Customer Sentimental Analysis - Iphone 15 128gb

Objective:

As a Data Analyst at Flipkart, analyze customer sentiment towards the iPhone 15 128GB model by evaluating reviews using sentiment analysis. The goal is to gain insights into public perception, identify product strengths and weaknesses, and support decision-making.

Libraries and Tools:

- **Selenium**: Web scraping automation.
- **BeautifulSoup**: HTML parsing.
- **Pandas**: Data cleaning and analysis.
- **TextBlob**: Sentiment analysis.
- **Matplotlib/Seaborn**: Data visualization.

1. **Data Collection (Web Scraping)**:

- **Tools**: Selenium, BeautifulSoup
- **Steps**:
  - Use Selenium to scrape at least 300 reviews from Flipkart's iPhone 15 128GB product page.
  - Extract **Username**, **Rating**, and **Review Text**.
  - Handle pagination to collect reviews from multiple pages.

```
# Import the necessary librariess
import requests
import time
import pandas as pd
from bs4 import BeautifulSoup
from selenium import webdriver
from selenium.webdriver.common.by import By
from selenium.webdriver.common.keys import Keys

# Create empty lists to store the user data such as Name, City, Date 
of Purchase, Review & Rating
Names = []
Cities = []
Dates = []
Reviews = []
Ratings = []

# Assign the url of the flipkart website and use selenium to scrape 
data
url = """https://www.flipkart.com/apple-iphone-15-blue-128-gb/product-
```

```
reviews/itmbf14ef54f645d?
pid=MOBGTAGPAQNVFZZY&lid=LSTMOBGTAGPAQNVFZZYQRLPCQ&marketplace=FLIPKAR
T"""
driver = webdriver.Chrome()
driver.get(url)


while len(Names) < 320:

    time.sleep(2)
    soup = BeautifulSoup(driver.page_source, "html.parser")

    # Extract names
    names_elements= soup.find_all("p", {"class": "_2NsDsF AwS1CA"})
    for name in  names_elements:
        Names.append(name.text)

    # Extract cities
    city_elements = soup.find_all("p", {"class": "MztJPv"})
    for city in city_elements:
        Cities.append(city.text)

    # Extract dates
    dates_elements = soup.find_all("p", {"class": "_2NsDsF"})
    for date in dates_elements:
        Dates.append(date.text)
    Actual_Dates = Dates[1::2]

    # Extract reviews
    reviews_elements = soup.find_all("div", {"class": "ZmyHeo"})
    for review in reviews_elements:
        Reviews.append(review.text)

    # Extract ratings
    ratings_elements = soup.find_all("div", class_ = "XQDdHH Ga3i8K")
    for ratings in ratings_elements:
        Ratings.append(ratings.text)

    # Try to click the "Next" button
    try:
        next_button = driver.find_element(By.XPATH,
"//span[text()='Next']")
        next_button.click()
        time.sleep(5)
    except:
        break

# Combine data into a DataFrame
df = pd.DataFrame({
    "Name": Names[:-1],
    "City": Cities[:-1],
    "Date": Actual_Dates[:-1],
    "Review": Reviews[:-1],
    "Ratings": Ratings
})
```

2. **Data Cleaning and Preprocessing**:

