```
# from google.colab import files
# uploaded = files.upload()
```

```
import pandas as pd
import numpy as np
```

```
rev_df = pd.read_csv('Amazon_Reviews.csv', engine='python')
rev_df
```

	Reviewer Name	Profile Link	Country	Review Count	Review Date	Rating	Review Title	Review Text	Date of Experience
0	Eugene ath	/users/66e8185ff1598352d6b3701a	US	1 review	2024-09-16T13:44:26.000Z	Rated 1 out of 5 stars	A Store That Doesn't Want to Sell Anything	I registered on the website, tried to order a ...	September 16, 2024
1	Daniel ohalloran	/users/5d75e460200c1f6a6373648c	GB	9 reviews	2024-09-16T18:26:46.000Z	Rated 1 out of 5 stars	Had multiple orders one turned up and…	Had multiple orders one turned up and driver h...	September 16, 2024
2	p fisher	/users/546cfcf1000064000197b88f	GB	90 reviews	2024-09-16T21:47:39.000Z	Rated 1 out of 5 stars	I informed these reprobates	I informed these reprobates that I WOULD NOT B...	September 16, 2024
3	Greg Dunn	/users/62c35cdbacc0ea0012ccaffa	AU	5 reviews	2024-09-17T07:15:49.000Z	Rated 1 out of 5 stars	Advertise one price then increase it on website	I have bought from Amazon before and no proble...	September 17, 2024
4	Sheila Hannah	/users/5ddbe429478d88251550610e	GB	8 reviews	2024-09-16T18:37:17.000Z	Rated 1 out of 5 stars	If I could give a lower rate I would	If I could give a lower rate I would! I cancel...	September 16, 2024
...	...	...	...	...	...	...	...	...	...

Next steps: Generate code with rev_df   View recommended plots   New interactive sheet

```
rev_df.info()
print()
print(f'Null : \n{rev_df.isnull().sum()}')
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 21214 entries, 0 to 21213
Data columns (total 9 columns):
 #   Column              Non-Null Count  Dtype 
---  ------              --------------  ----- 
 0   Reviewer Name       21214 non-null  object
 1   Profile Link        21163 non-null  object
 2   Country             21054 non-null  object
 3   Review Count        21055 non-null  object
 4   Review Date         21055 non-null  object
 5   Rating              21055 non-null  object
 6   Review Title        21055 non-null  object
 7   Review Text         21055 non-null  object
 8   Date of Experience  20947 non-null  object
dtypes: object(9)
memory usage: 1.5+ MB

Null : 
Reviewer Name           0
Profile Link           51
Country               160
Review Count          159
Review Date           159
Rating                159
Review Title          159
Review Text           159
Date of Experience    267
dtype: int64
```

```
# correcting all the column names

rev_df.columns = rev_df.columns.str.lower().str.replace(' ', '_')
rev_df.columns
```

```
Index(['reviewer_name', 'profile_link', 'country', 'review_count',
       'review_date', 'rating', 'review_title', 'review_text',
       'date_of_experience'],
      dtype='object')
```

```
# cleaning the profile links and removing duplicates
import uuid

uid = uuid.uuid4().hex[:24]
profile = f'/user/{uid}'
rev_df['profile_link'].fillna(profile,inplace=True)
rev_df.drop_duplicates(inplace=True)

```

```
<ipython-input-7-e2d94c52b8d0>:6: FutureWarning: A value is trying to be set on a copy of a DataFrame or Series through chained assi
The behavior will change in pandas 3.0. This inplace method will never work because the intermediate object on which we are setting

For example, when doing 'df[col].method(value, inplace=True)', try using 'df.method({col: value}, inplace=True)' or df[col] = df[col


  rev_df['profile_link'].fillna(profile,inplace=True)
```

```
# usingmos common country to fill in the country names using mode
most_common_country = rev_df['country'].mode()[0]
rev_df['country'].fillna(most_common_country, inplace=True)
rev_df
```

```
<ipython-input-8-e7df5d195954>:3: FutureWarning: A value is trying to be set on a copy of a DataFrame or Series through chained assi
The behavior will change in pandas 3.0. This inplace method will never work because the intermediate object on which we are setting

For example, when doing 'df[col].method(value, inplace=True)', try using 'df.method({col: value}, inplace=True)' or df[col] = df[col


  rev_df['country'].fillna(most_common_country, inplace=True)
```

