

Project Report

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How to use the Web App?

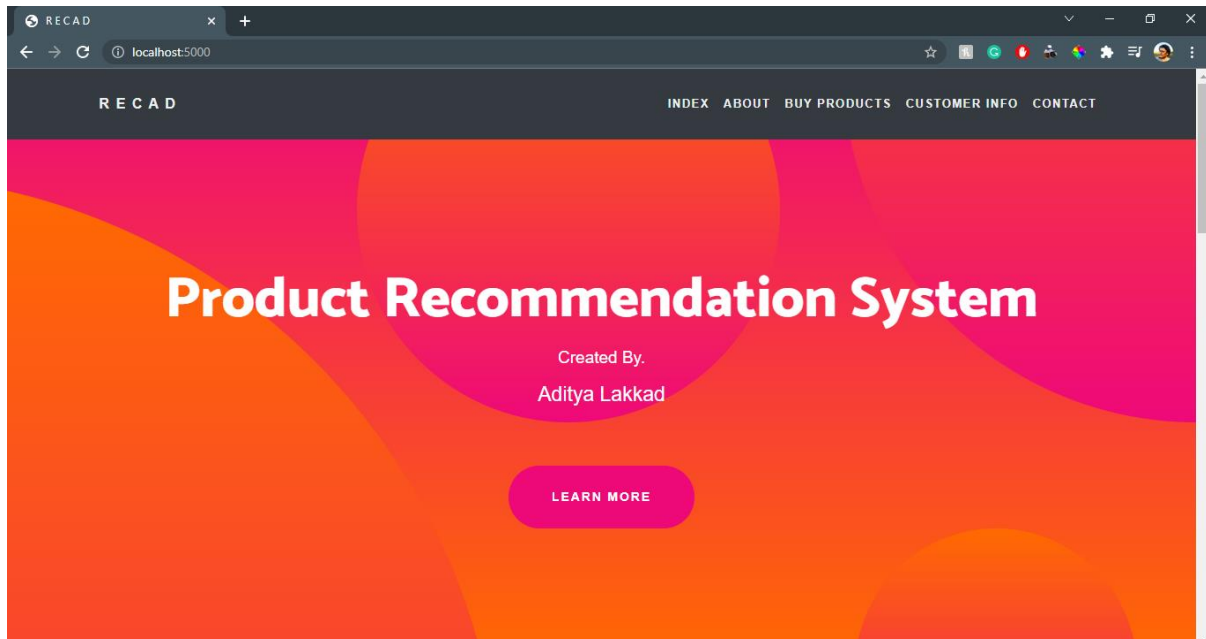
Step 1: First of all we have to run the project so run the command “python app.py” and wait for the response of the localhost URL.

```
PS E:\SEM-7\CGC\Project\Flask App> python app.py
Checking whether there is an H2O instance running at http://localhost:54321 ..
```

Step 2: Here we can see now our web app is up and running and here is a localhost URL that we can use to see our web app.

```
Python_version:      3.9.1 final
-----
* Debugger is active!
* Debugger PIN: 228-784-400
* Running on http://127.0.0.1:5000/ (Press CTRL+C to quit)
127.0.0.1 - - [22/Oct/2021 18:32:20] "GET / HTTP/1.1" 200 -
127.0.0.1 - - [22/Oct/2021 18:32:22] "GET /favicon.ico HTTP/1.1" 404 -
```

Step 3: Let's open this URL. And here we have our webapp's home page.



Step 4: You can see the time-based recommendation of the product and contact me form.

The screenshot displays a web application interface. At the top, a dark navigation bar contains the text "RECAD" on the left and a series of links: "INDEX", "ABOUT", "BUY PRODUCTS", "CUSTOMER INFO", and "CONTACT" on the right. Below the navigation bar, the main heading "Recommendations" is centered in a large, bold, black font. Underneath this heading, a subtext states: "The recommendation given here is generated based on current time." Below the subtext, there are four product categories, each represented by a square image with a red border and a red label underneath: "CHEESE" (a wedge of Swiss cheese), "CANNED FOOD" (various cans of food), "SPICES" (a bowl of mixed spices), and "FROZEN FOOD" (a box of frozen food). Below these categories, a large section with a vibrant orange and pink background features the heading "About" in a large, white, bold font. Underneath "About", there is a paragraph of text: "This web application is a simulation of Product Recommendation System. The above recommendation is being shown as the part of a Product Recommendation using Customer Segmentation Method. Click on 'Buy Product' which will leads you towards the simulation of Product recommendation using Market Basket Analysis method." Below this text, a pink button labeled "BUY PRODUCTS" is centered. At the bottom of the page, a white contact form is centered, titled "Contact us" in a bold, dark font. The form includes three input fields: "Name", "Email", and "Message", followed by a blue button labeled "SEND".

Step 5: Now click on “BUY PRODUCTS” to see the product purchase form.

Buy Product

Click on checkbox of the products that you want to buy.

