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Dr. Virendra Swarup Institute of Computer Studies

(An Institute of Computer Application & Management)

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Project Report

ON

Python-Diwali-Sales-Analysis

Master of Computer Application (MCA 2022-2024)



Submitted To -

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CONTENTS

SERIAL NO.	DESCRIPTION	PAGE NO.
1.	Acknowledgement	3
2.	Training Certificate	4
3.	Plagiarism Report	5
4.	Title & Introduction & Objective of Project	6-8
5.	Project Category, Tools & Platform used & Technical Details	8-9
6.	Hardware and Software Requirement	10-11
7.	Feasibility Study	12-13
8.	System Design	14
9.	Database Designs	14
10.	Data Flow Diagram	15-17
11.	Tools and Technologie	18
12.	Module Description	19
13.	Coding	20-176
14.	Screenshots	177-185
15.	Testing	186-187
16.	Implementation and maintenance	188-189
17.	System Security Measure	190-191
18.	Future Scope of the Project	192
19.	Glossary	193
20.	Bibliography	194

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Mr. Rahul Agnihotri
[HOD-MCA]

.....
Mr.Kamlesh C. Sharma
[Project Coordinator]

TRAINING CERTIFICATE



Jan 21, 2024

Mohd Faraj

has successfully completed

Google Cloud Big Data and Machine Learning
Fundamentals

an online non-credit course authorized by Google Cloud and offered through Coursera

Google Cloud Training

COURSE
CERTIFICATE



Verify at:

<https://coursera.org/verify/BXC84J2P5Q3M>

Coursera has confirmed the identity of this individual and their participation in the course.

PLAGIARISM REPORT



PLAGIARISM SCAN REPORT



Content Checked For Plagiarism

INTRODUCTION

Diwali Sales Analysis is a project designed to explore and understand the consumer behavior and sales trends during Diwali, one of India's most celebrated festivals. Known as the Festival of Lights, Diwali involves traditions such as decorating homes, lighting oil lamps (diyas), bursting fireworks, and, importantly, exchanging gifts. This gift-giving tradition leads to a significant increase in consumer spending, making Diwali a crucial period for retailers.

During Diwali, retail sales surge as consumers purchase items like electronics, apparel, jewelry, and home decor. Retailers capitalize on this by offering discounts and promotions. Understanding these consumer patterns is essential for optimizing business strategies and maximizing sales.

The Diwali Sales Analysis project aims to analyze sales data from past Diwali seasons to uncover insights into sales trends, consumer preferences, and purchasing behavior. By utilizing data analysis tools and techniques, this project seeks to provide a detailed understanding of Diwali's impact on the retail sector and identify opportunities for businesses to enhance their performance during this lucrative period.

The project's significance lies in its ability to offer actionable insights for retailers. By identifying peak sales periods, businesses can manage their inventory more effectively, ensuring popular items are well-stocked to meet demand. Additionally, understanding which product categories see the highest sales can help retailers focus their promotional efforts on these items, boosting overall sales.

The project also examines customer demographics to understand the characteristics of Diwali shoppers. Analyzing factors such as age, gender, and location allows retailers to tailor their marketing strategies to target specific customer segments. For instance, if data shows younger consumers are more active during Diwali, businesses can prioritize digital marketing on social media platforms popular among this demographic.

Tools and technologies used in this project include Python, Jupyter Notebook, NumPy, Pandas, Matplotlib, and Seaborn. Python's extensive libraries and robust community support make it ideal for data analysis. Jupyter Notebook offers an interactive environment for coding, data visualization, and documentation. NumPy and Pandas are essential for data manipulation, while Matplotlib and Seaborn are used to create informative visualizations.

Data preprocessing is critical for ensuring accuracy. This involves cleaning the raw sales data by removing duplicates, handling missing values, and standardizing formats. Exploratory Data Analysis (EDA) is then conducted to gain initial insights and identify anomalies.

In conclusion, the Diwali Sales Analysis project aims to provide valuable insights into consumer behavior and sales trends during Diwali. The findings will help retailers optimize their strategies, ensuring they meet consumer demands and

TITLE OF THE PROJECT

**“Python-Diwali-Sales-
Analysis”**

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OBJECTIVES

The primary objectives of this Diwali sales analysis project are:

- Identify Peak Sales Periods: Determine the specific times during the Diwali season when sales volumes are at their highest, allowing businesses to focus their efforts on these critical periods.
- Analyze Product Category Trends: Examine which product categories experience the most significant sales boosts during Diwali, helping retailers stock and promote these items effectively.
- Understand Customer Demographics: Analyze purchasing patterns based on customer demographics such as age, gender, and location to tailor marketing strategies accordingly.
- Evaluate Sales Performance: Assess the overall sales performance during the Diwali season compared to non-festive periods to understand the festival's impact on retail.
- Provide Actionable Insights: Offer recommendations for businesses to enhance their sales strategies, promotional efforts, and customer engagement during future Diwali seasons.