	reviewer_name	profile_link	country	review_count	review_date	rating	review_title	review_text	dat
0	Eugene ath	/users/66e8185ff1598352d6b3701a	US	1 review	2024-09-16T13:44:26.000Z	Rated 1 out of 5 stars	A Store That Doesn't Want to Sell Anything	I registered on the website, tried to order a ...	Se
1	Daniel ohalloran	/users/5d75e460200c1f6a6373648c	GB	9 reviews	2024-09-16T18:26:46.000Z	Rated 1 out of 5 stars	Had multiple orders one turned up and…	Had multiple orders one turned up and driver h...	Se
2	p fisher	/users/546cfcf1000064000197b88f	GB	90 reviews	2024-09-16T21:47:39.000Z	Rated 1 out of 5 stars	I informed these reprobates	I informed these reprobates that I WOULD NOT B...	Se
3	Greg Dunn	/users/62c35cdbacc0ea0012ccaffa	AU	5 reviews	2024-09-17T07:15:49.000Z	Rated 1 out of 5 stars	Advertise one price then increase it on website	I have bought from Amazon before and no proble...	Se
4	Sheila Hannah	/users/5ddbe429478d88251550610e	GB	8 reviews	2024-09-16T18:37:17.000Z	Rated 1 out of 5 stars	If I could give a lower rate I would	If I could give a lower rate I would! I cancel...	Se
...	...	...	...	...	...	...	...	...	
21209	Anders T	/users/47bd4ffe0000640001001044	DK	1 review	2009-03-22T13:14:12.000Z	Rated 5 out of 5	Fast!!	I have had perfect order fulfillment,	

Next steps: Generate code with rev_df   View recommended plots   New interactive sheet

```
# from the review count column numerocal values are extraxcted

rev_df['review_count'] = rev_df['review_count'].str.extract(r'(\d+)')
rev_df['review_count'] = pd.to_numeric(rev_df['review_count'], errors='coerce')
mean_val = rev_df['review_count'].mean()
rev_df['review_count'].fillna(mean_val, inplace=True)
```

```
rev_df['review_count'] = rev_df['review_count'].astype(int)
rev_df
```

```
<ipython-input-9-df4aa9abf6db>:6: FutureWarning: A value is trying to be set on a copy of a DataFrame or Series through chained assi
The behavior will change in pandas 3.0. This inplace method will never work because the intermediate object on which we are setting

For example, when doing 'df[col].method(value, inplace=True)', try using 'df.method({col: value}, inplace=True)' or df[col] = df[col


  rev_df['review_count'].fillna(mean_val, inplace=True)
```

	reviewer_name	profile_link	country	review_count	review_date	rating	review_title	review_text	dat
0	Eugene ath	/users/66e8185ff1598352d6b3701a	US	1	2024-09-16T13:44:26.000Z	Rated 1 out of 5 stars	A Store That Doesn't Want to Sell Anything	I registered on the website, tried to order a ...	Se
1	Daniel ohalloran	/users/5d75e460200c1f6a6373648c	GB	9	2024-09-16T18:26:46.000Z	Rated 1 out of 5 stars	Had multiple orders one turned up and…	Had multiple orders one turned up and driver h...	Se
2	p fisher	/users/546cfcf1000064000197b88f	GB	90	2024-09-16T21:47:39.000Z	Rated 1 out of 5 stars	I informed these reprobates	I informed these reprobates that I WOULD NOT B...	Se
3	Greg Dunn	/users/62c35cdbacc0ea0012ccaffa	AU	5	2024-09-17T07:15:49.000Z	Rated 1 out of 5 stars	Advertise one price then increase it on website	I have bought from Amazon before and no proble...	Se
4	Sheila Hannah	/users/5ddbe429478d88251550610e	GB	8	2024-09-16T18:37:17.000Z	Rated 1 out of 5 stars	If I could give a lower rate I would	If I could give a lower rate I would! I cancel...	Se
...	...	...	...	...	...	...	...	...	
21209	Anders T	/users/47bd4ffe0000640001001044	DK	1	2009-03-22T13:14:12.000Z	Rated 5 out of 5	Fast!!	I have had perfect order fulfillment,	