- **Tool**: Pandas
- **Steps**:
  - Remove duplicates and handle missing values.
  - **Text Preprocessing**:
    - Convert text to lowercase, remove special characters, and extra spaces.
    - Tokenize text, remove stop words, and apply lemmatization.

```
# Check the basic info of the dataframe
df.info()

<class 'pandas.core.frame.DataFrame'>
RangeIndex: 323 entries, 0 to 322
Data columns (total 5 columns):
 #   Column   Non-Null Count  Dtype 
---  ------   --------------  ----- 
 0   Name     323 non-null    object
 1   City     323 non-null    object
 2   Date     323 non-null    object
 3   Review   323 non-null    object
 4   Ratings  323 non-null    int64 
dtypes: int64(1), object(4)
memory usage: 12.7+ KB

# Drop the duplicates from the dataframe
df1 = df.copy()
df1 = df1.drop_duplicates()
df1

                 Name                                City
Date  \
0        Akshay Meena             Certified Buyer, Jaipur      Nov,
2023
1    Mousam  Guha Roy         Certified Buyer, Matialihat      Oct,
2023
2      bijaya mohanty          Certified Buyer, Baleshwar   6 months
ago
3     Prithivi Boruah            Certified Buyer, Bokajan      Oct,
2023
4              Ajin V           Certified Buyer, Balaghat      Oct,
2023
..                ...                                 ...            .
..
```

```
317       aditya verma         Certified Buyer, Khairagarh  10 months
ago
319       Devjyoti Das             Certified Buyer, Dhubri  10 months
ago
320  manish choudhary             Certified Buyer, Udaipur  11 months
ago
321       Rahul  Saini      Certified Buyer, Gangapur City  11 months
ago
322        Prashanth r  Certified Buyer, Chittoor District  11 months
ago

                                                Review  Ratings
0    So beautiful, so elegant, just a vowww😍❤READ ...        5
1                                   Very niceREAD MORE        4
2    Just go for it.Amazing one.Beautiful camera wi...        5
3        Camera Quality Is Improved Loving ItREAD MORE        5
4                        High quality camera😍READ MORE        5
..                                                 ...      ...
317         Most value for money iPhone ever.READ MORE        5
319  Amazing phone just no words to say...just one ...        5
320  I was sceptical at first about moving form an ...        5
321                                  Loved itREAD MORE        5
322                          Awesome picturesREAD MORE        5

[304 rows x 5 columns]

# Convert the Name column data into Title Case
df1['Name'] = df1['Name'].str.title()
df1.head()

               Name                         City          Date  \
0      Akshay Meena      Certified Buyer, Jaipur     Nov, 2023
1  Mousam  Guha Roy  Certified Buyer, Matialihat     Oct, 2023
2    Bijaya Mohanty   Certified Buyer, Baleshwar  6 months ago
3   Prithivi Boruah     Certified Buyer, Bokajan     Oct, 2023
4            Ajin V    Certified Buyer, Balaghat     Oct, 2023

                                              Review  Ratings
0  So beautiful, so elegant, just a vowww😍❤READ ...        5
1                                 Very niceREAD MORE        4
2  Just go for it.Amazing one.Beautiful camera wi...        5
3      Camera Quality Is Improved Loving ItREAD MORE        5
4                      High quality camera😍READ MORE        5

# Clean data of City column by removing unwanted characters/ part of
string
df1['City'] = df1['City'].str.replace("Certified Buyer, ", "",
regex=False).str.strip()
df1.head()
```

```
                 Name        City           Date  \
0       Akshay Meena      Jaipur      Nov, 2023
1  Mousam  Guha Roy  Matialihat      Oct, 2023
2     Bijaya Mohanty   Baleshwar  6 months ago
3    Prithivi Boruah     Bokajan      Oct, 2023
4             Ajin V    Balaghat      Oct, 2023

                                              Review  Ratings
0  So beautiful, so elegant, just a vowww😍❤READ ...        5
1                                 Very niceREAD MORE        4
2  Just go for it.Amazing one.Beautiful camera wi...        5
3       Camera Quality Is Improved Loving ItREAD MORE        5
4                        High quality camera😍READ MORE        5
```

```
# Clean data of Review column by removing unwanted characters/ part of
string and converting to lowercase
df1['Review'] = df1['Review'].str.lower().str.replace("read more", "",
regex=False)
df1head()
```

```
                 Name        City           Date  \
0       Akshay Meena      Jaipur      Nov, 2023
1  Mousam  Guha Roy  Matialihat      Oct, 2023
2     Bijaya Mohanty   Baleshwar  6 months ago
3    Prithivi Boruah     Bokajan      Oct, 2023
4             Ajin V    Balaghat      Oct, 2023

                                              Review  Ratings
0           so beautiful, so elegant, just a vowww😍❤        5
1                                          very nice        4
2  just go for it.amazing one.beautiful camera wi...        5
3                camera quality is improved loving it        5
4                               high quality camera😍        5
```

3. **Sentiment Analysis**:

- **Tool**: TextBlob
- **Steps**:
  - Analyze sentiment using TextBlob's polarity score (-1 to +1).
  - Classify sentiment:
    - Positive: Polarity ≥ 0.1
    - Negative: Polarity < 0.1
  - Store sentiment classification in the dataset.

```
# Import libraries for Sentimental analysis of review sentences
import nltk
from nltk.corpus import stopwords
from nltk.tokenize import sent_tokenize
from nltk.tokenize import word_tokenize
from textblob import TextBlob
```

```python
import string

nltk.download('stopwords')
nltk.download('punkt')
nltk.download('wordnet')
```

```
[nltk_data] Downloading package stopwords to
[nltk_data]     C:\Users\ethen\AppData\Roaming\nltk_data...
[nltk_data]   Package stopwords is already up-to-date!
[nltk_data] Downloading package punkt to
[nltk_data]     C:\Users\ethen\AppData\Roaming\nltk_data...
[nltk_data]   Package punkt is already up-to-date!
[nltk_data] Downloading package wordnet to
[nltk_data]     C:\Users\ethen\AppData\Roaming\nltk_data...
[nltk_data]   Package wordnet is already up-to-date!

True
```

```python
# Create a column called Reviews_t that stores tokenized sentences from the Review column using the sent_tokenize function.
df1["Reviews_t"] = df1['Review'].apply(sent_tokenize)
df1
```

```
                 Name               City           Date  \
0        Akshay Meena             Jaipur      Nov, 2023
1    Mousam  Guha Roy         Matialihat      Oct, 2023
2      Bijaya Mohanty          Baleshwar   6 months ago
3     Prithivi Boruah            Bokajan      Oct, 2023
4              Ajin V           Balaghat      Oct, 2023
..                ...                ...            ...
317      Aditya Verma         Khairagarh  10 months ago
319      Devjyoti Das             Dhubri  10 months ago
320  Manish Choudhary            Udaipur  11 months ago
321      Rahul  Saini      Gangapur City  11 months ago
322       Prashanth R  Chittoor District  11 months ago

                                                Review  Ratings  \
0             so beautiful, so elegant, just a vowww😍❤        5
1                                            very nice        4
2    just go for it.amazing one.beautiful camera wi...        5
3                 camera quality is improved loving it        5
4                                 high quality camera😍        5
..                                                 ...      ...
317                  most value for money iphone ever.        5
319  amazing phone just no words to say...just one ...        5
320  i was sceptical at first about moving form an ...        5
321                                           loved it        5
322                                   awesome pictures        5

                                             Reviews_t
```

```
0          [so beautiful, so elegant, just a vowww😍❤]
1                                          [very nice]
2    [just go for it.amazing one.beautiful camera w...
3               [camera quality is improved loving it]
4                               [high quality camera😍]
..                                                 ...
317                [most value for money iphone ever.]
319  [amazing phone just no words to say...just one...
320  [i was sceptical at first about moving form an...
321                                         [loved it]
322                                 [awesome pictures]

[304 rows x 6 columns]
```

```
# Import mean from statistics for basic statistics
from statistics import mean

# Function created for assigning Polarity to the Reviews_t column
def get_polarity(sentences):
    return [TextBlob(sentence).sentiment.polarity for sentence in
sentences]

# Calls get_polarity function on the Reviews_t column to assign
polarity
df1['Polarity'] = df1['Reviews_t'].apply(get_polarity)

# Function created to calculate the average polarity of each review
(Average of polarity for each sentences in a review)
def calculate_average_polarity(polarities):
    return mean(polarities) if polarities else 0

# Calls calculate_average_polarity function on the Polarity column to
assign the average polarity for each review
df1['Average_Polarity'] =
df1['Polarity'].apply(calculate_average_polarity)
df1['Average_Polarity'] = df1['Average_Polarity'].round(2)
df1.head(10)
```

```
                    Name             City           Date  \
0           Akshay Meena           Jaipur      Nov, 2023
1       Mousam  Guha Roy       Matialihat      Oct, 2023
2         Bijaya Mohanty        Baleshwar   6 months ago