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Baby Food	Diapers	Formula	Lotion	Baby wash	Wipes
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Fresh Fruits	Fresh Vegetables	Beer	Wine	Club Soda	Sports Drink
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Chips	Popcorn	Oatmeal	Medicines	Canned Foods	Cigarettes
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Cheese	CleaningProducts	Condiments	Frozen Foods	Kitchen Items	Meat
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Office Supplies	Personal Care	Pet Supplies	Sea Food	Spices	

Predict

Step 6: Here I will select some of the product and click on the button “predict” given at last. This product will be sent to fetch results of association rule responses.

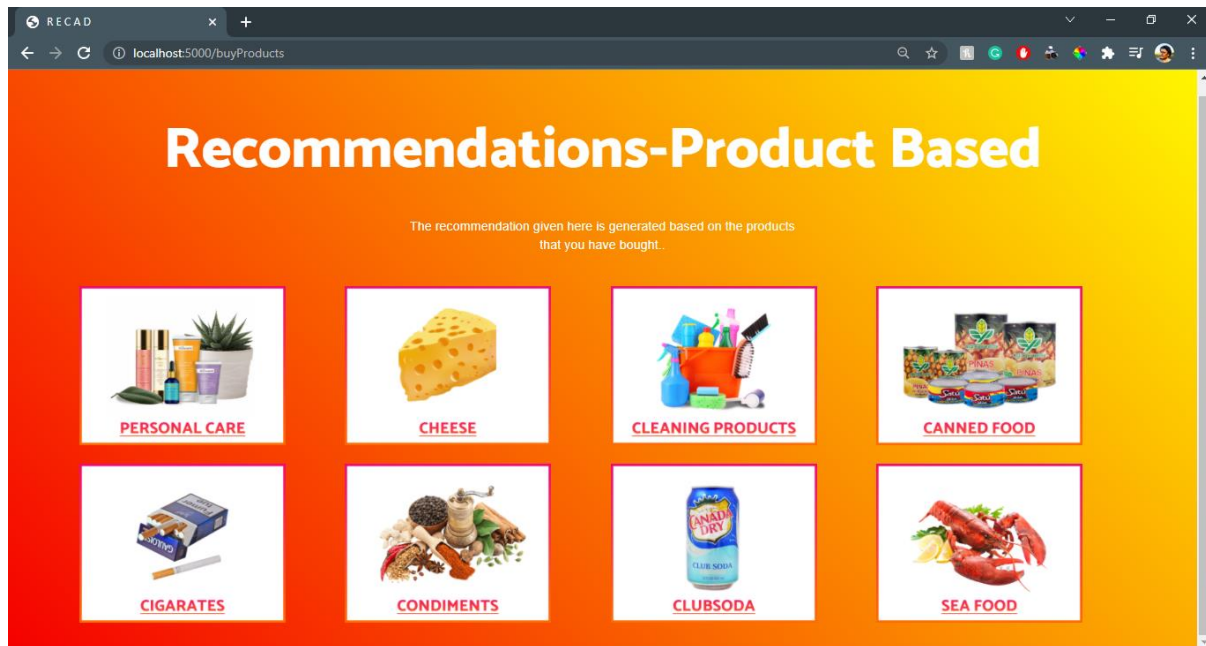
Buy Product

Click on checkbox of the products that you want to buy.

<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Baby Food	Diapers	Formula	Lotion	Baby wash	Wipes
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Fresh Fruits	Fresh Vegetables	Beer	Wine	Club Soda	Sports Drink
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Chips	Popcorn	Oatmeal	Medicines	Canned Foods	Cigarettes
<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Cheese	CleaningProducts	Condiments	Frozen Foods	Kitchen Items	Meat
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Office Supplies	Personal Care	Pet Supplies	Sea Food	Spices	

Predict

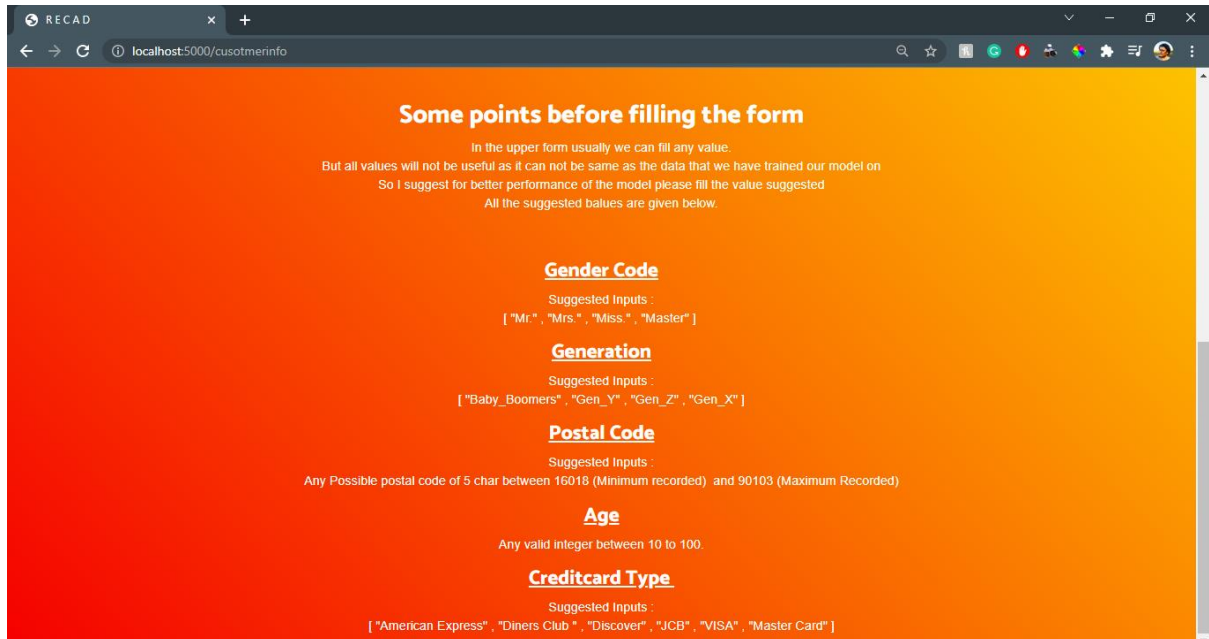
Step 7: Here we can see our recommended products from the associative rules.