Next steps: Generate code with rev_df View recommended plots New interactive sheet

```
# Transforming the review_date column as per datetime

rev_df['review_date'] = pd.to_datetime(rev_df['review_date'], errors='coerce')
# rev_df['review_date'] = rev_df['review_date'].dt.strftime('%Y-%m-%d')
most_common_date = rev_df['review_date'].mode()[0]
rev_df['review_date'] = rev_df['review_date'].fillna(most_common_date)

rev_df['date_of_experience'] = pd.to_datetime(rev_df['date_of_experience'])
# rev_df['date_of_experience'] = rev_df['date_of_experience'].dt.strftime('%Y-%m-%d')
most_common_date = rev_df['date_of_experience'].mode()[0]
rev_df['date_of_experience'] = rev_df['date_of_experience'].fillna(most_common_date)

rev_df
```

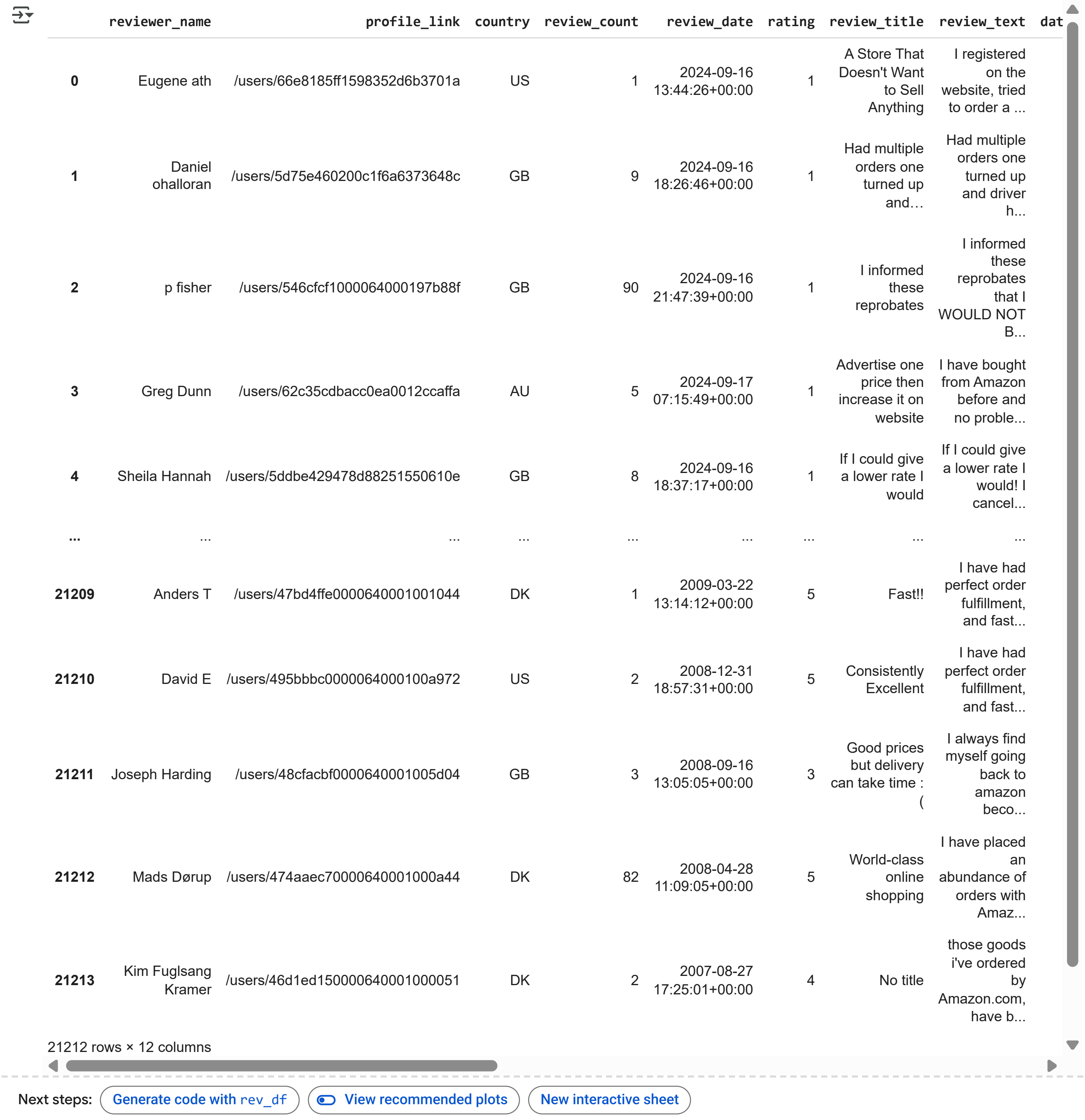
	reviewer_name	profile_link	country	review_count	review_date	rating	review_title	review_text	date_
0	Eugene ath	/users/66e8185ff1598352d6b3701a	US	1	2024-09-16 13:44:26+00:00	Rated 1 out of 5 stars	A Store That Doesn't Want to Sell Anything	I registered on the website, tried to order a ...	
1	Daniel ohalloran	/users/5d75e460200c1f6a6373648c	GB	9	2024-09-16 18:26:46+00:00	Rated 1 out of 5 stars	Had multiple orders one turned up and…	Had multiple orders one turned up and driver h...	
2	p fisher	/users/546cfcf1000064000197b88f	GB	90	2024-09-16 21:47:39+00:00	Rated 1 out of 5 stars	I informed these reprobates	I informed these reprobates that I WOULD NOT B...	
3	Greg Dunn	/users/62c35cdbacc0ea0012ccaffa	AU	5	2024-09-17 07:15:49+00:00	Rated 1 out of 5 stars	Advertise one price then increase it on website	I have bought from Amazon before and no proble...	
4	Sheila Hannah	/users/5ddbe429478d88251550610e	GB	8	2024-09-16 18:37:17+00:00	Rated 1 out of 5 stars	If I could give a lower rate I would	If I could give a lower rate I would! I cancel...	
...	...	...	...	...	...	...	...	...	
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2009-03-22	Rated 5 out	[illegible]	I have had perfect order	

