Feynn Labs AI Company

MOBILE PHONE RECOMMENDATION SYSTEM

By: Siva Sri Harsha Pulipati
Date: 10-7-2023

Index:

Abstract:

In today's dynamic market, the availability of numerous mobile phone models with similar features has made it challenging for average consumers to make informed purchasing decisions. The Mobile Phone Recommendation System presented in this project aims to address this issue by providing personalized recommendations based on individual preferences and requirements. It utilizes a combination of machine learning algorithms and user feedback to generate accurate and reliable recommendations.

The system begins by collecting user data through a comprehensive questionnaire that captures various aspects of the user's needs and preferences, including budget, desired features, brand preference, and usage patterns. The collected data is then processed using machine learning techniques to identify patterns and correlations between user preferences and phone attributes. This enables the system to create user profiles and build a recommendation model.

Overall, the Mobile Phone Recommendation System addresses the challenge faced by average consumers when selecting a mobile phone from a vast array of options. By leveraging machine learning techniques and user feedback, the system provides personalized recommendations that consider individual preferences and requirements. This empowers consumers with valuable insights, enabling them to make more informed decisions when purchasing a mobile phone.

1) Problem Statement:

The increasing number of mobile phone models with similar features has created a daunting challenge for average consumers in making informed purchasing decisions. The abundance of options makes it difficult for consumers to navigate through the vast array of choices and select a mobile phone that best suits their preferences and requirements. The lack of a reliable and personalized recommendation system exacerbates this issue, as consumers are left to rely on limited information and subjective reviews, often resulting in suboptimal purchases.

The absence of an efficient mobile phone recommendation system leads to several problems. Firstly, consumers are overwhelmed by the sheer number of options available in the market, making it time-consuming and confusing to compare specifications, features, and prices. This overload of information hampers the decision-making process and may lead to buyer's remorse or dissatisfaction with the purchased phone.

Secondly, consumers may not possess sufficient technical knowledge to understand the significance of various specifications and features, such as processor speed, camera quality, battery life, and operating system compatibility. Without expert guidance or a reliable recommendation system, consumers are more likely to make uninformed decisions and end up with a phone that does not meet their expectations or requirements.

Furthermore, the absence of personalized recommendations fails to consider individual preferences and usage patterns, resulting in generic suggestions that may not align with a consumer's specific needs. This lack of personalization diminishes the consumer experience and hinders the ability to find a mobile phone that truly caters to their unique requirements, budget constraints, and brand preferences.

In light of these challenges, there is a clear need for an efficient and personalized mobile phone recommendation system that utilizes advanced technologies such as machine learning and data analysis. Such a system would empower consumers by providing accurate, reliable, and personalized recommendations based on their preferences, usage patterns, and budget constraints. By addressing these issues, the recommendation system would streamline the decision-making process, reduce consumer confusion, and improve overall customer satisfaction when purchasing a mobile phone.

2) Market/Customer/Business Need Assessment:

The mobile phone market has witnessed tremendous growth and innovation over the years, resulting in a wide variety of options for consumers. However, this abundance of choices has created a need for an effective mobile phone recommendation system due to the following market, customer, and business needs:

2.1 Market Need:

a. **Overwhelming Choices:** The market is saturated with numerous mobile phone models from various brands, leading to consumer confusion and decision paralysis. Consumers are seeking a solution that simplifies the decision-making process by offering relevant and personalized recommendations.

b. **Time Efficiency:** Consumers face challenges in conducting extensive research and comparing different phone models, which can be time-consuming. There is a need for a system that saves time by providing concise and tailored recommendations based on user preferences.

c. **Increasing Complexity:** With advancing technology and new features being introduced regularly, consumers find it difficult to keep up with the latest trends and understand the technical specifications. A recommendation system can bridge this knowledge gap by offering simplified explanations and highlighting key features.

2.2 Customer Need:

a. **Personalized Recommendations:** Customers desire a recommendation system that considers their individual preferences, budget constraints, and usage patterns. They seek tailored suggestions that align with their specific needs and requirements.

b. **Enhanced Decision Making:** Customers want to make informed decisions and feel confident about their mobile phone purchases. They require reliable guidance that takes into account factors like performance, camera quality, battery life, and design, enabling them to select a phone that meets their expectations.

c. **Trust and Confidence:** Customers value trustworthy recommendations backed by reliable data and expert insights. They are more likely to rely on a recommendation system that has a proven track record of accuracy and customer satisfaction.

2.3 Business Need:

a. **Competitive Advantage:** Businesses in the mobile phone industry strive to differentiate themselves from competitors by offering value-added services. A mobile phone recommendation system can be a unique selling point, attracting customers and enhancing brand loyalty.

b. **Improved Customer Experience:** By providing personalized recommendations, businesses can enhance the overall customer experience, leading to increased customer satisfaction, repeat purchases, and positive word-of-mouth.

c. **Data-driven Insights:** A recommendation system generates valuable data on customer preferences, buying behavior, and market trends. Businesses can leverage this data to gain insights into consumer demands, optimize their product offerings, and implement targeted marketing strategies.

In summary, there is a clear market, customer, and business need for a mobile phone recommendation system. By addressing these needs, such a system can simplify the decision-making process, provide personalized recommendations, improve customer satisfaction, and offer businesses a competitive edge in the dynamic mobile phone market.

3) Target Specifications and Characterization:

To effectively address the market and customer needs identified earlier, the mobile phone recommendation system should possess the following specifications and characteristics:

1. **Personalization:** The system should capture and analyze individual customer preferences, including budget constraints, desired features, brand preferences, and usage patterns, to provide personalized recommendations.

2. **Comprehensive Database:** The system needs an extensive and up-to-date database of mobile phone models, including specifications, features, performance metrics, and customer reviews, to generate accurate recommendations.

3. **Machine Learning Algorithms:** The system should use machine learning algorithms to analyze customer data, identify patterns, and make accurate predictions for improved recommendation accuracy.

4. **User-Friendly Interface:** The system should have an intuitive and user-friendly interface that allows customers to input preferences, view recommendations, and compare phone models easily.

5. **Trust and Transparency:** The system should inspire trust and transparency by providing reliable recommendations backed by data and explanations for its suggestions.

By incorporating these specifications and characteristics, the mobile phone recommendation system can effectively address the market and customer needs, enabling personalized recommendations, informed decision-making, and improved customer satisfaction.

4) External Search:

4.1 Datasets:

- https://datasetsearch.research.google.com/search?src=0&query=mobile%20phone&docid=L2cvMTF0ZGh2NV9ibA%3D%3D
- https://github.com/theomkale/Mobile_Recommendation_System/blob/main/mainDataset.csv

4.2 References:

- https://www.kaggle.com/code/mohitkumar409/smartphone-recommendation-system/notebook
- ChatGPT

5) Benchmarking Alternate Products:

When comparing the mobile phone recommendation system with existing market alternatives, it is important to address the challenges they face. Many existing companies may skew data and provide false predictions, undermining the accuracy and reliability of their recommendations. Here's a concise comparison:

Comparison Criteria	Existing Alternatives	Proposed Mobile Phone Recommendation System
Bias and Data Manipulation	Skewed data and false predictions may be prevalent	Utilizes transparent and unbiased algorithms
Reliability of Recommendations	Reviews may be biased or unverified	Relies on verified data and expert insights
Personalization	Limited personalization in recommendations	Tailors recommendations to individual needs
Commercial Interests	May prioritize specific brands/models for profit	Offers an unbiased approach with diverse options
Expert Insights	Expert opinions may not consider individual preferences	Combines expertise with personalized recommendations
Customer Satisfaction	Mixed feedback due to inaccuracies or biases	Emphasizes accuracy, transparency, and personalization

6) Applicable Patents :

the requirements for patentability of a ML-based phone recommendation system in points:

- **Novelty:** The invention must be new.
- **Non-obviousness:** The invention must not be obvious to a person skilled in the art.
- **Usefulness:** The invention must be capable of being used in some way.