3        Prithivi Boruah          Bokajan      Oct, 2023
4                 Ajin V         Balaghat      Oct, 2023
5  Sheetla Prasad Maurya        Sultanpur      Oct, 2023
6         Kriti Customer        Sarkaghat  10 months ago
7      Flipkart Customer           Aizawl  10 months ago
8           Nikhil Kumar  Meerut Division  10 months ago
9           Rahul Shedge           Satara      Oct, 2023
```

```
                                              Review  Ratings  \
0          so beautiful, so elegant, just a vowww😍❤        5
1                                          very nice        4
2  just go for it.amazing one.beautiful camera wi...        5
3                camera quality is improved loving it        5
4                                high quality camera😍        5
5  best mobile phonecamera quality is very nice b...        4
6  just loved the product , colour , design is wo...        5
7  awesome photography experience. battery backup...        5
8  switch from oneplus to iphone i am stunned wit...        5
9  totally happy!camera 5battery 5 display 5design 5        5

                                           Reviews_t
Polarity  \
0        [so beautiful, so elegant, just a vowww😍❤]
[0.675]
1                                        [very nice]
[0.78]
2  [just go for it.amazing one.beautiful camera w...
[0.26666666666666666]
3              [camera quality is improved loving it]
[0.6]
4                              [high quality camera😍]
[0.16]
5  [best mobile phonecamera quality is very nice ...
[0.738]
6  [just loved the product , colour , design is w...
[0.4125]
7  [awesome photography experience., battery back...        [1.0, 0.7,
0.5]
8  [switch from oneplus to iphone i am stunned wi...             [0.0,
1.0]
9  [totally happy!camera 5battery 5 display 5desi...
[0.0]

   Average_Polarity
0              0.68
1              0.78
2              0.27
3              0.60
4              0.16
5              0.74
6              0.41
7              0.73
8              0.50
9              0.00

# Function to assign the Class to the Polarity
def sentiment_class(polarity):
    if polarity > 0.75:
        return 'extremely positive'
    elif 0 < polarity <= 0.75:
        return 'positive'
    elif polarity == 0:
        return 'neutral'
    elif -0.75 <= polarity < 0:
        return 'negative'
    else:
        return 'extremely negative'

# Calls sentiment_class function on the Average_Polarit column to
assign the sentiment class
df1['Sentiment_Class'] =
df1['Average_Polarity'].apply(sentiment_class)

df1.head()
```

```
               Name        City          Date  \
0      Akshay Meena      Jaipur     Nov, 2023
1  Mousam  Guha Roy  Matialihat     Oct, 2023
2    Bijaya Mohanty   Baleshwar  6 months ago
3   Prithivi Boruah     Bokajan     Oct, 2023
4            Ajin V    Balaghat     Oct, 2023

                                              Review  Ratings  \
0          so beautiful, so elegant, just a vowww😍❤        5
1                                          very nice        4
2  just go for it.amazing one.beautiful camera wi...        5
3               camera quality is improved loving it        5
4                                high quality camera😍        5

                                           Reviews_t
Polarity  \
0        [so beautiful, so elegant, just a vowww😍❤]
[0.675]
1                                        [very nice]
[0.78]
2  [just go for it.amazing one.beautiful camera w...
[0.26666666666666666]
3             [camera quality is improved loving it]
[0.6]
4                             [high quality camera😍]
[0.16]

   Average_Polarity     Sentiment_Class
0              0.68            positive
1              0.78  extremely positive
2              0.27            positive
3              0.60            positive
4              0.16            positive
```

```python
# Calculates and prints the overall average polarity score of the
entire dataset of reviews
polarity_score = df1['Average_Polarity'].mean().round(2)
print(f'Average Polarity Score : {polarity_score}')
if polarity_score > 0.75:
        print('The Average Polarity Score is Extremely Positive')
elif 0 < polarity_score <= 0.75:
    print('The Average Polarity Score is Positive')
elif polarity_score == 0:
    print('The Average Polarity Score is Neutral')
elif -0.75 <= polarity_score < 0:
    print('The Average Polarity Score is Negative')
else:
    print('The Average Polarity Score is Extremely Negative')
```