Step 8: Navigate towards to the home page and from there let's click on "CUSTOMER INFO". It's based on customer-based prediction. On this page here you can see a form.

The screenshot shows a web browser window with the URL `localhost:5000/cusotmerinfo`. The page has the same orange-to-yellow gradient background. In the center, there is a white box titled "Customer Information". Inside this box, a subtitle reads: "Before filling out the form take a look at the suggested output given below.". Below the subtitle are five input fields: "Age" (a dropdown menu), "Gender Code", "Generation", "Postal Code", and "Creditcard Type". A green "Submit" button is located at the bottom of the form. A small tooltip with the text "Please fill in this field." is visible next to the "Age" dropdown.

Step 9: Down below you can see the suggested input, giving suggested input will get you the best output.



A screenshot of a web browser window with the address bar showing 'localhost:5000/cusotmerinfo'. The page has an orange background and contains the following text:

Some points before filling the form

In the upper form usually we can fill any value.
But all values will not be useful as it can not be same as the data that we have trained our model on
So I suggest for better performance of the model please fill the value suggested
All the suggested values are given below.

Gender Code
Suggested Inputs :
["Mr ", "Mrs ", "Miss ", "Master"]

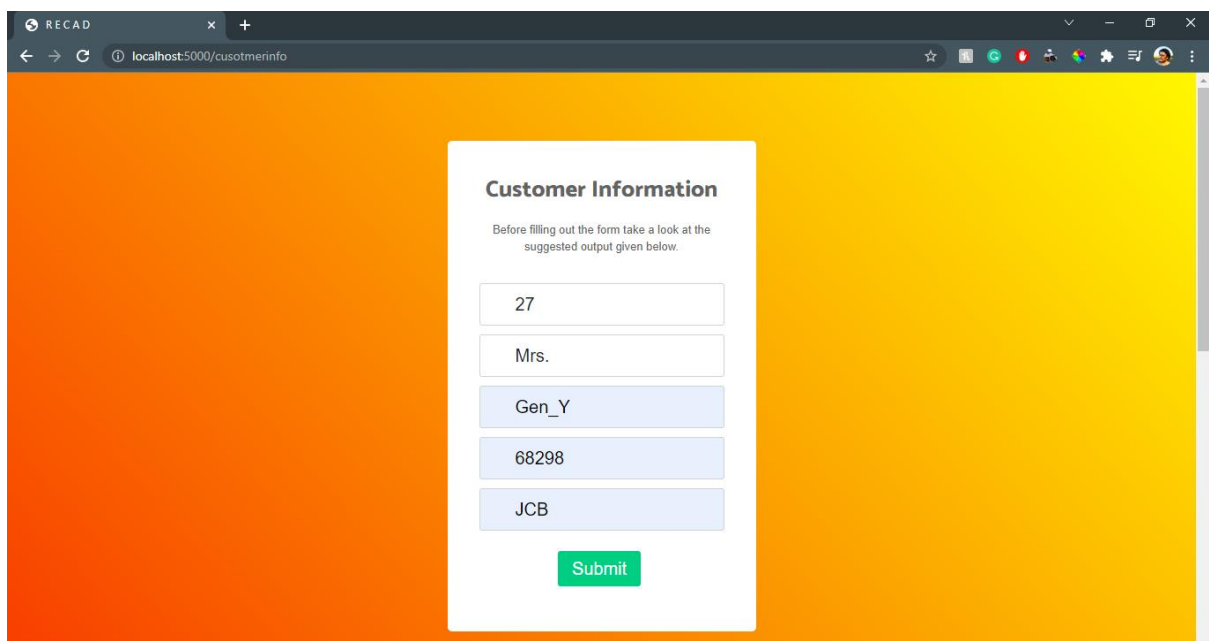
Generation
Suggested Inputs :
["Baby_Boomers", "Gen_Y", "Gen_Z", "Gen_X"]

Postal Code
Suggested Inputs :
Any Possible postal code of 5 char between 16018 (Minimum recorded) and 90103 (Maximum Recorded)

Age
Any valid integer between 10 to 100.