Next steps: Generate code with rev_df | View recommended plots | New interactive sheet

```
# Extracting the numerical value from string

rev_df['rating'] = rev_df['rating'].str.extract(r'Rated (\d+) out of 5 stars')
rev_df['rating'] = pd.to_numeric(rev_df['rating'], errors='coerce')
mean_value = rev_df['rating'].mean()
rev_df['rating'] = rev_df['rating'].fillna(mean_value).round().astype(int)
```

```
rev_df['review_title'] = rev_df['review_title'].fillna('N/A')
rev_df['review_text'] = rev_df['review_text'].fillna('N/A')

rev_df['text_features'] = rev_df['review_text'] + ' ' + rev_df['review_title']
```

```
from textblob import TextBlob

rev_df['polarity'] = rev_df['review_text'].apply(lambda x: TextBlob(x).sentiment.polarity)
rev_df['sentiment'] = rev_df['polarity'].apply(lambda x: 'positive' if x > 0 else ('negative' if x < 0 else 'neutral'))
rev_df
```



	reviewer_name	profile_link	country	review_count	review_date	rating	review_title	review_text	dat
0	Eugene ath	/users/66e8185ff1598352d6b3701a	US	1	2024-09-16 13:44:26+00:00	1	A Store That Doesn't Want to Sell Anything	I registered on the website, tried to order a ...	
1	Daniel ohalloran	/users/5d75e460200c1f6a6373648c	GB	9	2024-09-16 18:26:46+00:00	1	Had multiple orders one turned up and…	Had multiple orders one turned up and driver h...	
2	p fisher	/users/546cfcf1000064000197b88f	GB	90	2024-09-16 21:47:39+00:00	1	I informed these reprobates	I informed these reprobates that I WOULD NOT B...	
3	Greg Dunn	/users/62c35cdbacc0ea0012ccaffa	AU	5	2024-09-17 07:15:49+00:00	1	Advertise one price then increase it on website	I have bought from Amazon before and no proble...	
4	Sheila Hannah	/users/5ddbe429478d88251550610e	GB	8	2024-09-16 18:37:17+00:00	1	If I could give a lower rate I would	If I could give a lower rate I would! I cancel...	
...	...	...	...	...	...	...	...	...	
21209	Anders T	/users/47bd4ffe0000640001001044	DK	1	2009-03-22 13:14:12+00:00	5	Fast!!	I have had perfect order fulfillment, and fast...	
21210	David E	/users/495bbbc0000064000100a972	US	2	2008-12-31 18:57:31+00:00	5	Consistently Excellent	I have had perfect order fulfillment, and fast...	
21211	Joseph Harding	/users/48cfacbf0000640001005d04	GB	3	2008-09-16 13:05:05+00:00	3	Good prices but delivery can take time :(	I always find myself going back to amazon beco...	
21212	Mads Dørup	/users/474aaec70000640001000a44	DK	82	2008-04-28 11:09:05+00:00	5	World-class online shopping	I have placed an abundance of orders with Amaz...	
21213	Kim Fuglsang Kramer	/users/46d1ed150000640001000051	DK	2	2007-08-27 17:25:01+00:00	4	No title	those goods i've ordered by Amazon.com, have b...	