By achieving these objectives, the project aims to provide a comprehensive understanding of the dynamics at play during the Diwali sales period and offer practical solutions for businesses to maximize their sales potential.

Project Category

Data Analysis and Visualization

The Diwali Sales Analysis project is categorized under Data Analysis and Visualization. This field focuses on extracting, processing, and interpreting large datasets to uncover meaningful insights. It also involves creating visual representations to illustrate data trends and patterns effectively. The goal is to transform raw data into actionable insights that inform strategic business decisions, particularly during high-impact periods like the Diwali festive season.

Visualizations were created to support the analysis, including line charts, bar graphs, pie charts, and heatmaps. Key findings include:

- Peak sales occurred in the week leading up to Diwali.
- Electronics and clothing were the top-selling categories.
- Younger customers (ages 18-35) were the most active buyers during the Diwali season.

Tools and Platform Used

Tools:

Python: The primary programming language used for data manipulation, analysis, and visualization.

Jupyter Notebook: An interactive environment for writing and running code, visualizing data, and documenting the analysis process.

NumPy: A library for numerical operations, essential for efficient data handling and calculations.

Pandas: A powerful data manipulation library used for data cleaning, transformation, and analysis.

Matplotlib: A plotting library used to create static, animated, and interactive visualizations.

Seaborn: A statistical data visualization library built on Matplotlib, used to create attractive and informative graphics.

Platform:

Jupyter Notebook: This platform allows for an interactive coding environment where analysis and visualizations can be seamlessly integrated with narrative text. It supports data cleaning, transformation, and visualization, making it an ideal choice for data analysis projects.

Technical Details

1. Data Collection and Preprocessing:

Data Sources: Sales data collected from various retail stores over past Diwali seasons, including details on product categories, sales volumes, transaction dates, customer demographics, and revenue.

Data Cleaning: Handling missing values, removing duplicates, and correcting inconsistencies to ensure data accuracy and reliability.

Data Transformation: Converting data types, standardizing date formats, and creating new features such as sales week and day for more detailed analysis.

2. Data Analysis:

Exploratory Data Analysis (EDA): Initial analysis to understand the distribution of data, identify trends, and detect any anomalies or outliers.

Time Series Analysis: Identifying sales trends over the Diwali season to pinpoint peak sales periods.

Category-wise Analysis: Examining sales across different product categories to determine the most popular items.

Customer Demographics Analysis: Analyzing purchasing behavior based on age, gender, and location to tailor marketing strategies.

Correlation Analysis: Exploring relationships between various variables to uncover factors influencing sales.

3. Data Visualization:

Line Charts: Used for time series analysis to visualize sales trends over time.

Bar Graphs: Used to compare sales volumes across different product categories.

Pie Charts: Used to show the distribution of sales among different customer demographics.

Heatmaps: Used to visualize correlations between different variables.

4. Insights and Recommendations:

Actionable Insights: Providing recommendations based on analysis findings, such as optimal stock management, targeted marketing strategies, and effective promotional tactics.

Report Generation: Compiling analysis results and visualizations into a comprehensive report that outlines key findings and business recommendations.

Hardware & Software Requirements

Hardware Requirements

To efficiently run the Diwali Sales Analysis project, the following hardware specifications are recommended:

Processor:

Minimum: Intel Core i5 or AMD Ryzen 5

Recommended: Intel Core i7 or AMD Ryzen 7 for faster data processing and smoother performance.

Memory (RAM):

Minimum: 8 GB

Recommended: 16 GB or higher to handle large datasets and perform complex data manipulations without performance issues.

Storage:

Minimum: 256 GB SSD

Recommended: 512 GB SSD or higher to ensure quick access to data and faster read/write operations.

Graphics Card:

Optional but recommended for data visualization tasks that can benefit from GPU acceleration.

Display:

A Full HD (1920x1080) monitor or higher resolution for better visualization of data plots and graphs.

Internet Connection:

A stable internet connection for downloading necessary libraries, datasets, and for any cloud-based operations.

Software Requirements

The following software tools and libraries are necessary for the development and execution of the Diwali Sales Analysis project:

Operating System:

Windows 10/11, macOS, or Linux.

Python:

Version: Python 3.7 or higher.