Creditcard Type
Suggested Inputs :
["American Express", "Diners Club ", "Discover", "JCB", "VISA", "Master Card"]

Step 10: Please fill those inputs in customer info form.



A screenshot of a web browser window with the address bar showing 'localhost:5000/cusotmerinfo'. The page has a yellow background and contains a white form titled 'Customer Information'. The form includes the following text and input fields:

Customer Information

Before filling out the form take a look at the suggested output given below.

Age: 27

Gender: Mrs.

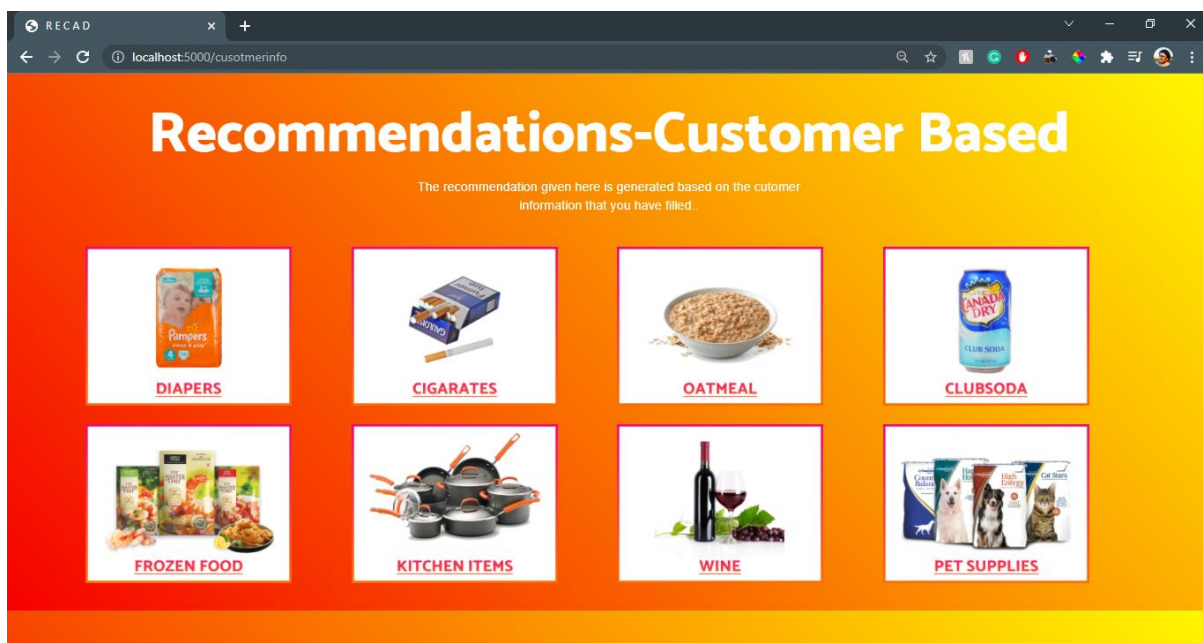
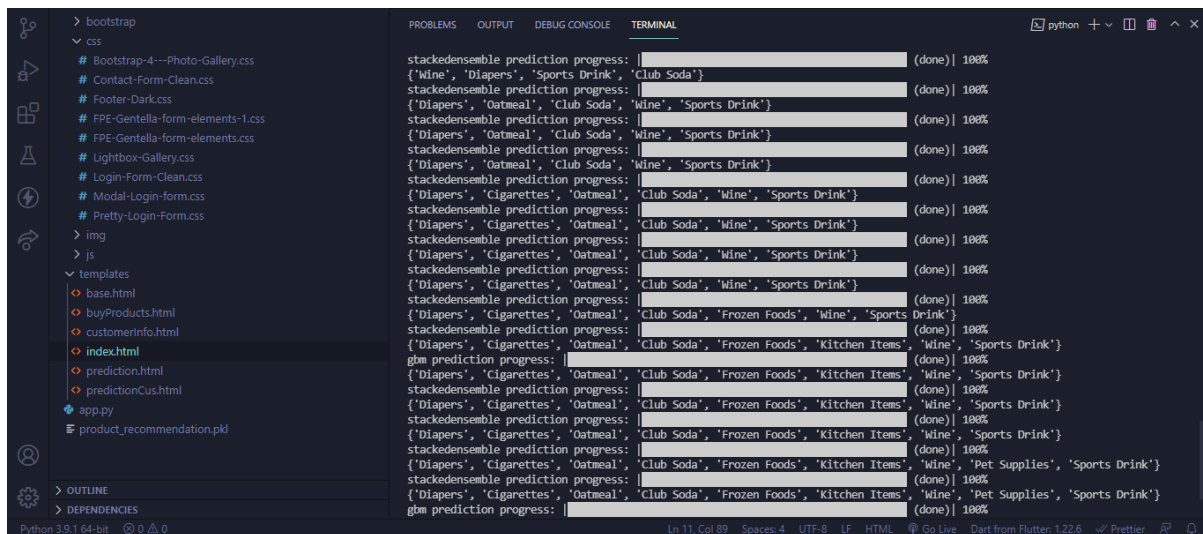
Generation: Gen_Y

Postal Code: 68298

Creditcard Type: JCB

Submit

Step 11: Please wait for some time as there are models running in the backend for our customer info input. Based on that it will predict some items that we can see in the terminal. And it will be shown on the web page.