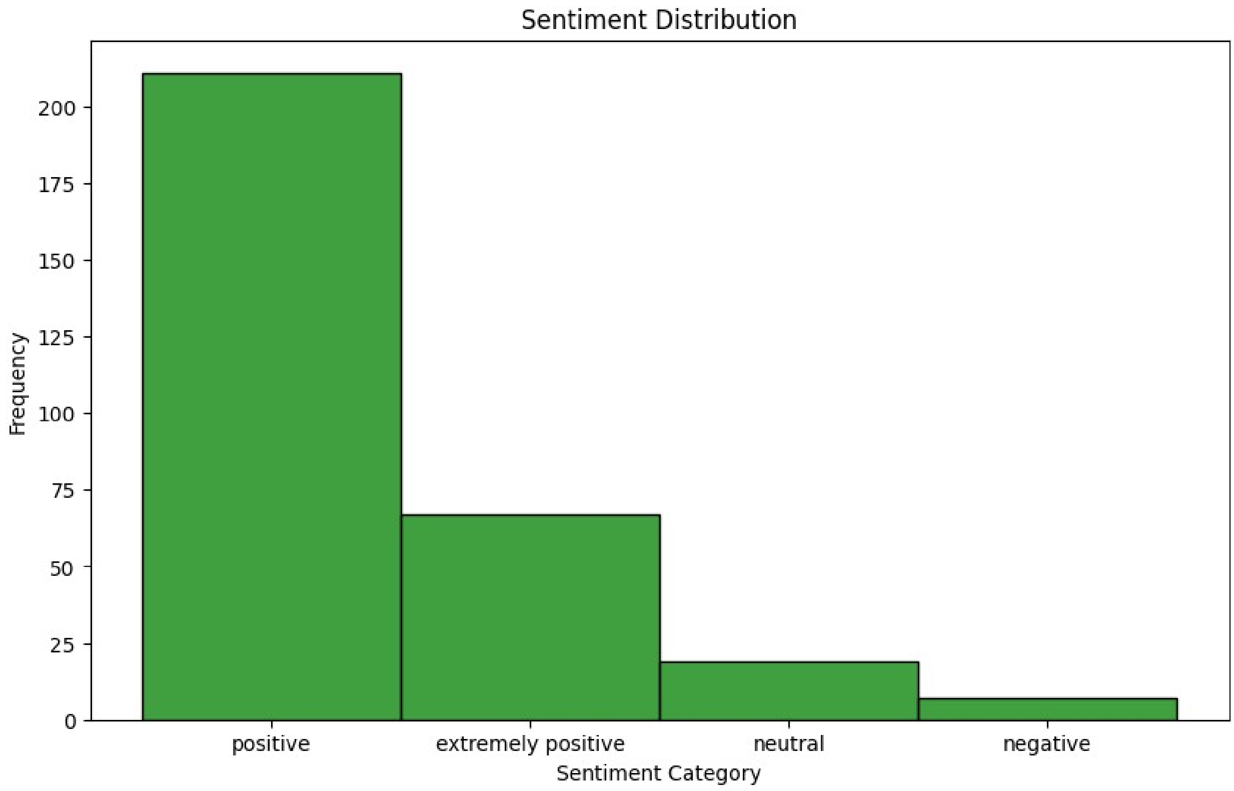
```
Average Polarity Score : 0.52
The Average Polarity Score is Positive
```