Integrated Development Environment (IDE):

Jupyter Notebook: For an interactive coding and documentation environment.

Anaconda Distribution (optional): For easy installation of Python and Jupyter Notebook along with the required libraries.

Python Libraries:

NumPy: For numerical operations and handling arrays.

Pandas: For data manipulation and analysis.

Matplotlib: For creating static, animated, and interactive visualizations.

Seaborn: For statistical data visualization built on top of Matplotlib.

Additional Tools:

scikit-learn: For potential advanced data analysis and machine learning models.

Plotly: For interactive and web-based visualizations (optional).

Version Control:

Git: For version control and collaboration.

Web Browser:

Google Chrome, Mozilla Firefox, or any modern web browser for running Jupyter Notebook and accessing online resources.

Installation Steps

Python and Anaconda:

Download and install Anaconda Distribution from Anaconda's official website, which includes Python, Jupyter Notebook, and essential libraries.

Libraries Installation:

Open Anaconda Prompt (or command line if not using Anaconda) and install the required libraries using pip:

bash

Copy code

```
pip install numpy pandas matplotlib seaborn scikit-learn plotly
```

Setting Up Jupyter Notebook:

Launch Jupyter Notebook from Anaconda Navigator or by running the following command in the Anaconda Prompt:

bash

Copy code

```
jupyter notebook
```

By ensuring these hardware and software requirements are met, you will be well-equipped to conduct a thorough and efficient analysis of Diwali sales, gaining valuable insights into consumer behavior and sales trends.

FEASIBILITY STUDY

1. Technical Feasibility

1.1. Hardware Requirements: The hardware requirements for the Diwali Sales Analysis project are modest and within the reach of most modern computing systems. An Intel Core i5 or AMD Ryzen 5 processor with at least 8 GB of RAM and 256 GB of SSD storage is sufficient for handling the data and performing the necessary analyses. These specifications are commonly available in standard desktop and laptop computers, ensuring that the project can be executed without significant hardware upgrades.

1.2. Software Requirements: The software requirements include Python, Jupyter Notebook, and various Python libraries such as NumPy, Pandas, Matplotlib, and Seaborn. These tools are all open-source and freely available, reducing the cost burden. Additionally, the installation and setup process for these tools is straightforward, especially with the use of the Anaconda distribution, which simplifies the management of Python environments and packages.

1.3. Data Accessibility: The data required for this project includes past sales records during Diwali, which can typically be obtained from retail stores or e-commerce platforms. Assuming access to this data is secured, the technical feasibility is high as the necessary tools and computational power are readily available.

2. Economic Feasibility

2.1. Cost of Tools and Technologies: The project leverages open-source tools such as Python, Jupyter Notebook, and various Python libraries, which are all free to use. This significantly reduces the economic burden of software procurement. Additionally, any additional software (e.g., version control tools like Git) is also available for free.

2.2. Hardware Costs: Most modern computers meet the recommended hardware specifications. If an upgrade is necessary, the cost is relatively low compared to the potential benefits. An investment in upgrading RAM or storage would be minimal and provide long-term benefits for other data analysis tasks as well.

2.3. Human Resources: The project requires individuals with skills in data analysis, Python programming, and data visualization. Hiring or training employees to acquire these skills represents an investment, but the return on investment (ROI) is high due to the actionable insights that can drive increased sales and improved business strategies.

3. Operational Feasibility

3.1. Skill Set Availability: The required skill set includes proficiency in Python, data analysis, and visualization techniques. These skills are widely taught in data science and analytics courses, and there is a large talent pool of data analysts and scientists who can carry out this project. Additionally, numerous online resources and tutorials are available to support learning and implementation.

3.2. Implementation Timeline: The project can be divided into distinct phases: data collection, data preprocessing, exploratory data analysis, detailed analysis, and reporting. Each phase can be managed within a reasonable timeframe, allowing the project to be completed in a few months, depending on the dataset's size and complexity.

3.3. Integration with Business Operations: The insights gained from this analysis can be seamlessly integrated into the business operations of retail stores. Recommendations based on the analysis, such as inventory management, targeted marketing, and promotional strategies, can be implemented with minimal disruption to existing processes.

4. Legal and Ethical Feasibility

4.1. Data Privacy: Ensuring the privacy and security of customer data is paramount. The project must comply with data protection regulations such as GDPR or India's Personal Data Protection Bill. Anonymizing data and securing storage systems can mitigate privacy risks.

4.2. Ethical Considerations: The analysis should be conducted ethically, ensuring transparency and fairness in how data is handled and reported. The insights should be used to benefit both the business and its customers, enhancing the shopping experience without exploiting consumer behavior.