Explanation of Product Based Recommendation Notebook

Step 1: Loading the data.

```
In [1]: import pandas as pd

In [2]: data = pd.read_csv("order_transactions.csv")

In [3]: data.head()
```

Out[3]:

	CUSTNAME	GenderCode	ADDRESS1	CITY	STATE	COUNTRY_CODE	POSTAL_CODE	POSTAL_CODE_PLUS4	ADDRESS2	EMAIL_ADDRESS	...	C
0	Allen Perl	Mr.	4707 Hillcrest Lane	Abeto	PG	IT	6040	0	NaN	Allen.M.Perl@spambob.com	...	P
1	Allen Perl	Mr.	4707 Hillcrest Lane	Abeto	PG	IT	6040	0	NaN	Allen.M.Perl@spambob.com	...	
2	Allen Perl	Mr.	4707 Hillcrest Lane	Abeto	PG	IT	6040	0	NaN	Allen.M.Perl@spambob.com	...	
3	Allen Perl	Mr.	4707 Hillcrest Lane	Abeto	PG	IT	6040	0	NaN	Allen.M.Perl@spambob.com	...	
4	Allen Perl	Mr.	4707 Hillcrest Lane	Abeto	PG	IT	6040	0	NaN	Allen.M.Perl@spambob.com	...	

5 rows x 62 columns

Step 2: Now get all product column and store it in a dataframe.

```
In [4]: df_filtered = data[['CUST_ID', 'Baby Food', 'Diapers', 'Formula', 'Lotion', 'Baby wash', 'Wipes', 'Fresh Fruits', 'Fresh Vegetables', 'Beer', 'Wine', 'Cleaning Products', 'Condiments', 'Frozen Foods', 'Kitchen Items', 'Meat', 'Office Supplies', 'Personal Care']]

In [5]: df_customer_products = df_filtered.groupby('CUST_ID').sum()

In [6]: df_customer_products.head()
```

Out[6]:

	Baby Food	Diapers	Formula	Lotion	Baby wash	Wipes	Fresh Fruits	Fresh Vegetables	Beer	Wine	...	Cleaning Products	Condiments	Frozen Foods	Kitchen Items	Meat	Office Supplies	Personal Care
CUST_ID																		
10001	0	0	1	0	0	1	0	1	0	1	...	1	0	0	0	0	0	0
10002	0	0	0	0	0	0	0	0	0	2	...	0	0	2	0	0	0	3
10003	0	1	2	2	1	0	0	1	1	0	...	2	1	0	0	0	0	0
10004	0	1	0	0	0	0	2	0	1	3	...	1	0	2	0	2	0	2
10005	1	0	0	0	0	0	0	0	0	0	...	0	1	0	0	0	0	0

5 rows x 29 columns

Step 3: Encode the values as 0 for 0 and 1 for value greater than 1 or equals to 1. And also import libraries for apriori algo and association_rules.

```
In [7]: def encode_units(x):
        if x <= 0:
            return 0
        if x >= 1:
            return 1

        df_customer_products.applymap(encode_units)

In [9]: from mlxtend.frequent_patterns import apriori
        from mlxtend.frequent_patterns import association_rules
```


Step 4: Get the frequent item sets from apriori algorithm with the support value. And using association rule get the confidence and lift.

```
In [10]: my_frequent_itemsets = apriori(df_basket, min_support=0.07, use_colnames=True)
my_frequent_itemsets.head()

Out[10]:
```

	support	itemsets
0	0.140463	(Baby Food)
1	0.247613	(Diapers)
2	0.147889	(Formula)
3	0.133885	(Lotion)
4	0.141736	(Baby wash)

```
In [11]: my_rules = association_rules(my_frequent_itemsets, metric="lift", min_threshold=1)
my_rules.head()

Out[11]:
```

	antecedents	consequents	antecedent support	consequent support	support	confidence	lift	leverage	conviction
0	(Wine)	(Baby Food)	0.361341	0.140463	0.083174	0.230182	1.638743	0.032419	1.116546
1	(Baby Food)	(Wine)	0.140463	0.361341	0.083174	0.592145	1.638743	0.032419	1.565897
2	(Baby Food)	(Cigarettes)	0.140463	0.364099	0.084023	0.598187	1.642924	0.032881	1.582580
3	(Cigarettes)	(Baby Food)	0.364099	0.140463	0.084023	0.230769	1.642924	0.032881	1.117399
4	(Condiments)	(Baby Food)	0.543603	0.140463	0.077658	0.142857	1.017048	0.001302	1.002794