Here are some examples of patents that have been granted for ML-based phone recommendation systems:

- US Patent 9,489,886: "System and method for recommending mobile phones"
- US Patent 9,332,938: "Method and system for recommending mobile phones based on user preferences"
- US Patent 9,153,808: "Method and system for recommending mobile phones based on user usage patterns"

We can go for a patent after incorporating additional innovative functionalities that may be eligible for patent protection, it is advisable to consult with a qualified patent attorney or intellectual property professional.

7) Applicable Regulations :

When developing a mobile phone recommendation system or any product/service, it's important to consider and comply with applicable government regulations and environmental standards. Here are some key regulatory areas to consider:

- **Data Privacy and Protection:** Ensure compliance with data privacy regulations such as the General Data Protection Regulation (GDPR) in the European Union or the California Consumer Privacy Act (CCPA) in the United States. Implement appropriate data protection measures and obtain user consent for data collection and processing.

- **Intellectual Property Rights:** Respect intellectual property rights by avoiding infringement of existing patents, trademarks, copyrights, or trade secrets. Conduct proper due diligence and consult with legal experts to ensure your system does not violate any intellectual property regulations.

- **Consumer Protection Laws:** Adhere to consumer protection laws that govern product/service warranties, guarantees, refund policies, and fair trade practices. Provide clear and accurate information to consumers regarding the capabilities and limitations of the mobile phone recommendation system.

- **Anti-Discrimination Regulations:** Ensure that the recommendation system does not discriminate against individuals based on protected characteristics such as race, gender, age, religion, or disability. Avoid bias in recommendations and ensure fairness and inclusivity.

- **Environmental Regulations:** Consider environmental regulations related to mobile phone manufacturing, recycling, and disposal. Comply with regulations regarding hazardous substances (e.g., RoHS - Restriction of Hazardous Substances) and promote environmentally responsible practices throughout the product lifecycle.

- **International Trade and Export Controls:** Comply with international trade regulations and export control laws when distributing or selling the mobile phone recommendation system in different countries. Obtain necessary licenses and adhere to trade restrictions imposed by respective governments.

It's crucial to conduct thorough research and consult with legal professionals who specialize in the specific regulatory requirements of the jurisdictions you plan to operate in. This will help ensure compliance with relevant laws and regulations, minimize legal risks, and demonstrate ethical business practices.

8) Applicable Constraints:

- **Space and Infrastructure:** Consider physical space and necessary infrastructure for hosting and operating the recommendation system**.**

- **Budgetary Constraints:** Account for budget limitations in development, deployment, and maintenance costs.

- **Technical Expertise:** Assess the required level of expertise and availability of skilled professionals.

- **Data Availability and Quality:** Consider data accessibility, accuracy, completeness, and reliability for training and validating the system.

- **Regulatory Compliance:** Ensure compliance with relevant regulations and legal constraints.
- **Time Constraints:** Consider project timelines and delivery schedules.

Keeping these constraints in mind will help guide the development process and ensure that the mobile phone recommendation system is implemented within the available resources and adheres to applicable limitations.

9) Business Model (Monetization Idea):

To prioritize a good user experience and maintain an ad-free environment within the mobile phone recommendation system, the monetization strategy can focus on alternative revenue streams. Here are monetization ideas that aligns with my preference:

Affiliate Marketing and Commission-Based Sales:

- Establish partnerships with mobile phone retailers, manufacturers, or e-commerce platforms.
- Enable consumers to make purchases directly from specific retailers through the recommendation system.
- Earn a commission from the retailer for each sale generated through the system's referral links or codes.

Additional monetization ideas could include:

Premium Subscription Model:

- Offer a premium subscription tier that provides users with additional benefits and exclusive features.
- Subscribers gain access to advanced filtering options, personalized recommendations, or priority customer support.
- Charge a recurring subscription fee to generate revenue from premium subscribers.

Data Licensing and Analytics:

- Aggregate and anonymize the data collected through the recommendation system.
- Offer valuable consumer insights and market research to mobile phone manufacturers, retailers, or other businesses.
- Generate revenue through data licensing agreements or by providing customized analytics services.

White-Label Solution:

- Offer the mobile phone recommendation system as a white-label solution to mobile phone retailers or e-commerce platforms.
- Allow them to integrate the system into their websites or applications.
- Generate revenue through licensing fees or revenue-sharing arrangements with partners using the technology.

By focusing on affiliate marketing, offering premium subscription options, and providing data licensing services, the mobile phone recommendation system can generate revenue without relying heavily on intrusive advertisements. This approach ensures a positive user experience while still enabling monetization and supporting the sustainability of the system.

10) Concept Generation:

The process of generating the idea for a mobile phone recommendation system stemmed from personal experiences and identified pain points. Here's an overview of the concept generation process :

- **Identifying a Common Problem:** Recognizing a recurring problem faced by myself, friends, and family members when it comes to choosing a mobile phone. The difficulty arises from the overwhelming number of options available with similar features, making it challenging to make an informed decision.

- **Empathy and Understanding:** Putting myself in the shoes of those seeking recommendations and empathizing with their struggle. Understanding the frustration and time-consuming nature of comparing numerous phone models, especially when they offer similar features.

- **Personalization and Tailored Approach:** Recognizing the importance of personalization in recommendations to address individual preferences, budgets, and usage patterns. Understanding the value of a tailored approach to ensure that consumers find the right phone that suits their specific needs.

11) Concept Development:

Project Description:

- The mobile phone recommendation system is a web-based or mobile application designed to assist users in selecting the most suitable mobile phone from a vast range of options available in the market.
- The system utilizes advanced algorithms and user preferences to generate personalized recommendations based on individual needs, budgets, and usage patterns.

Project Objective:

- The primary objective is to simplify the mobile phone selection process for consumers by providing accurate and personalized recommendations.
- The system aims to save users time and effort by offering a curated list of mobile phone options that best align with their preferences and requirements.

Project Approach and Methodology:

- Data Collection: Gather comprehensive data on mobile phone models, including specifications, features, performance metrics, and customer reviews, from reliable sources and update the database regularly.
- User Preferences: Develop a user-friendly interface for users to input their preferences, such as desired features, price range, brand preferences, and usage requirements.
- Recommendation Engine: Utilize machine learning algorithms and collaborative filtering techniques to analyze user preferences and generate tailored recommendations.
- User Interface Design: Design an intuitive and visually appealing interface that allows users to view recommended options, compare specifications, read customer reviews, and make informed decisions.
- Testing and Optimization: Conduct extensive testing to ensure the accuracy and effectiveness of the recommendation engine, refine algorithms, and improve user experience based on user feedback.