4. **Data Analysis and Insights**:

- **Tools**: Pandas, Matplotlib/Seaborn
- **Steps**:
  - **Sentiment Distribution**: Calculate positive and negative sentiment proportions.
  - **Average Rating vs Sentiment**: Analyze correlation between numeric ratings (1-5 stars) and sentiment.
  - **Word Cloud**: Generate a word cloud for frequently mentioned words in positive/negative reviews.
  - **Review Length Analysis**: Investigate the relationship between review length and sentiment.

```python
# Imports libraries for visualisation
import matplotlib.pyplot as plt
import seaborn as sns

# Plots figure for Sentiment Distribution based on Sentiment Category
plt.figure(figsize=(10, 6))
sns.histplot(x=new_df1.Sentiment_Class, color='green')
plt.title('Sentiment Distribution')
plt.xlabel('Sentiment Category')
plt.ylabel('Frequency')
plt.xticks(rotation=0)
plt.show()
```



Sentiment Distribution

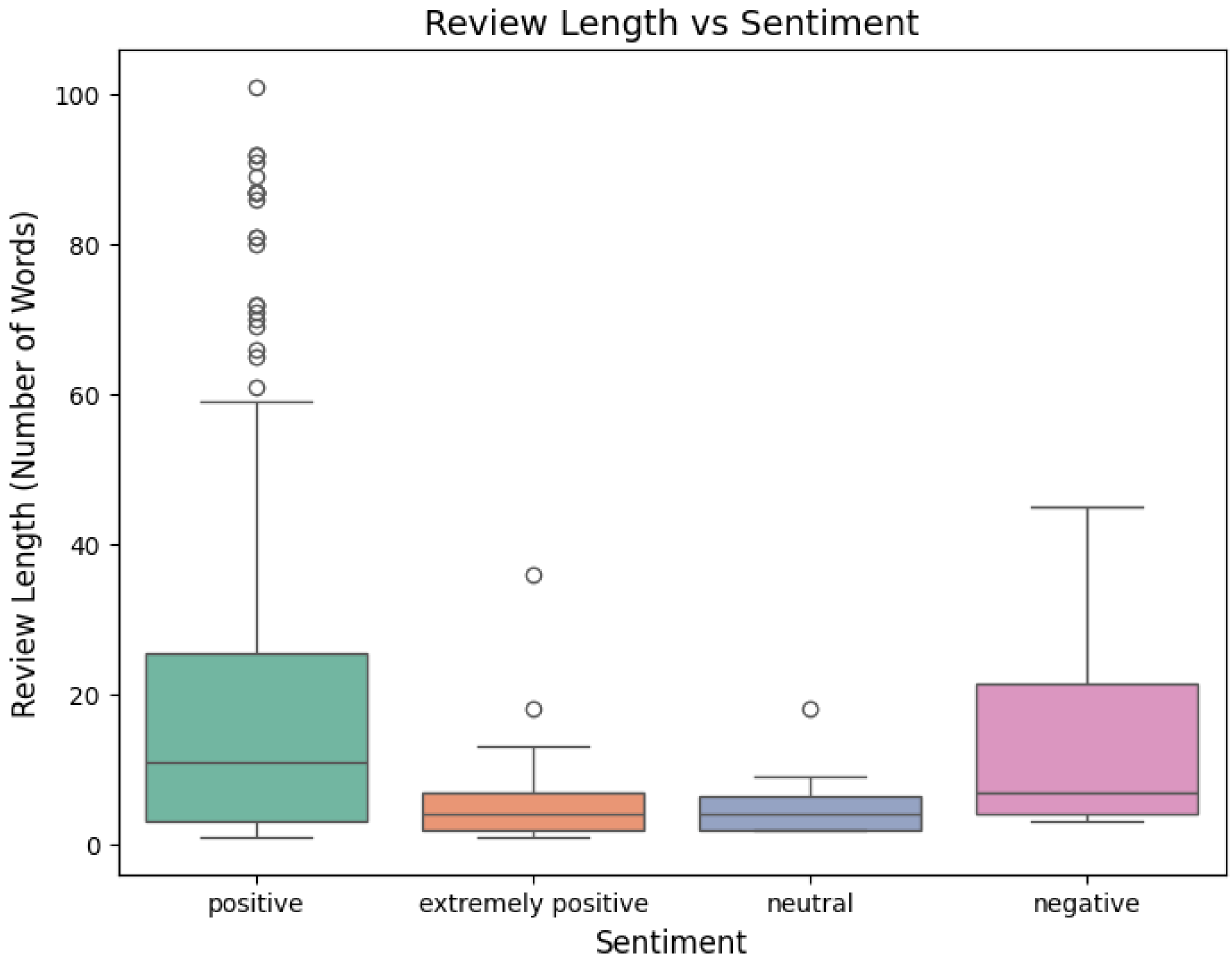
The bar chart visualizes the distribution of sentiment categories in the dataset. The x-axis represents various sentiment categories, and the y-axis shows the frequency of occurrences in each category. The categories are as follows:

1. **Positive**: The most frequent sentiment, with over 200 instances.
2. **Extremely Positive**: This category follows, though it appears much less frequently than "Positive".
3. **Neutral**: Appears less often than both positive categories.
4. **Negative**: The least frequent sentiment in the dataset.