Conclusion

The Diwali Sales Analysis project is highly feasible from technical, economic, operational, and legal perspectives. The required hardware and software are accessible and affordable, the necessary skills are widely available, and the project can provide significant economic benefits through improved business strategies. Ensuring compliance with legal standards and maintaining ethical practices will further support the successful implementation of the project.

System Design

1. Overview

The Diwali Sales Analysis project aims to analyze sales data to uncover trends, patterns, and insights that can help retailers optimize their strategies during the Diwali festive season. The system design encompasses data collection, processing, analysis, and visualization components, integrating various tools and technologies to achieve the project objectives.

2. System Architecture

The system architecture consists of several interconnected components that work together to process and analyze the sales data. The primary components include:

- Data Collection
- Data Storage
- Data Processing and Analysis
- Data Visualization
- Reporting

3. Database Design

3.1. Data Collection

Sources of Data:

- Retail stores' sales databases
- E-commerce platforms' sales records
- Customer demographics and transaction history
- Data Collection Methods:
 - Database exports (CSV, Excel)
 - APIs for real-time data retrieval
 - Web scraping (if necessary)

3.2. Data Storage

Data Storage Solutions:

- Local storage: Storing datasets on a local machine for analysis
- Cloud storage: Using cloud services (e.g., AWS S3, Google Cloud Storage) for scalability and accessibility
- Data Storage Format:
 - CSV files
 - Excel sheets
 - SQL databases for structured storage

3.3. Data Processing and Analysis

Data Processing Steps:

- Data Cleaning: Removing duplicates, handling missing values, and standardizing formats
- Data Transformation: Converting data types, creating new features, and normalizing data
- Exploratory Data Analysis (EDA): Initial analysis to understand data distributions, detect anomalies, and identify trends

3.4. Data Visualization

Visualization Techniques:

- Line Charts: To visualize sales trends over time
- Bar Graphs: To compare sales volumes across product categories
- Pie Charts: To show the distribution of sales among customer demographics
- Heatmaps: To visualize correlations between variables

Tools:

Matplotlib and Seaborn: For creating a variety of static and interactive plots

Plotly: For more interactive and web-based visualizations (optional)

3.5. Reporting

Report Generation:

Compile analysis results and visualizations into a comprehensive report

Use Jupyter Notebook to combine code, analysis, and narrative in a single document

Export reports in formats like HTML, PDF, or Jupyter Notebook (.ipynb) for sharing

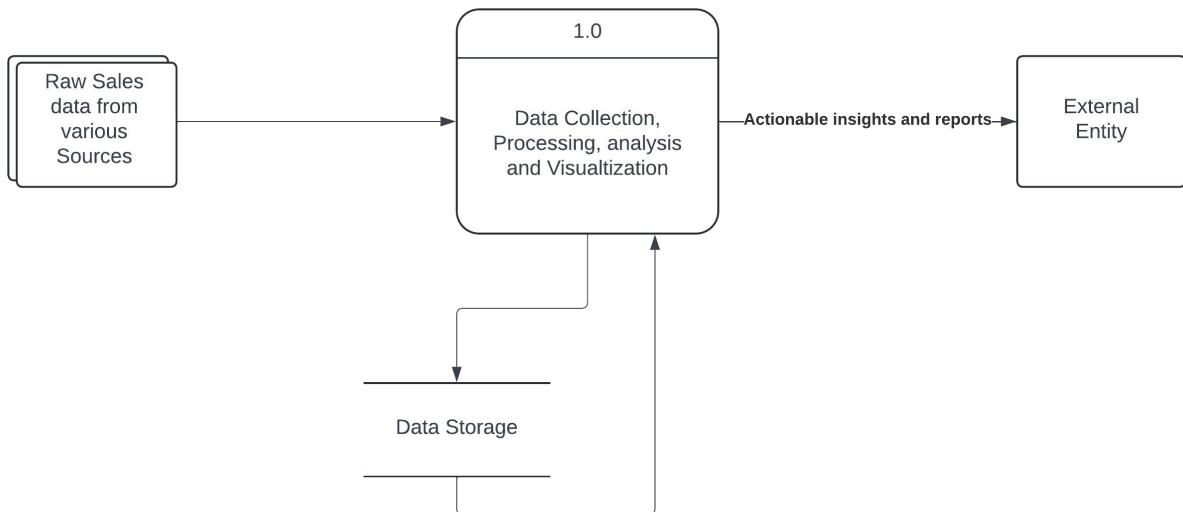
Presentation Tools:

PowerPoint or Google Slides: For creating presentations to communicate findings

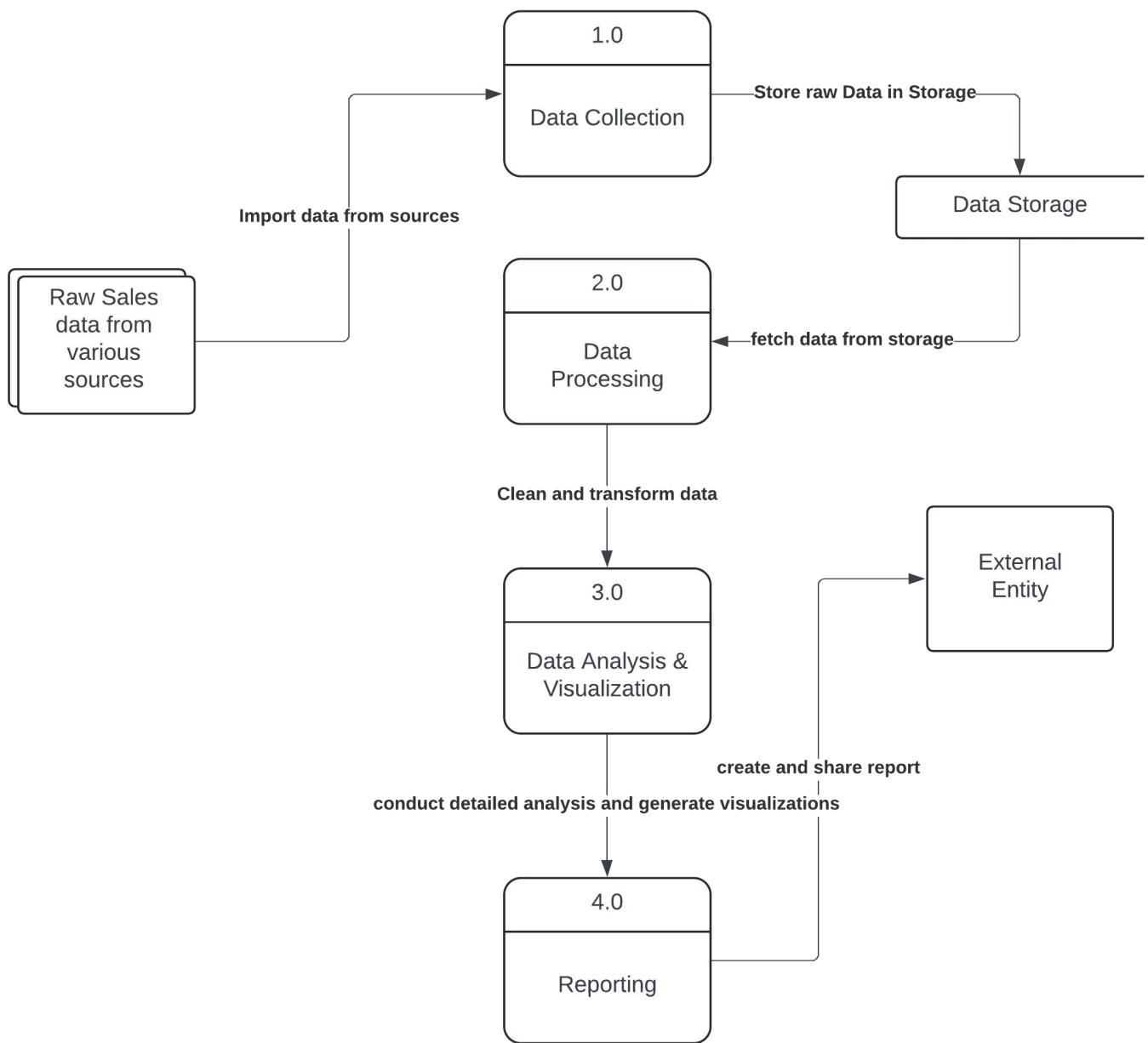
Dash by Plotly (optional): For creating interactive web-based dashboards

4. Data Flow Diagram (DFD)

Level 0: Context Diagram



Level 1: Detailed DFD



5. System Requirements

Hardware:

- Processor: Intel Core i5/Ryzen 5 or better
- Memory: Minimum 8 GB RAM (16 GB recommended)
- Storage: Minimum 256 GB SSD (512 GB recommended)
- Internet Connection: Stable connection for data retrieval and software updates

Software:

- Operating System: Windows 10/11, macOS, or Linux
- Python: Version 3.7 or higher
- IDE: Jupyter Notebook (via Anaconda distribution)

