INDIANA UNIVERSITY BLOOMINGTON

CSCI B 565

DATA MINING

MARKET BASKET ANALYSIS, CUSTOMER SEGMENTATION AND LIFETIME VALUE PREDICTION

*Authors: Professor:*

Akshat Arvind Yuzhen Ye

Aniket Kale

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Abstract

Dataset Information

Tables present in the dataset -

* **Products** –

**Columns -** [product\_id, product name, aisle\_id, department\_id]

**Size –** 813.67 KB

* **Orders** –

**Columns -**[order\_id,user\_id,eval\_set,order\_number,order\_dow,order\_hour\_of\_day days\_since\_prior\_order]

**Size –** 32.81 MB

* **Order\_products\_\_prior** –

**Columns** - [order\_id, product\_id, add\_to\_cart\_order, reordered]

**Size** – 164.69 MB

* **aisles** –

**Columns** - [aisle\_id, aisle\_name]

**Size** – 1.91 KB

* **Department** –

**Columns -** [department\_id, department\_name]

**Size –** 804B

Introduction

Using the market basket data from Kaggle Instacart Market Basket Analysis competition, we have targeted 4 major objectives in our project –

* Exploratory Data Analysis on data to extract actionable insights.
* To come up with a model to predict customer segmentation and the customer lifetime value using RFM Analysis.
* Use Association Rule Mining to give suggestions of possible products which could be added in a customer’s order basket.
* Also, we have tried to complement the prediction results by adding rewards, promos or clubbed offers to specific customer segments using Association Rule Mining to convert this model into a possible profitable business model.

**Methods**

**Objective -1 EDA**

Exploratory Data Analysis has been performed on the dataset to extract insights and trends from the data.

Tools Used: -

* Matplotlib
* Seaborn
* Pandas
* Plotly

**Objective -2 Association Rule Mining**

Association Rule Mining has been done to suggest additional products based on the products present in the customer’s order basket.

Tools Used: -

* mlxtend
* fpgrowth
* association rules

**Objective -3 Customer Segmentation**

**Objective -4 Customer Lifetime Value**

**Results**

**Objective – 1 EDA**

These are some of the interesting insights extracted from the data –

Chart, histogram

Description automatically generated

The plot shows the count of orders vs days since prior order for customers. We can observe the spikes on 7th, 14th, 21st and 30th day confirming the weekly and monthly trend of reordering supplies.

Chart, histogram

Description automatically generated

The plot shows the count of orders vs order hour of the day. The maximum orders are placed during the day hours from 9 AM – 5PM.

Chart, line chart

Description automatically generated

The plot shows the reorder ratio of items from different departments. We can see that item from bakery, supplies and produce have high reorder ratio compared to items like personal care and household which are products that are frequently ordered.

Graphical user interface, application

Description automatically generated with medium confidence

The plot shows the number of items that customers usually keep in their order basket. According to the data, we can see that an average of 5-10 items are added in the basket by customers before placing their orders.

Chart, histogram

Description automatically generated

The plot shows the number of occurrences of a product type across all the orders in the dataset. We can see that fresh fruits and vegetables are highest ordered products and baby food and herbs are least ordered.

A picture containing graphical user interface

Description automatically generated

The plot shows the first and second product that the customers add in their order basket while placing an order. Produce and dairy eggs are added first by majority of the customers.

**Objective – 2 Association Rule Mining**

Association rule mining technique when used in Market Basket Analysis enables one to find sets of items that are often found together in a customer’s basket. This can be used to improve or create bundles of products to improve sales. Also, the created bundles can be used to provide special offers for customers with discounted pricing on bundled products. We have used fpgrowth algorithm from mlxtend module to extract frequent itemsets and association rules module to generate the rules.

Using the data from the Order\_products\_\_prior table, we create a truth table of order\_id and products.

Graphical user interface, text, application

Description automatically generated

After the truth table is generated, it is used to generate frequent itemsets, that are used to generate association rules.

Table

Description automatically generated

Antecedents – The original order basket for a customer.

Consequents – The suggestions added by the association rules.

Some of the suggestions generated from association rule mining –

Example -1

Shape

Description automatically generated with medium confidence

Example -2

Graphical user interface

Description automatically generated with medium confidence

**Objective – 3**

**Discussion**

**References**

* <http://rasbt.github.io/mlxtend/user_guide/frequent_patterns/fpgrowth/>
* <https://www.qualtrics.com/experience-management/customer/customer-lifetime-value/>
* <https://knowledge.dataiku.com/latest/kb/industry-solutions/rfm-customer-lifetime-value/rfm-customer-lifetime-value.html>
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