21212 rows × 12 columns

```
rev_df['has_negative_title'] = rev_df['review_title'].str.contains("w ointed", case=False, na=False)
rev_df['has_positive_title'] = rev_df['review_title'].str.contains("great|excellent|amazing|perfect|love", case=False, na=False)
rev_df
```

	reviewer_name	profile_link	country	review_count	review_date	rating	review_title	review_text	dat
0	Eugene ath	/users/66e8185ff1598352d6b3701a	US	1	2024-09-16 13:44:26+00:00	1	A Store That Doesn't Want to Sell Anything	I registered on the website, tried to order a ...	
1	Daniel ohalloran	/users/5d75e460200c1f6a6373648c	GB	9	2024-09-16 18:26:46+00:00	1	Had multiple orders one turned up and…	Had multiple orders one turned up and driver h...	
2	p fisher	/users/546cfcf1000064000197b88f	GB	90	2024-09-16 21:47:39+00:00	1	I informed these reprobates	I informed these reprobates that I WOULD NOT B...	
3	Greg Dunn	/users/62c35cdbacc0ea0012ccaffa	AU	5	2024-09-17 07:15:49+00:00	1	Advertise one price then increase it on website	I have bought from Amazon before and no proble...	
4	Sheila Hannah	/users/5ddbe429478d88251550610e	GB	8	2024-09-16 18:37:17+00:00	1	If I could give a lower rate I would	If I could give a lower rate I would! I cancel...	
...	...	...	...	...	...	...	...	...	
21209	Anders T	/users/47bd4ffe0000640001001044	DK	1	2009-03-22 13:14:12+00:00	5	Fast!!	I have had perfect order fulfillment, and fast...	
21210	David E	/users/495bbbc0000064000100a972	US	2	2008-12-31 18:57:31+00:00	5	Consistently Excellent	I have had perfect order fulfillment, and fast...	
21211	Joseph Harding	/users/48cfacbf0000640001005d04	GB	3	2008-09-16 13:05:05+00:00	3	Good prices but delivery can take time :(	I always find myself going back to amazon beco...	
21212	Mads Dørup	/users/474aaec70000640001000a44	DK	82	2008-04-28 11:09:05+00:00	5	World-class online shopping	I have placed an abundance of orders with Amaz...	
21213	Kim Fuglsang Kramer	/users/46d1ed150000640001000051	DK	2	2007-08-27 17:25:01+00:00	4	No title	those goods i've ordered by Amazon.com, have b...	

21212 rows × 14 columns

Next steps: Generate code with rev_df | View recommended plots | New interactive sheet