Risk Assessment:

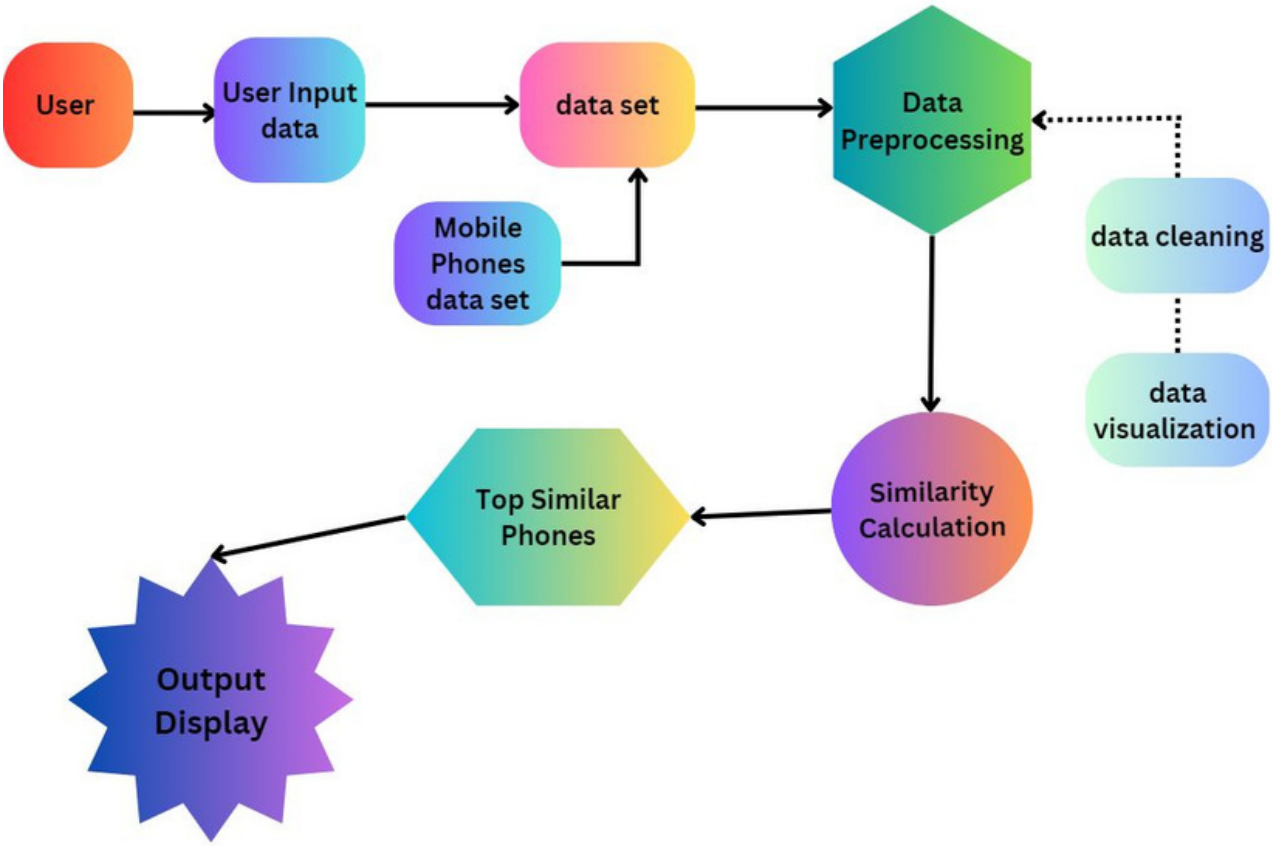
- Data Privacy: Implement stringent security measures to protect user data and ensure compliance with data protection regulations.
- Accuracy of Recommendations: Continuously monitor and improve the recommendation algorithms to enhance accuracy and relevance.
- Technical Challenges: Address potential technical hurdles such as database management, scalability, and optimization to ensure seamless performance and responsiveness.

Features of the App:

- **User Profile Creation:** Allow users to create profiles and input their preferences and requirements.
- **Recommendation Generation:** Generate personalized mobile phone recommendations based on user preferences and specifications.
- **Product Database:** Maintain a comprehensive and up-to-date database of mobile phone models, including detailed specifications and customer reviews.
- **Comparison Tools:** Enable users to compare different phone models based on features, price, performance, and customer ratings.
- **User Reviews and Ratings:** Provide a platform for users to share their experiences and ratings for different mobile phones.
- **Notifications and Alerts:** Offer price drop notifications or updates on new releases that match users' preferences.
- **User Feedback Mechanism:** Allow users to provide feedback on recommended phones, helping to improve the system's accuracy and relevance over time.

12) Final Product Prototype :

Schematic Diagram:



- **User Interface:** The user interacts with the system through a user interface, which could be a web application, mobile app, or any other suitable interface. The interface allows the user to input their preferences for various phone features.

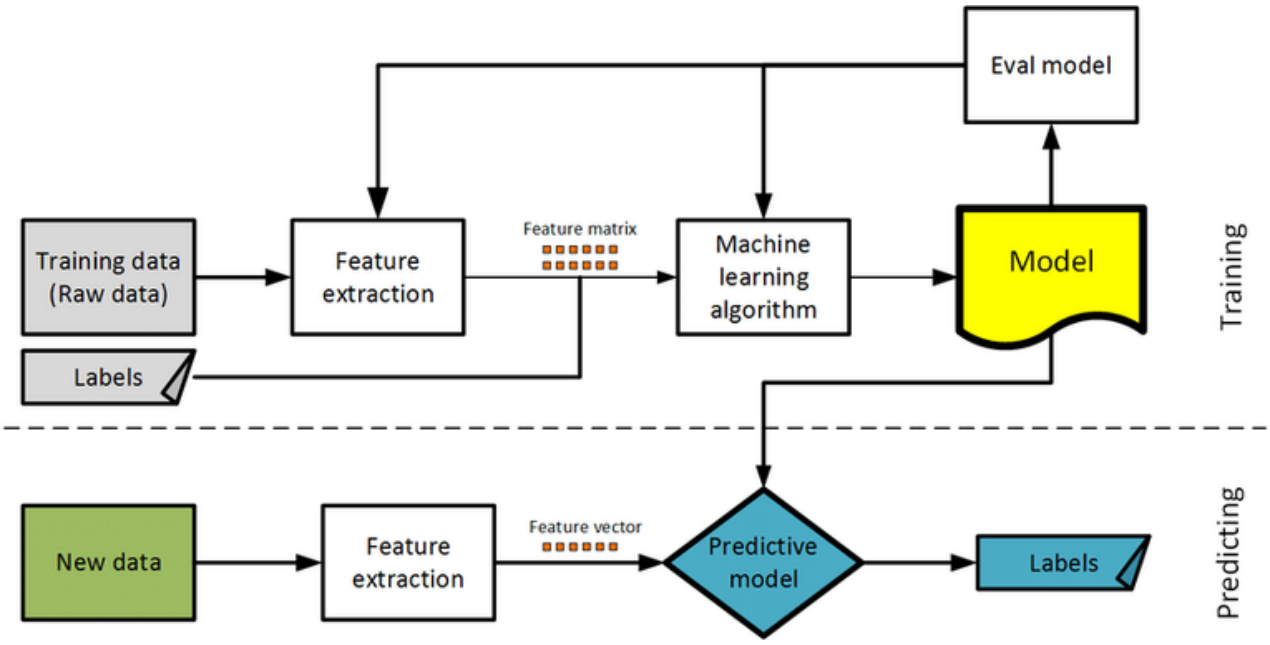
- **Input Processing:** The user's preferences are received and processed by the system. The input processing module extracts the relevant data, such as the user's preferred price range, rating, RAM, ROM, size, camera specifications, and battery capacity.

- **Data Preprocessing:** The input data is preprocessed to prepare it for similarity calculation. This includes converting the data into a suitable format and combining the selected features into a single representation.

- **Similarity Calculation:** The preprocessed data is used to calculate the cosine similarity between the user's preferences and the phones available in the dataset. The cosine similarity algorithm measures the similarity between two vectors by calculating the cosine of the angle between them.

- **Top Similar Phones:** The phones with the highest similarity scores are selected as the top similar phones. The system retrieves the names of these phones from the dataset.

