in heerogeneous information networks, ICDM, (2014) 50–59.

[9] Fethi F. Similarity measures for Collaborative Filtering-based Recommender Systems: Review and experimental comparison, *Journal of King Saud University - Computer and Information Sciences*, (2021).

[10] http://zims-en.kiwix.campusafrica.gos.orange.com

[11] http://www.sastodeal.com

*****