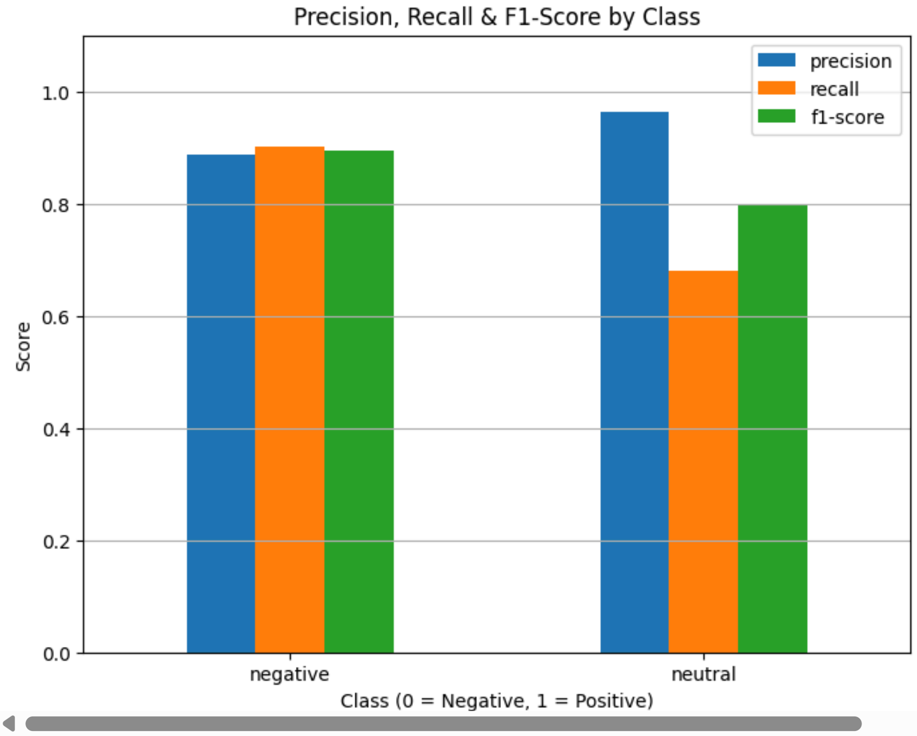
```
# from google.colab import files
# rev_df.to_csv('cleaned_ecomm_data.csv', index=False)
# files.download('cleaned_ecomm_data.csv')
```

Machine Learning

```
# Importing required libraries for prediction using machine learning

from sklearn.linear_model import LogisticRegression
from sklearn.feature_extraction.text import TfidfVectorizer
from sklearn.model_selection import train_test_split
from sklearn.metrics import classification_report, accuracy_score
import matplotlib.pyplot as plt

tf = TfidfVectorizer()
x = tf.fit_transform(rev_df['text_features'])
y = rev_df['sentiment']

x_train, x_test, y_train, y_test = train_test_split(x, y, test_size=0.2, random_state=42)

```

```
model = LogisticRegression()
model.fit(x, y)
y_pred = model.predict(x_test)

print(classification_report(y_test, y_pred))
report = classification_report(y_test, y_pred, output_dict=True)
metrics_df = pd.DataFrame(report).transpose().iloc[:2][['precision', 'recall', 'f1-score']]
metrics_df.plot(kind='bar', figsize=(8, 6))
plt.title('Precision, Recall & F1-Score by Class')
plt.xlabel('Class (0 = Negative, 1 = Positive)')
plt.ylabel('Score')
plt.ylim(0, 1.1)
plt.grid(True, axis='y')
plt.xticks(rotation=0)
plt.show()
```

```
              precision    recall  f1-score   support

    negative       0.89      0.90      0.89      1692
     neutral       0.96      0.68      0.80       465
    positive       0.89      0.94      0.91      2086

    accuracy                           0.89      4243
   macro avg       0.91      0.84      0.87      4243
weighted avg       0.90      0.89      0.89      4243
```