- **Output Display:** The top similar phones are displayed to the user through the user interface. The user can view the names of the recommended phones along with their corresponding index numbers.



13) Product details:

How does it work?

- The mobile phone recommendation system works by leveraging user preferences and a dataset of mobile phone features.
- Users input their preferences, such as budget, desired specifications, and usage requirements.
- The system combines these preferences with the dataset and applies content-based filtering techniques.
- It calculates the similarity between mobile phones based on their features using cosine similarity.
- The system then recommends the top similar phones to the user, excluding their own input.

Data Sources:

- The data for the mobile phone recommendation system can come from various sources, including:
- Official websites of mobile phone manufacturers.
- E-commerce platforms that provide mobile phone listings and specifications.
- User-generated reviews and ratings.
- Tech publications and industry reports.
- https://datasetsearch.research.google.com/search?src=0&query=mobile%20phone&docid=L2cvMTF0ZGh2NV9ibA%3D%3D
- https://github.com/theomkale/Mobile_Recommendation_System/blob/main/mainDataset.csv

Algorithms, Frameworks, Software, etc. needed:

- **CountVectorizer:** From the scikit-learn library, it is used to convert text data into a numerical representation.
- **Cosine Similarity:** Also from scikit-learn, it measures the similarity between vectors based on the cosine of the angle between them.
- **Pandas:** A popular data manipulation library used for data handling and preprocessing.
- **NumPy:** A library for numerical computations and array operations.
- **Python:** The programming language used to develop the system.
- **Web development frameworks:** If building a web-based application, frameworks like Django or Flask can be used for backend development.
- **Database management system:** Depending on the scale and requirements, a suitable database management system like MySQL or PostgreSQL may be utilized.

Team required to develop:

- The development team typically consists of:
- Data scientists or machine learning engineers for algorithm development and recommendation engine implementation.
- Backend developers for building the server-side logic and API integration.
- Frontend developers for creating the user interface and ensuring a seamless user experience.
- Quality assurance engineers for testing and debugging.
- UX/UI designers for designing an intuitive and visually appealing interface.
- Project managers to oversee the development process and ensure timely delivery.

Cost:

- The cost of developing a mobile phone recommendation system can vary based on several factors, including:
- Complexity of the system and its features.
- Size and expertise of the development team.
- Integration with external data sources and APIs.
- Development time and effort required.

14) Code Implementation:

Understanding the data:

```
# importing required libraries
import pandas as pd
import numpy as np
import seaborn as sns
import matplotlib.pyplot as plt
from sklearn.feature_extraction.text import CountVectorizer
from sklearn.metrics.pairwise import cosine_similarity
```

```
# getting the dataset
df = pd.read_csv('/content/mainDataset.csv', encoding='unicode_escape')

df.head()
```

	Name	Rating	Price Rs	RAM Gb	ROM Gb	Expandable GB	Size Cm	Size Inch	R1 Cam MP	R2 Cam MP	R3 Cam MP	R4 Cam MP	Battery Mah	Proce
0	Realme Narzo 20 (Victory Blue, 128 GB)	4.5	11,499	4	128	256.0	16.56	6.52	48.0	8.0	2	NaN	6000	MediaTek G85 Proce
1	Realme Narzo 20 (Victory Blue, 64 GB)	4.5	10,499	4	64	256.0	16.56	6.52	48.0	8.0	2	NaN	6000	MediaTek G85 Proce
2	Realme Narzo 20 (Glory Sliver, 128 GB)	4.5	11,499	4	128	256.0	16.56	6.52	48.0	8.0	2	NaN	6000	MediaTek G85 Proce
3	Realme Narzo 20 (Glory Sliver, 64 GB)	4.5	10,499	4	64	256.0	16.56	6.52	48.0	8.0	2	NaN	6000	MediaTek G85 Proce
4	POCO M2 (Pitch Black, 64 GB)	4.4	10,999	6	64	512.0	16.59	6.53	13.0	8.0	5	2.0	5000	MediaTek G80 Proce

```
[4]  df.info()
```

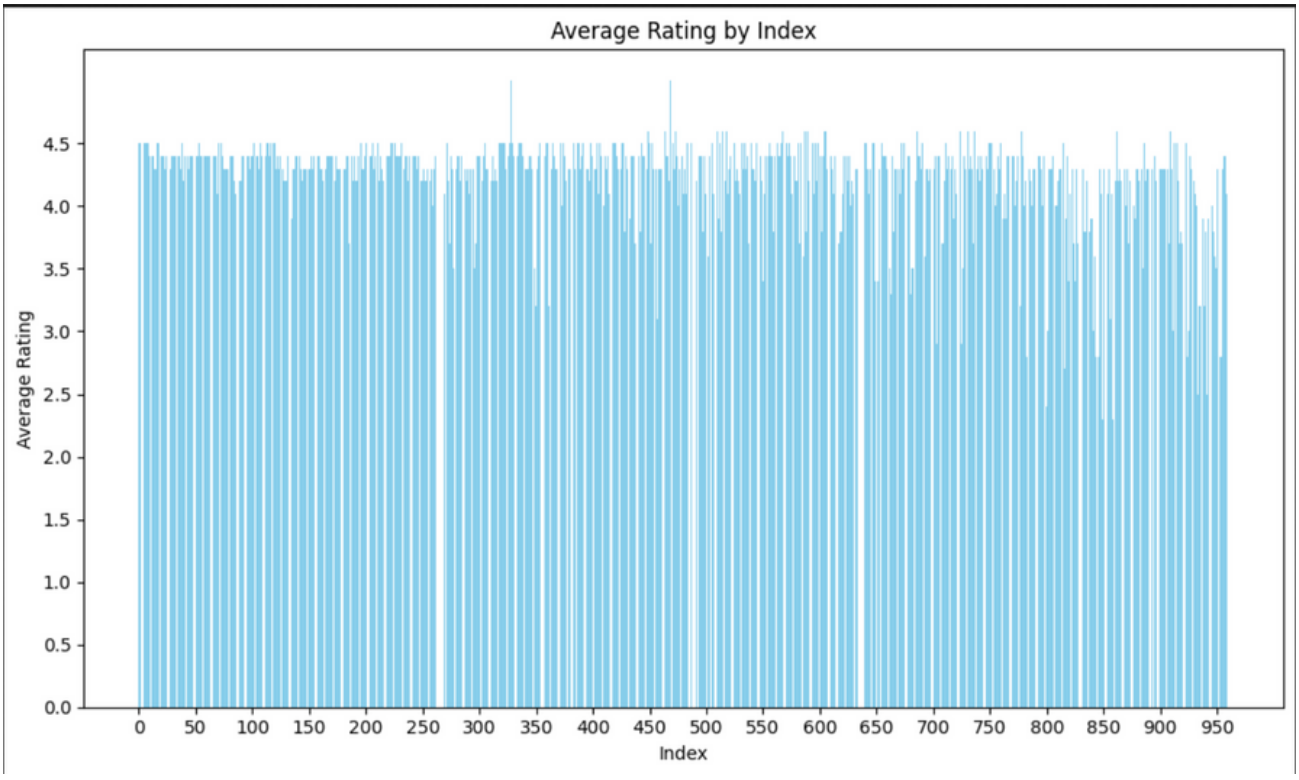
```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 961 entries, 0 to 960
Data columns (total 15 columns):
 #   Column         Non-Null Count  Dtype
---  ------         --------------  -----
 0   Name           961 non-null    object
 1   Rating         936 non-null    float64
 2   Price Rs       959 non-null    object
 3   RAM Gb         961 non-null    int64
 4   ROM Gb         961 non-null    int64
 5   Expandable GB  715 non-null    float64
 6   Size Cm        961 non-null    float64
 7   Size Inch      961 non-null    float64
 8   R1 Cam MP      961 non-null    float64
 9   R2 Cam MP      619 non-null    float64
 10  R3 Cam MP      362 non-null    object
 11  R4 Cam MP      205 non-null    float64
 12  Battery Mah    961 non-null    int64
 13  Processor      961 non-null    object
 14  Image          961 non-null    object
dtypes: float64(7), int64(3), object(5)
memory usage: 112.7+ KB
```

```
[6]  df.shape

     (961, 15)

[7]  # Data preprocessing
     df['Rating'] = pd.to_numeric(df['Rating'])
     df['Price Rs'] = df['Price Rs'].str.replace(',', '').astype(float)
     df['RAM Gb'] = pd.to_numeric(df['RAM Gb'])
     df['ROM Gb'] = pd.to_numeric(df['ROM Gb'])
     df['Size Inch'] = pd.to_numeric(df['Size Inch'])
     df['R1 Cam MP'] = pd.to_numeric(df['R1 Cam MP'])
     df['Battery Mah'] = pd.to_numeric(df['Battery Mah'])
```