Step 5: Get the proper data frame value and store it using pickle.

```
my_rules[(my_rules['lift'] >= 3) & (my_rules['confidence'] >= 0.5)].sort_values(by='confidence', ascending=False)
```

	antecedents	consequents	antecedent support	consequent support	support	confidence	lift	leverage	conviction
8	(Beer)	(Diapers)	0.146404	0.247613	0.146404	1.000000	4.038560	0.110152	inf
246	(Beer, Cigarettes)	(Diapers)	0.088479	0.247613	0.088479	1.000000	4.038560	0.066570	inf
4278	(Condiments, Meat)	(Spices, Cigarettes)	0.081052	0.298748	0.081052	1.000000	3.347301	0.056838	inf
258	(Spices, Beer)	(Diapers)	0.086145	0.247613	0.086145	1.000000	4.038560	0.064814	inf
1210	(Canned Foods, Pet Supplies)	(Cleaning Products)	0.074687	0.245703	0.074687	1.000000	4.069948	0.056336	inf
...
8122	(Sea Food, Personal Care)	(Spices, Wine, Cigarettes, Frozen Foods)	0.197751	0.154679	0.099512	0.503219	3.253320	0.068924	1.701597
7602	(Cheese, Wine, Frozen Foods)	(Spices, Medicines, Personal Care)	0.173138	0.154042	0.086993	0.502451	3.261779	0.060323	1.700251
9195	(Spices, Wine, Cigarettes, Medicines)	(Sea Food, Personal Care, Frozen Foods)	0.156588	0.144918	0.078294	0.500000	3.450220	0.055602	1.710163
9080	(Spices, Cheese, Personal Care)	(Wine, Sea Food, Cigarettes, Medicines)	0.155739	0.152132	0.077870	0.500000	3.286611	0.054177	1.695735
8411	(Spices, Cheese, Personal Care)	(Sea Food, Cigarettes, Medicines)	0.155739	0.152132	0.077870	0.500000	3.286611	0.054177	1.695735

Explanation of Customer Based Recommendation Notebook.

Step 1: Import all necessary libraries and initialize h2o.

```
In [1]: import pandas as pd
import h2o
from h2o.automl import H2OAutoML
h2o.init()
```

Checking whether there is an H2O instance running at <http://localhost:54321> not found.
 Attempting to start a local H2O server...
 ; Java HotSpot(TM) 64-Bit Server VM (build 25.311-b11, mixed mode)
 Starting server from C:\Users\Aditya\AppData\Local\Programs\Python\Python39\Lib\site-packages\h2o\backend\bin\h2o.jar
 Ice root: C:\Users\Aditya\AppData\Local\Temp\tmpqngfi9ng
 JVM stdout: C:\Users\Aditya\AppData\Local\Temp\tmpqngfi9ng\h2o_Aditya_started_from_python.out
 JVM stderr: C:\Users\Aditya\AppData\Local\Temp\tmpqngfi9ng\h2o_Aditya_started_from_python.err
 Server is running at <http://127.0.0.1:54321>
 Connecting to H2O server at <http://127.0.0.1:54321> ... successful.

H2O_cluster_uptime:	07 secs
H2O_cluster_timezone:	Asia/Kolkata
H2O_data_parsing_timezone:	UTC
H2O_cluster_version:	3.34.0.3
H2O_cluster_version_age:	14 days, 23 hours and 58 minutes
H2O_cluster_name:	H2O_from_python-Aditya_jmh0jm
H2O_cluster_total_nodes:	1
H2O_cluster_free_memory:	1.746 Gb
H2O_cluster_total_cores:	4

Step 2: Get the products and create models for each product as well as train it on the customer data columns. And save the data files.

```
In [4]: x = ['GenderCode','POSTAL_CODE','AGE','CREDITCARD_TYPE','GENERATION']  
        l = []  
        model_path_dict = {}  
        for y in product_list:  
            df[y] = df[y].asfactor()  
            aml = H2OAutoML(max_models = 10, seed = 1)  
            aml.train(x = x, y = y, training_frame = df)  
            l.append(aml.leaderboard.head(3))  
            model = aml.leader  
            model_path = h2o.save_model(model=model, path="/tmp/mymodel", force=True)  
            model_path_dict[y] = model_path
```