The chart clearly demonstrates a strong inclination towards positive sentiments, with "Positive" being the predominant category, followed by "Extremely Positive". Both neutral and negative sentiments occur much less frequently.

```
df1['Review_Length'] = df1['Review'].apply(lambda x: len(x.split()))

# Box Plot for Review Length by Sentiment
plt.figure(figsize=(8, 6))
sns.boxplot(x='Sentiment_Class', y='Review_Length', data=df1, hue =
'Sentiment_Class', palette='Set2')
plt.title('Review Length vs Sentiment', fontsize=14)
plt.xlabel('Sentiment', fontsize=12)
plt.ylabel('Review Length (Number of Words)', fontsize=12)
plt.show()
```



Review Length Vs Sentiment

Correlation:

- **Reviews with more positive sentiment tend to align with higher ratings** (e.g., 4.5–5 stars), as demonstrated by the clustering and color gradient.

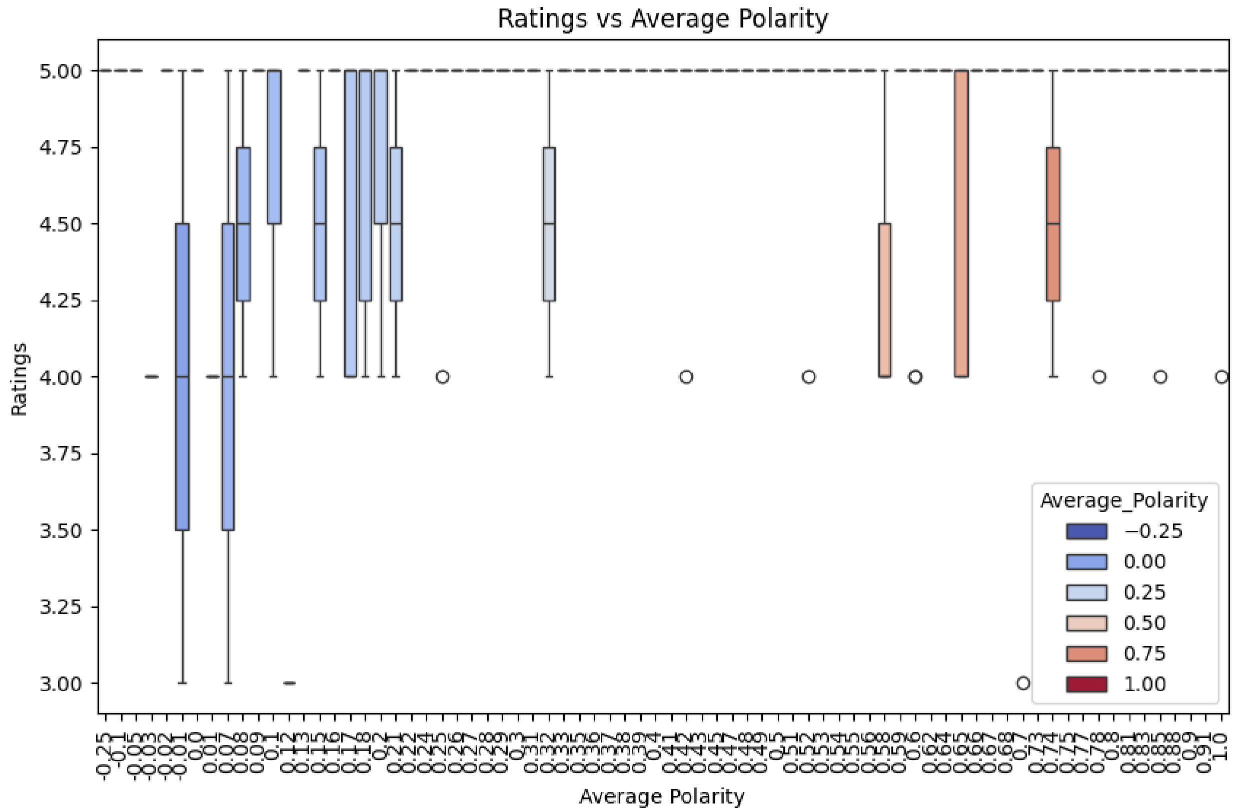
Neutral Reviews:

- **Neutral reviews are spread across various ratings**, suggesting that sentiment does not always align with the assigned star rating.