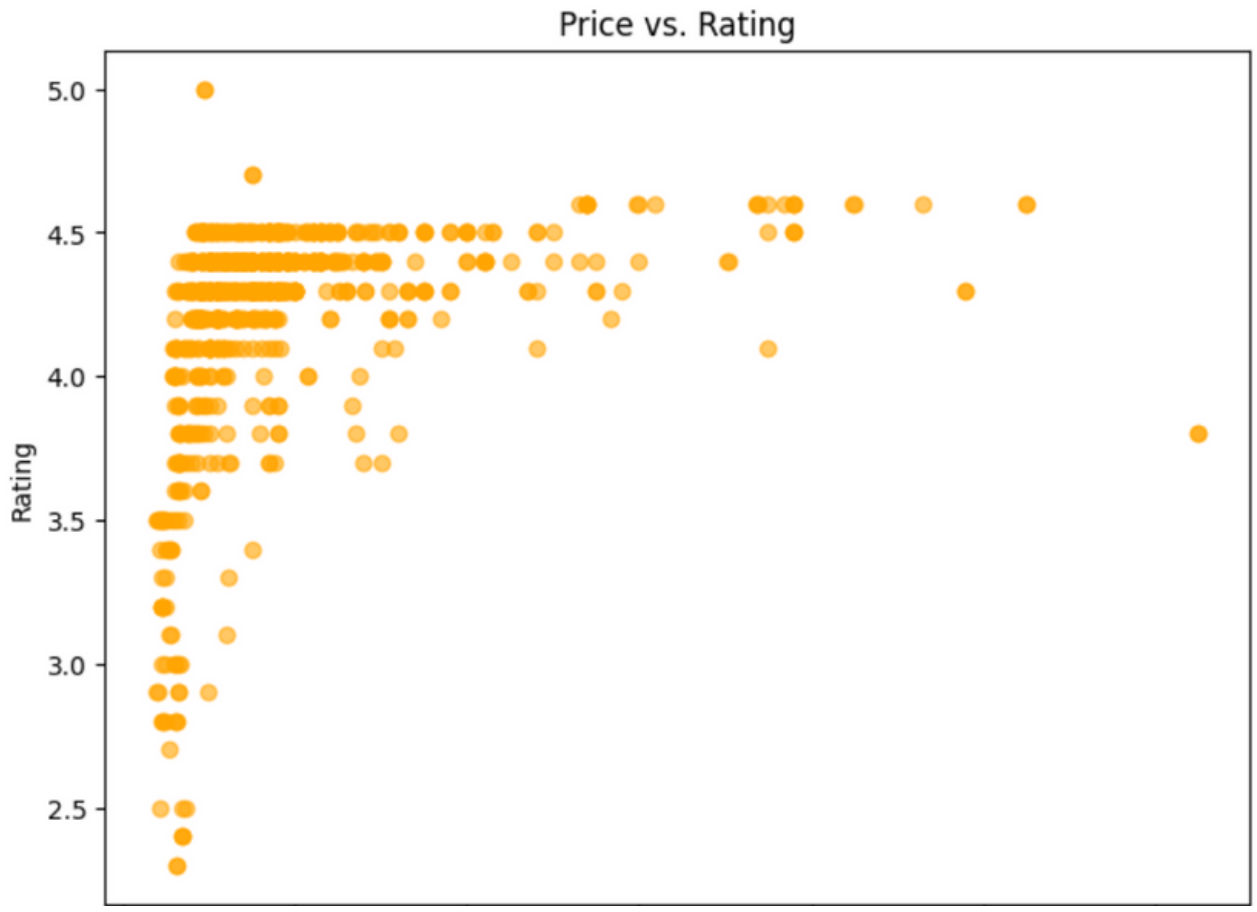
Simple EDA/ Data Visualization:

Benchmarking and visualizations

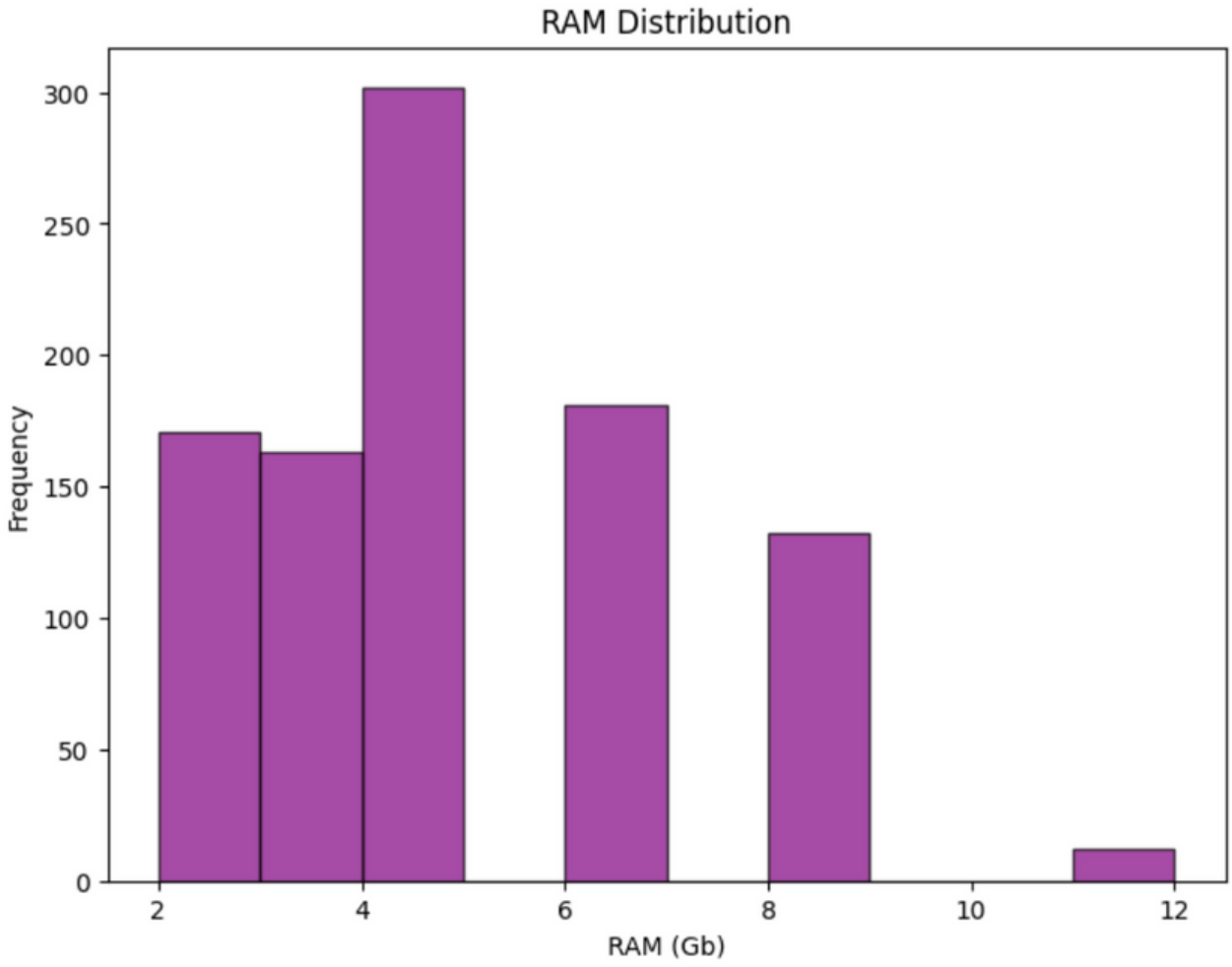
```
# Bar graph: Average Rating by Index
average_rating_by_index = df['Rating']
plt.figure(figsize=(10, 6))
plt.bar(df.index, average_rating_by_index, color='skyblue')
plt.title('Average Rating by Index')
plt.xlabel('Index')
plt.ylabel('Average Rating')
plt.xticks(np.arange(0, len(df.index), 50))
plt.yticks(np.arange(0, 5, 0.5))
plt.tight_layout()
plt.show()
```