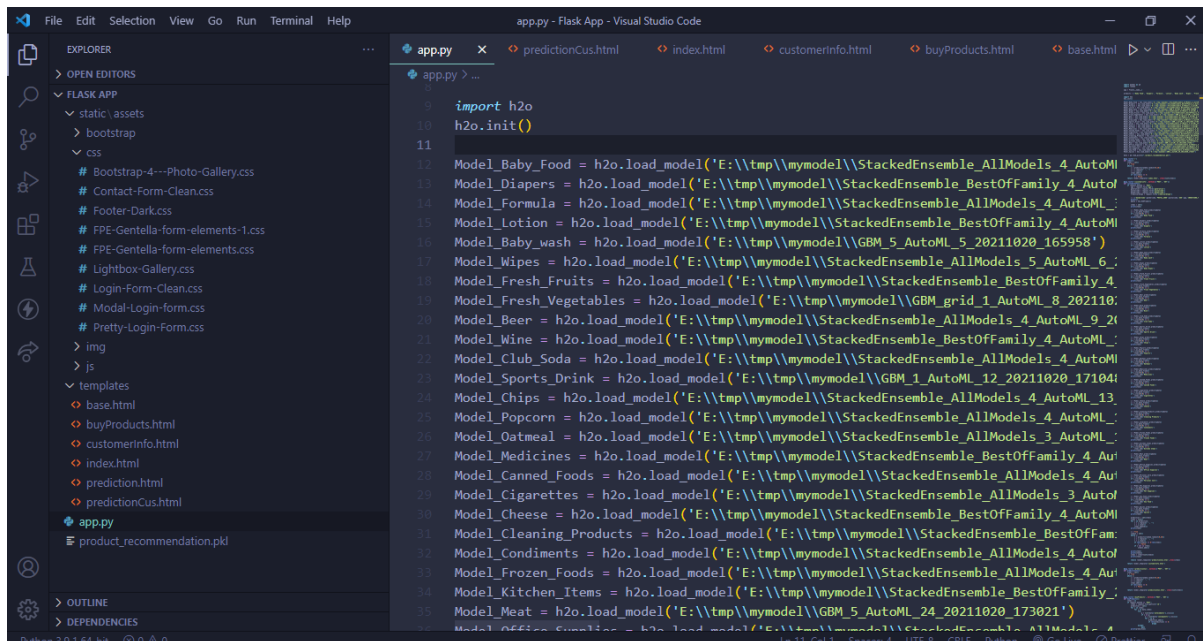
AutoML progress: |
16:53:37.527: AutoML: XGBoost is not available; skipping it.
16:53:37.559: Step 'best_of_family_xgboost' not defined in provider 'StackedEnsemble': skipping it.
16:53:37.559: Step 'all_xgboost' not defined in provider 'StackedEnsemble': skipping it.

|██████████████████████████| (done) 100%
AutoML progress: |
16:55:31.612: AutoML: XGBoost is not available; skipping it.
16:55:31.612: Step 'best_of_family_xgboost' not defined in provider 'StackedEnsemble': skipping it.
16:55:31.612: Step 'all_xgboost' not defined in provider 'StackedEnsemble': skipping it.

|██████████████████████████| (done) 100%
AutoML progress: |
16:57:03.352: AutoML: XGBoost is not available; skipping it.
16:57:03.352: Step 'best_of_family_xgboost' not defined in provider 'StackedEnsemble': skipping it.
16:57:03.352: Step 'all_xgboost' not defined in provider 'StackedEnsemble': skipping it.

|██████████████████████████| (done) 100%

Step 3: In the backend of the web app import all the files from the models that we have stored.