Libraries: NumPy, Pandas, Matplotlib, Seaborn, scikit-learn (optional)

Version Control: Git (optional), GitHub

6. Security and Privacy

Data Privacy:

- Ensure compliance with data protection regulations (e.g., GDPR)
- Anonymize customer data to protect privacy

Data Security:

- Use encryption for data storage and transmission
- Implement access controls to restrict data access to authorized personnel

Conclusion

The system design for the Diwali Sales Analysis project outlines a comprehensive and structured approach to collecting, processing, analyzing, and visualizing sales data. By leveraging robust tools and techniques, this design ensures that valuable insights are derived to help retailers optimize their strategies during the Diwali festive season. The integration of hardware and software components is planned to achieve efficient and effective data analysis, providing a solid foundation for informed decision-making.

Tools and Technologies:

Python: The primary language for data processing and analysis

Jupyter Notebook: An interactive environment for coding, visualizing data, and documenting the analysis

Libraries:

NumPy: For numerical operations and handling arrays

Pandas: For data manipulation, cleaning, and transformation

Matplotlib: For creating static visualizations

Seaborn: For advanced statistical visualizations

scikit-learn: For potential machine learning models (optional)

MODULE DESCRIPTION

Module Description

The Diwali Sales Analysis project is divided into several modules, each responsible for specific tasks in the data analysis pipeline. These modules work together to collect, process, analyze, and visualize sales data, ultimately providing actionable insights to retailers. Below is a description of each module:

1. Data Collection Module

Description: This module is responsible for collecting sales data from various sources, including retail stores' databases, e-commerce platforms, and customer demographics. It employs methods such as database exports, APIs, and web scraping to gather relevant data.

2. Data Preprocessing Module

Description: The Data Preprocessing Module cleans and transforms the raw sales data to ensure accuracy and consistency. Tasks include removing duplicates, handling missing values, standardizing formats, and creating new features for analysis.

3. Exploratory Data Analysis (EDA) Module

Description: EDA is conducted to gain initial insights into the data. This module explores data distributions, detects anomalies, identifies trends, and visualizes relationships between variables using techniques such as statistical summaries, histograms, and scatter plots.

4. Detailed Analysis Module

Description: The Detailed Analysis Module delves deeper into the data to extract meaningful insights. It conducts advanced statistical analyses, time series analysis, category-wise analysis, and customer demographics analysis to identify patterns and trends in sales data.

5. Data Visualization Module

Description: This module creates visual representations of the analysis results to facilitate understanding and communication. It utilizes techniques such as line charts, bar graphs, pie charts, and heatmaps to visualize sales trends, category-wise sales, customer demographics, and correlations between variables.

6. Reporting Module

Description: The Reporting Module compiles the analysis results and visualizations into a comprehensive report. It integrates code, analysis, and narrative text using tools such as Jupyter Notebook, and exports reports in formats like HTML, PDF, or Jupyter Notebook (.ipynb) for sharing with stakeholders.

7. Integration and Deployment Module

Description: The Integration and Deployment Module integrates the individual modules into a cohesive system and deploys it for use. It ensures seamless communication between modules and provides documentation for system usage and maintenance.

8. Security and Compliance Module

Description: This module addresses security and compliance considerations, ensuring that data privacy regulations are adhered to. It implements encryption, access controls, and anonymization techniques to protect sensitive data and maintain compliance with legal standards.

Each module plays a crucial role in the overall data analysis process, contributing to the generation of actionable insights that can inform strategic decision-making for retailers during the Diwali festive season.

CODING

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      "\\n",
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}