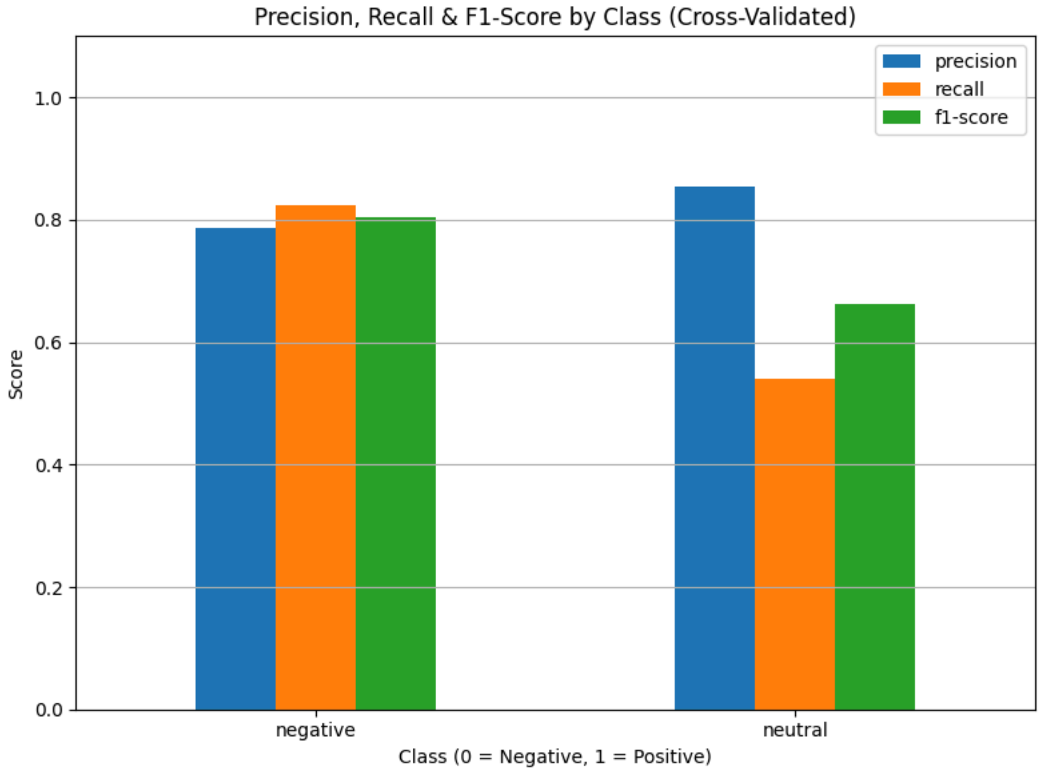
Cross-Validation

Generated code may be subject to a license | NAIST-SE/SOImages | mrkntrci/Forest_Fire_Susceptibility_ML

```
from sklearn.model_selection import cross_val_score, StratifiedKFold, cross_val_predict
from sklearn.metrics import classification_report, accuracy_score

tf = TfidfVectorizer()
x = tf.fit_transform(rev_df['text_features'])
y = rev_df['sentiment']

model = LogisticRegression()

skf = StratifiedKFold(n_splits=5, shuffle=True, random_state=42)
cv_scores = cross_val_score(model, x, y, cv=skf, scoring='accuracy')

print(f'Cross-Validation Scores : {cv_scores[0]}')

y_pred_cv = cross_val_predict(model, x, y, cv=skf)
print(f'Classification Report : {classification_report(y, y_pred_cv)}')
print(f'Accuracy Score : {accuracy_score(y, y_pred_cv):.2f}')

report = classification_report(y, y_pred_cv, output_dict=True)
metrics_df = pd.DataFrame(report).transpose().iloc[:2][['precision', 'recall', 'f1-score']]

# Plot metrics
```

```
metrics_df.plot(kind='bar', figsize=(8, 6))
plt.title('Precision, Recall & F1-Score by Class (Cross-Validated)')
plt.xlabel('Class (0 = Negative, 1 = Positive)')
plt.ylabel('Score')
plt.ylim(0, 1.1)
plt.grid(True, axis='y')
plt.xticks(rotation=0)
plt.tight_layout()
plt.show()

```

```
Cross-Validation Scores : 0.8197030403016733
Mean Accuracy : 0.81
Classification Report :               precision    recall  f1-score   support

    negative       0.79      0.82      0.80      8340
     neutral       0.85      0.54      0.66      2251
    positive       0.83      0.86      0.85     10621

    accuracy                           0.81     21212
   macro avg       0.82      0.74      0.77     21212
weighted avg       0.81      0.81      0.81     21212

Accuracy Score : 0.81
```



NLP

```
from textblob import TextBlob
import nltk
nltk.download('punkt_tab')

aspects = ['price', 'delivery', 'quality']
def aspect_sentiment(text):
    blob = TextBlob(text)
    aspect_sentiments = {}
    for aspect in aspects:
      for sentence in blob.sentences:
        if aspect in sentence.lower():
          aspect_sentiments[aspect] = sentence.sentiment.polarity
    return aspect_sentiments

rev_df['Aspect_Sentiment'] = rev_df['text_features'].apply(aspect_sentiment)
print(rev_df[['text_features','Aspect_Sentiment']].head())
```

```
[nltk_data] Downloading package punkt_tab to /root/nltk_data...
[nltk_data]   Unzipping tokenizers/punkt_tab.zip.
                                       text_features   Aspect_Sentiment
0  I registered on the website, tried to order a ...                 {}
1  Had multiple orders one turned up and driver h...  {'delivery': 0.0}
```