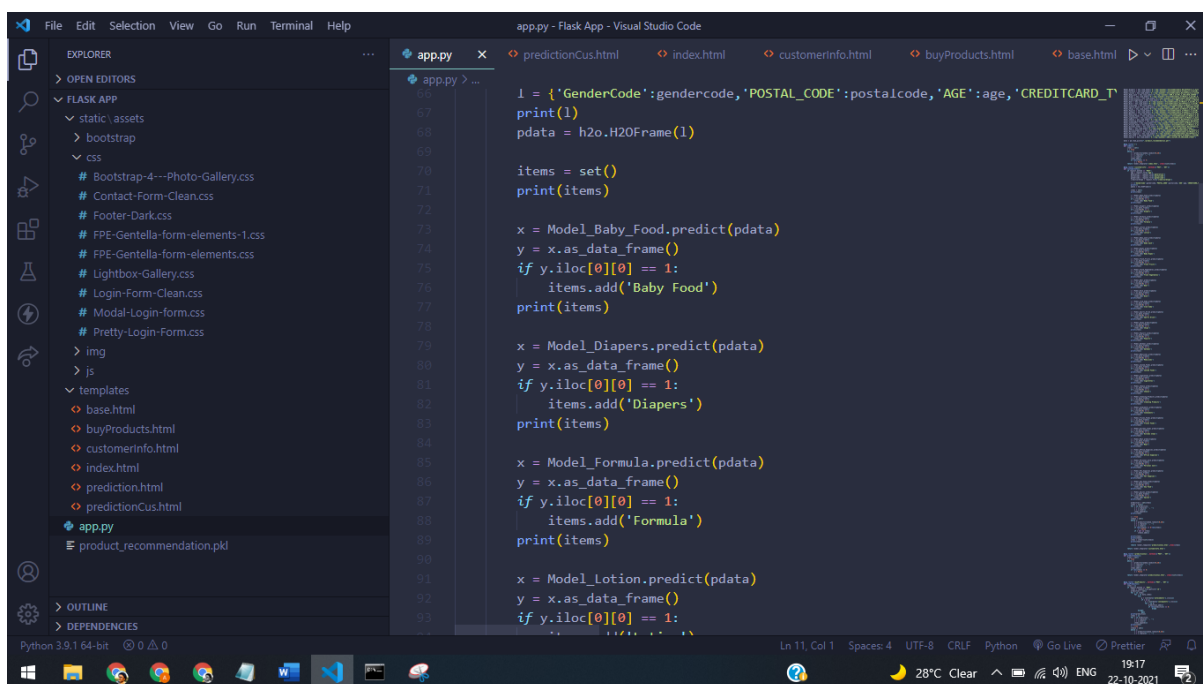


```

app.py - Flask App - Visual Studio Code
...
app.py x
9 import h2o
10 h2o.init()
11
12 Model_Baby_Food = h2o.load_model('E:\\tmp\\mymodel\\StackedEnsemble_AllModels_4_AutoML_12_20211020_171041.pkl')
13 Model_Diapers = h2o.load_model('E:\\tmp\\mymodel\\StackedEnsemble_BestOffFamily_4_AutoML_12_20211020_171041.pkl')
14 Model_Formula = h2o.load_model('E:\\tmp\\mymodel\\StackedEnsemble_AllModels_4_AutoML_12_20211020_171041.pkl')
15 Model_Lotion = h2o.load_model('E:\\tmp\\mymodel\\StackedEnsemble_BestOffFamily_4_AutoML_12_20211020_171041.pkl')
16 Model_Baby_wash = h2o.load_model('E:\\tmp\\mymodel\\GBM_5_AutoML_5_20211020_165958.pkl')
17 Model_Wipes = h2o.load_model('E:\\tmp\\mymodel\\StackedEnsemble_AllModels_5_AutoML_6_20211020_171041.pkl')
18 Model_Fresh_Fruits = h2o.load_model('E:\\tmp\\mymodel\\StackedEnsemble_BestOffFamily_4_AutoML_12_20211020_171041.pkl')
19 Model_Fresh_Vegetables = h2o.load_model('E:\\tmp\\mymodel\\GBM_grid_1_AutoML_8_20211020_171041.pkl')
20 Model_Beer = h2o.load_model('E:\\tmp\\mymodel\\StackedEnsemble_AllModels_4_AutoML_9_20211020_171041.pkl')
21 Model_Wine = h2o.load_model('E:\\tmp\\mymodel\\StackedEnsemble_BestOffFamily_4_AutoML_12_20211020_171041.pkl')
22 Model_Club_Soda = h2o.load_model('E:\\tmp\\mymodel\\StackedEnsemble_AllModels_4_AutoML_12_20211020_171041.pkl')
23 Model_Sports_Drink = h2o.load_model('E:\\tmp\\mymodel\\GBM_1_AutoML_12_20211020_171041.pkl')
24 Model_Chips = h2o.load_model('E:\\tmp\\mymodel\\StackedEnsemble_AllModels_4_AutoML_12_20211020_171041.pkl')
25 Model_Popcorn = h2o.load_model('E:\\tmp\\mymodel\\StackedEnsemble_AllModels_4_AutoML_12_20211020_171041.pkl')
26 Model_Oatmeal = h2o.load_model('E:\\tmp\\mymodel\\StackedEnsemble_AllModels_3_AutoML_12_20211020_171041.pkl')
27 Model_Medicines = h2o.load_model('E:\\tmp\\mymodel\\StackedEnsemble_BestOffFamily_4_AutoML_12_20211020_171041.pkl')
28 Model_Canned_Foods = h2o.load_model('E:\\tmp\\mymodel\\StackedEnsemble_AllModels_4_AutoML_12_20211020_171041.pkl')
29 Model_Cigarettes = h2o.load_model('E:\\tmp\\mymodel\\StackedEnsemble_AllModels_3_AutoML_12_20211020_171041.pkl')
30 Model_Cheese = h2o.load_model('E:\\tmp\\mymodel\\StackedEnsemble_BestOffFamily_4_AutoML_12_20211020_171041.pkl')
31 Model_Cleaning_Products = h2o.load_model('E:\\tmp\\mymodel\\StackedEnsemble_BestOffFamily_4_AutoML_12_20211020_171041.pkl')
32 Model_Condiments = h2o.load_model('E:\\tmp\\mymodel\\StackedEnsemble_AllModels_4_AutoML_12_20211020_171041.pkl')
33 Model_Frozen_Foods = h2o.load_model('E:\\tmp\\mymodel\\StackedEnsemble_AllModels_4_AutoML_12_20211020_171041.pkl')
34 Model_Kitchen_Items = h2o.load_model('E:\\tmp\\mymodel\\StackedEnsemble_BestOffFamily_4_AutoML_12_20211020_171041.pkl')
35 Model_Meat = h2o.load_model('E:\\tmp\\mymodel\\GBM_5_AutoML_24_20211020_173021.pkl')
36 Model_Office_Supplies = h2o.load_model('E:\\tmp\\mymodel\\StackedEnsemble_AllModels_4_AutoML_12_20211020_171041.pkl')

```

Step 4: After getting the data from the form use all this imported model to predict the values



```

app.py - Flask App - Visual Studio Code
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app.py x
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