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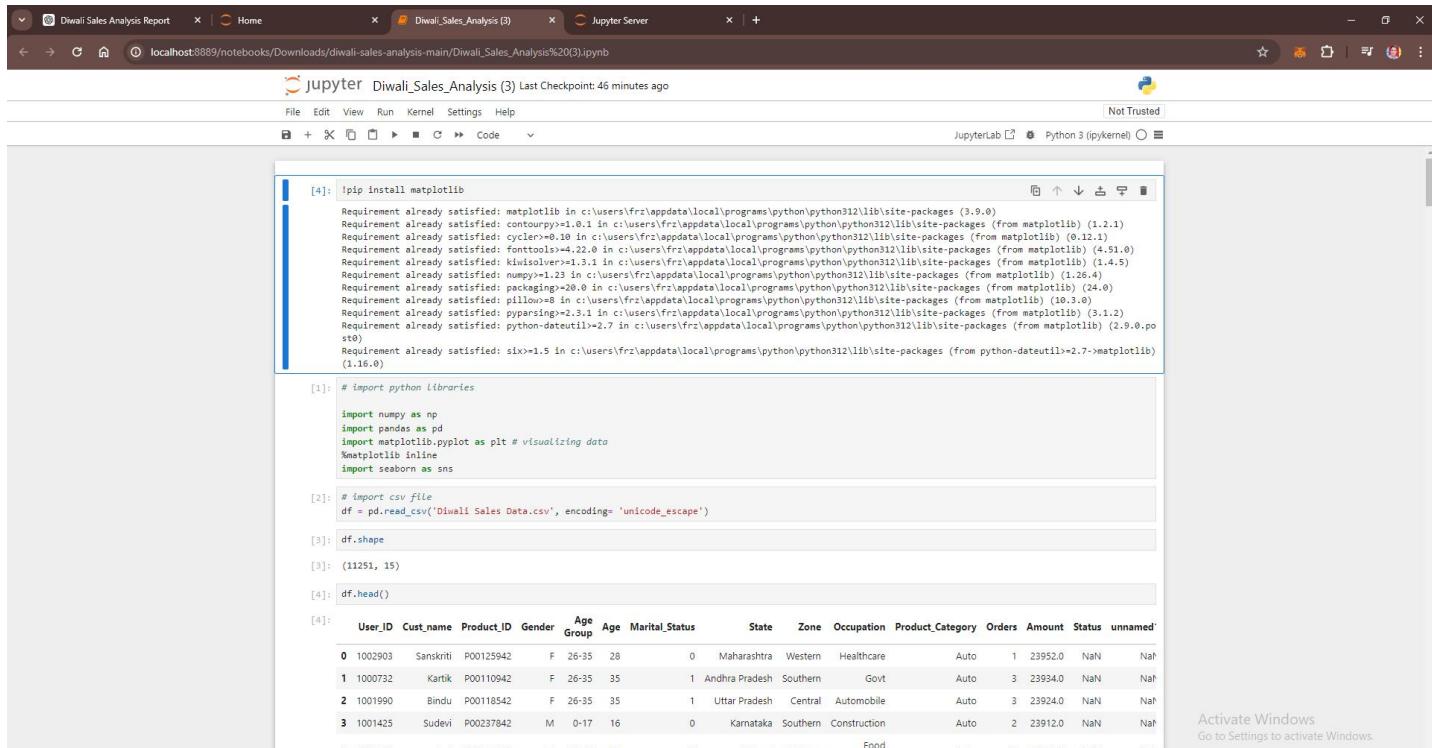
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ScreenShots