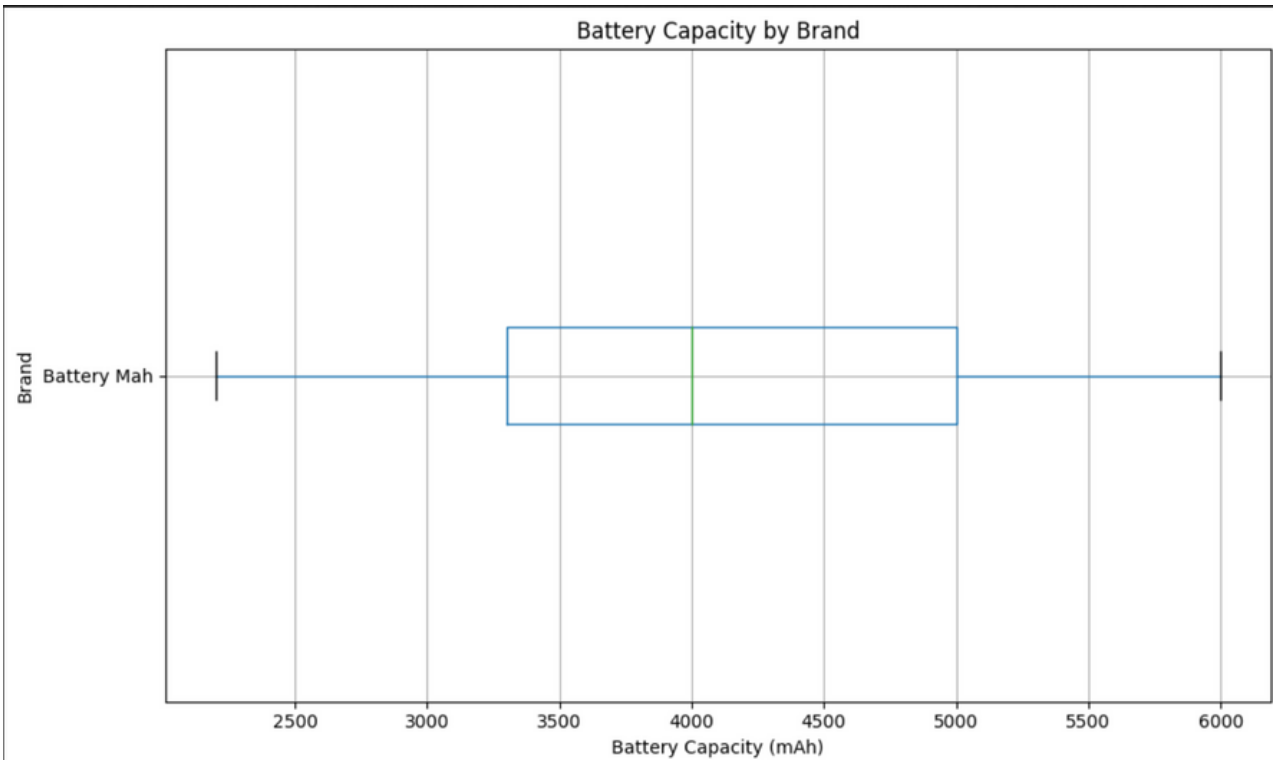
```
# Scatter plot: Price vs. Rating
plt.figure(figsize=(8, 6))
plt.scatter(df['Price Rs'], df['Rating'], color='orange', alpha=0.6)
plt.title('Price vs. Rating')
plt.xlabel('Price (Rs)')
plt.ylabel('Rating')
plt.show()
```



```
# Histogram: RAM Distribution
plt.figure(figsize=(8, 6))
plt.hist(df['RAM Gb'], bins=10, color='purple', edgecolor='black', alpha=0.7)
plt.title('RAM Distribution')
plt.xlabel('RAM (Gb)')
plt.ylabel('Frequency')
plt.show()
```

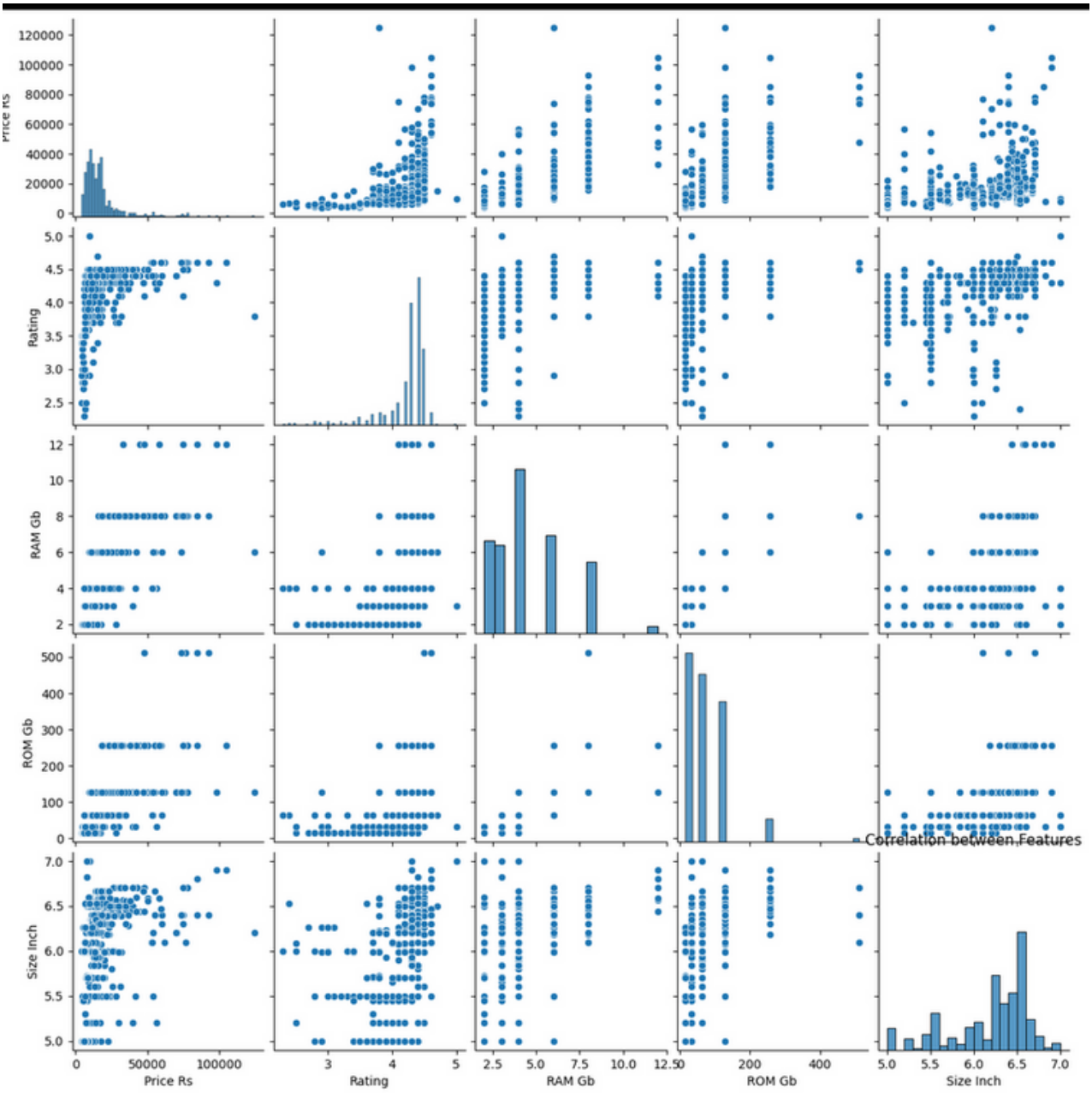


```
[11] # Box plot: Battery Capacity by Brand
     plt.figure(figsize=(10, 6))
     df.boxplot(column='Battery Mah', vert=False)
     plt.title('Battery Capacity by Brand')
     plt.xlabel('Battery Capacity (mAh)')
     plt.ylabel('Brand')
     plt.tight_layout()
     plt.show()
```