Negative Reviews:

- **Negative and extremely negative reviews typically receive lower ratings**, but they can still vary due to individual reviewer perspectives and subjective interpretation.

```
# Plotting ratings vs average polarity
plt.figure(figsize=(10, 6))
sns.boxplot(x='Average_Polarity', y='Ratings', data = df1, hue =
'Average_Polarity', palette='coolwarm')
plt.title('Ratings vs Average Polarity')
plt.xlabel('Average Polarity')
plt.ylabel('Ratings')
plt.xticks(rotation=90)
plt.show()
```



Ratings vs Average Polarity:

Positive Sentiment:

- **Shows the widest variation in review length**, with a few notable outliers.
- **The median review length is higher** than that of other sentiment categories.

Extremely Positive Sentiment:

- **Has the shortest overall review lengths**, with a tighter distribution and fewer outliers.

Neutral Sentiment:

- **Displays a narrower range of review lengths**, similar to the "Extremely Positive" sentiment group.

Negative Sentiment:

- **Exhibits a moderate range of review lengths.**
- **The median length is shorter** than "Positive" but longer than both "Extremely Positive" and "Neutral."

Interpretation:

- **Positive reviews are generally more detailed (longer)** compared to other sentiment categories.
- **Extremely positive and neutral reviews are typically short**.
- **Negative reviews vary in length** but tend to be more concise than positive ones.

5. **Reporting**:

- Summarize findings, including:
  - Overview of data collection and cleaning.
  - Sentiment Analysis Results: Distribution of sentiments, average sentiment per rating.
  - Insights: Key trends, issues, and positive highlights.
  - Recommendations: Based on sentiment, suggest areas for product improvement or marketing.

Sentiment Analysis Report: Customer Reviews of the iPhone 15 128GB on Flipkart

1. **Data Collection and Cleaning Process**

- **Data Source**: Customer reviews for the iPhone 15 128GB were gathered from Flipkart using web scraping techniques with tools such as Selenium and BeautifulSoup.
- **Data Preparation**:
  - The reviews were preprocessed by removing unnecessary characters, standardizing text formatting, and eliminating excess spaces.
  - Text data was tokenized to prepare it for further analysis.
  - Sentiments were categorized into different labels (e.g., positive, extremely positive, neutral, negative, extremely negative) using sentiment analysis methods.

2. **Sentiment Analysis Findings**

- **Sentiment Breakdown**:
  - A majority of the reviews expressed positive sentiment, followed by a smaller share of extremely positive feedback, as shown in the sentiment distribution chart.
  - Neutral and negative reviews represented a much smaller percentage of the total feedback.
- **Sentiment by Rating**:
  - Higher star ratings were generally associated with positive or extremely positive sentiments.
  - Lower star ratings tended to correspond with more neutral or negative feedback, signaling dissatisfaction among those customers.

3. **Key Insights**
   - **Positive Aspects**:
     - Customers frequently praised the **design, camera quality, and overall performance** of the iPhone 15.
     - Many reviews highlighted **improvements in battery life** as a notable positive feature.
   - **Common Complaints***:
     - Neutral and negative reviews often pointed to **pricing issues** and occasional problems with **delivery or packaging**.
     - A few customers mentioned **compatibility problems** with certain accessories and minor **software glitches**.

4. **Recommendations**
   - **Product Enhancements**
     - Address minor **software glitches** mentioned by users to improve overall experience.
     - Look into **compatibility issues** with accessories to ensure that users have a smooth and hassle-free experience.
   - **Marketing Suggestions**
     - Emphasize the **camera quality**, **battery life**, and **sleek design** in future marketing campaigns.
     - Mitigate **pricing concerns** by offering **EMI options**, **exchange offers**, or time-limited discounts to make the product more accessible.
   - **Operational Improvements**
     - Focus on enhancing **delivery services** to reduce complaints related to packaging or shipping delays.
     - Keep a close eye on **customer feedback** to swiftly identify and resolve any new issues that arise.