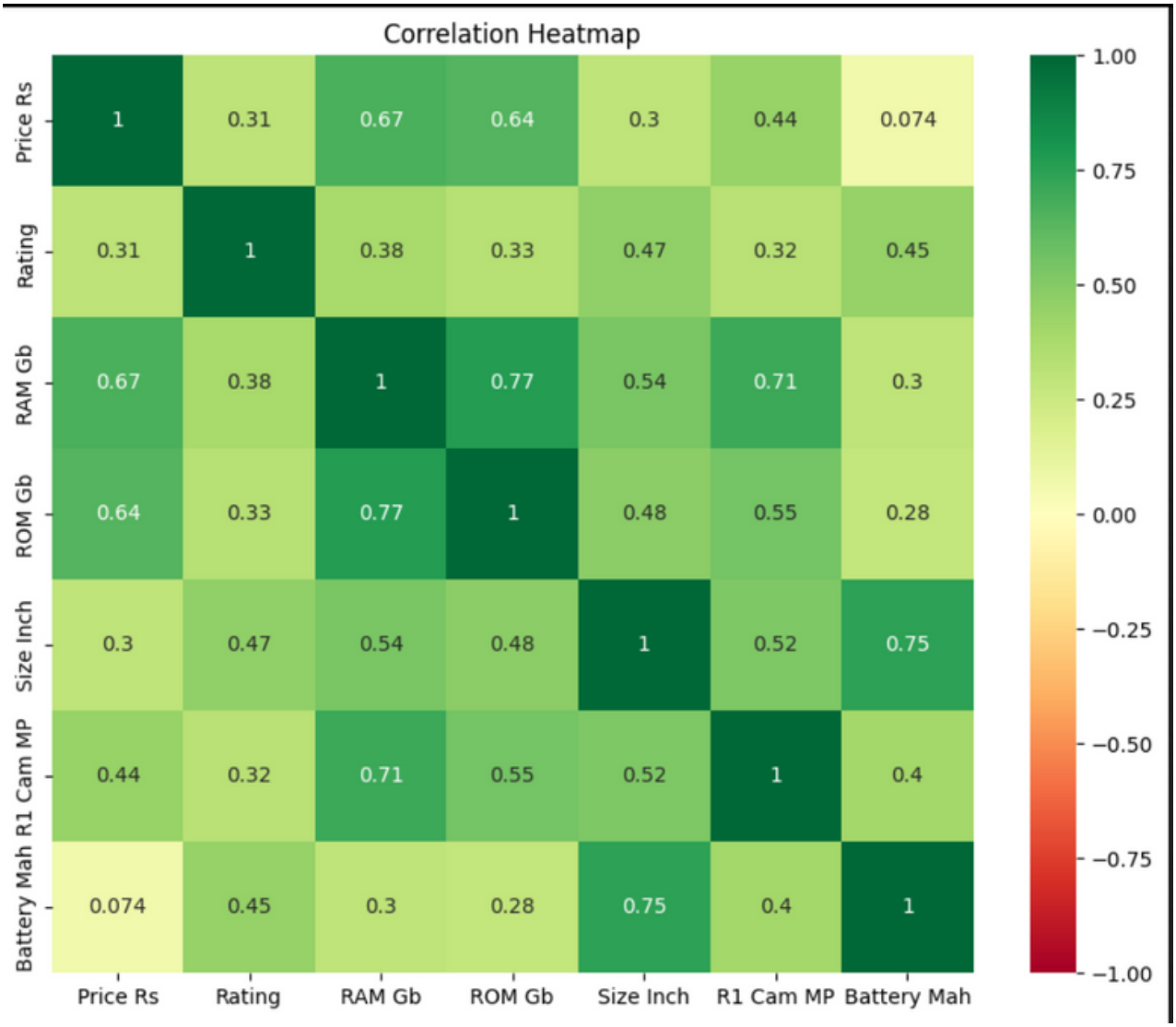


14s

```
# Pairplot: Correlation between features
feature_subset = ['Price Rs', 'Rating', 'RAM Gb', 'ROM Gb', 'Size Inch']
sns.pairplot(df[feature_subset])
plt.title('Correlation between Features')
plt.show()
```



```
# Calculate the correlation matrix
correlation_matrix = df[features].corr()

# Plot the heat map
plt.figure(figsize=(10, 8))
sns.heatmap(correlation_matrix, annot=True, cmap='RdYlGn', vmin=-1, vmax=1)
plt.title('Correlation Heatmap')
plt.show()
```



Getting User Data:

```
# User Requirements and preferences

user_data = {
    "Name": ['harsha'],
    "Rating": [4],
    "Price Rs": [20000],
    "RAM Gb": [8],
    "ROM Gb": [128],
    "Expandable GB": [' '],
    "Size Cm": [' '],
    "Size Inch": [6.52],
    "R1 Cam MP": [58],
    "R2 Cam MP": [' '],
    "R3 Cam MP": [' '],
    "R4 Cam MP": [' '],
    "Battery Mah": [5000],
    "Processor": 'snapdragon ',
    "Image": ' '
}
user_df = pd.DataFrame(user_data);

df = pd.concat([user_df, df], ignore_index=True)
```

Feature Selection:

```
#Features Selection
features = ['Price Rs', 'Rating', 'RAM Gb', 'ROM Gb', 'Size Inch', 'R1 Cam MP', 'Battery Mah']
print(features)
```

```
['Price Rs', 'Rating', 'RAM Gb', 'ROM Gb', 'Size Inch', 'R1 Cam MP', 'Battery Mah']
```

```
[14] #replacing the null values with null string
     for feature in features:
       df[feature] = df[feature].fillna('')
```

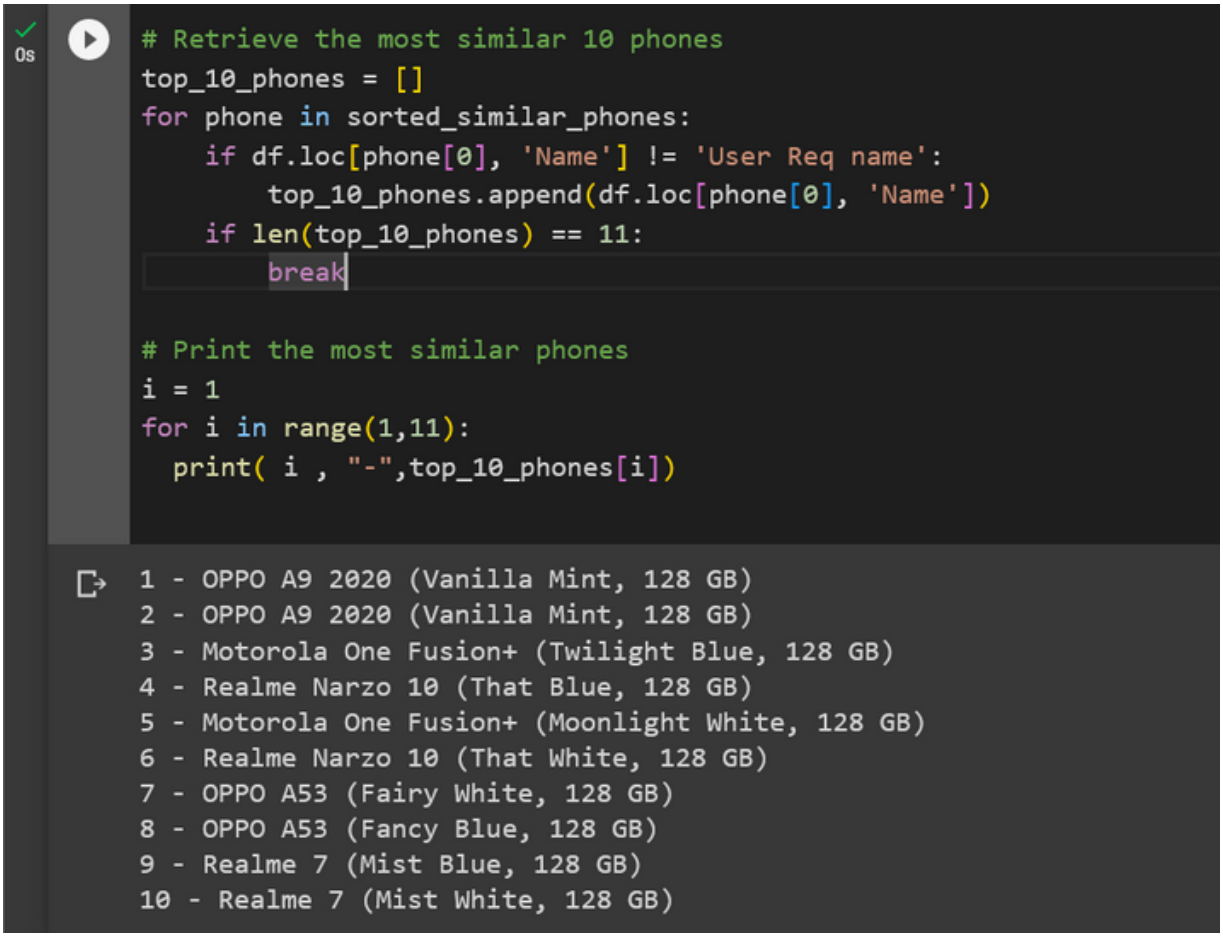
```
[15] # Create a column which will contain all these features
     def combineFeatures(row):
         return ' '.join([str(row[feature]) for feature in features])

     # This will create a separate column of combined features
     df["combinedFeatures"] = df.apply(combineFeatures, axis=1)
```

Similarity Calculation:

```
[17] cv = CountVectorizer()
     count_matrix = cv.fit_transform(df['combinedFeatures'])

[18] # Calculate cosine similarity
     similar = cosine_similarity(count_matrix)

     print(similar)

     [[1.        0.4       0.2       ... 0.        0.        0.       ]
      [0.4       1.        0.6       ... 0.        0.        0.       ]
      [0.2       0.6       1.        ... 0.        0.        0.2236068]
      ...
      [0.        0.        0.        ... 1.        0.25      0.5      ]
      [0.        0.        0.        ... 0.25      1.        0.25     ]
      [0.        0.        0.2236068 ... 0.5       0.25      1.       ]]

[20] print(similar.shape)

     (962, 962)

[21] # Get indices of similar phones
     similar_phones = list(enumerate(similar[0]))
```

```
[22] # Sort the entries according to similarity scores
     sorted_similar_phones = sorted(similar_phones, key=lambda x: x[1], reverse=True)
     similarity_matrix = pd.DataFrame(similar, columns=df['Name'], index=df['Name'])
```

Output Display:



```
# Retrieve the most similar 10 phones
top_10_phones = []
for phone in sorted_similar_phones:
    if df.loc[phone[0], 'Name'] != 'User Req name':
        top_10_phones.append(df.loc[phone[0], 'Name'])
    if len(top_10_phones) == 11:
        break

# Print the most similar phones
i = 1
for i in range(1,11):
  print( i , "-",top_10_phones[i])
```

```
1 - OPPO A9 2020 (Vanilla Mint, 128 GB)
2 - OPPO A9 2020 (Vanilla Mint, 128 GB)
3 - Motorola One Fusion+ (Twilight Blue, 128 GB)
4 - Realme Narzo 10 (That Blue, 128 GB)
5 - Motorola One Fusion+ (Moonlight White, 128 GB)
6 - Realme Narzo 10 (That White, 128 GB)
7 - OPPO A53 (Fairy White, 128 GB)
8 - OPPO A53 (Fancy Blue, 128 GB)
9 - Realme 7 (Mist Blue, 128 GB)
10 - Realme 7 (Mist White, 128 GB)
```

GitHub Link :

https://github.com/sivasriharshapulipati/Mobile-recommondation-sys

15) Conclusion:

The mobile phone recommendation system addresses the challenge faced by consumers in choosing the right mobile phone from a vast array of options with similar features. The system utilizes advanced algorithms, user preferences, and a comprehensive dataset to generate personalized recommendations tailored to individual needs and preferences.

Through the development and implementation of the system, several key aspects have been addressed. The system incorporates content-based filtering and cosine similarity to calculate the similarity between mobile phones, enabling accurate and relevant recommendations. The data for the system is sourced from various reliable sources, including manufacturers' websites, e-commerce platforms, user reviews, and tech publications.

The development team, comprising data scientists, backend and frontend developers, QA engineers, UX/UI designers, and project managers, collaboratively worked to bring the mobile phone recommendation system to fruition. Their expertise and collective effort ensured the system's functionality, usability, and seamless user experience.

While the cost of development may vary depending on factors such as system complexity, team size, data integration, and infrastructure requirements, the mobile phone recommendation system proves to be a valuable tool for consumers seeking guidance in their mobile phone purchasing decisions.

Overall, the mobile phone recommendation system simplifies the decision-making process, saves time, and assists users in making informed choices. By leveraging cutting-edge technology, user preferences, and a comprehensive dataset, the system enhances the user experience and empowers consumers in navigating the vast and ever-evolving mobile phone market.