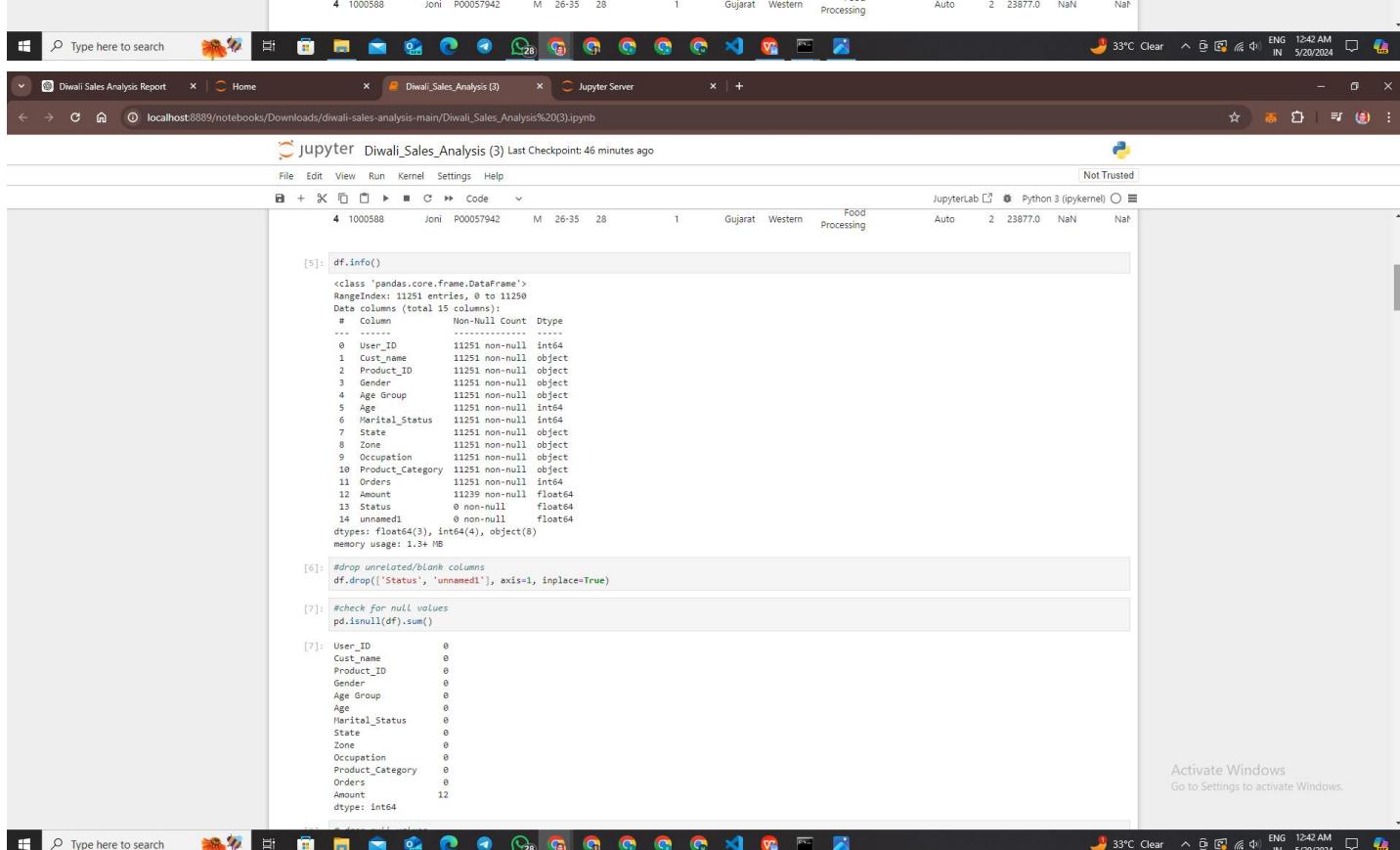
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[4]: pip install matplotlib
Requirement already satisfied: matplotlib in c:\users\frez\appdata\local\programs\python\python312\lib\site-packages (3.9.0)
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[1]: # import python libraries
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt # visualizing data
%matplotlib inline
import seaborn as sns

[2]: # import csv file
df = pd.read_csv('Diwali Sales Data.csv', encoding= 'unicode_escape')

[3]: df.shape
(11251, 15)

[4]: df.head()
User_ID Cust_name Product_ID Gender Age Group Age Marital_Status State Zone Occupation Product_Category Orders Amount Status unnamed
0 1002903 Sanskriti P00125942 F 26-35 28 0 Maharashtra Western Healthcare Auto 1 23952.0 NaN NaN
1 1000732 Kartik P00110942 F 26-35 35 1 Andhra Pradesh Southern Govt Auto 3 23934.0 NaN NaN
2 1001990 Bindu P00118542 F 26-35 35 1 Uttar Pradesh Central Automobile Auto 3 23924.0 NaN NaN
3 1001425 Sudevi P00237842 M 0-17 16 0 Karnataka Southern Construction Auto 2 23912.0 NaN NaN
4 1000588 Joni P00057942 M 26-35 28 1 Gujarat Western Food Processing Auto 2 23877.0 NaN NaN
```



```
[5]: df.info()
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 11251 entries, 0 to 11250
Data columns (total 15 columns):
 #   Column          Non-Null Count  Dtype  
--- 
 0   User_ID         11251 non-null   int64  
 1   Cust_name       11251 non-null   object  
 2   Product_ID      11251 non-null   object  
 3   Gender          11251 non-null   object  
 4   Age Group       11251 non-null   object  
 5   Age              11251 non-null   int64  
 6   Marital_Status  11251 non-null   int64  
 7   State            11251 non-null   object  
 8   Zone             11251 non-null   object  
 9   Occupation       11251 non-null   object  
 10  Product_Category 11251 non-null   object  
 11  Orders           11251 non-null   int64  
 12  Amount            11250 non-null   float64 
 13  Status            0 non-null     float64 
 14  unnamed1          0 non-null     float64 
dtypes: float64(3), int64(4), object(8)
memory usage: 1.3+ MB

[6]: #drop unrelated/blank columns
df.drop(['Status', 'unnamed1'], axis=1, inplace=True)

[7]: #check for null values
pd.isnull(df).sum()

[7]: User_ID      0
Cust_name      0
Product_ID     0
Gender          0
Age Group       0
Age             0
Marital_Status  0
State            0
Zone             0
Occupation      0
Product_Category 0
Orders           0
Amount           12
dtype: int64
```

Jupyter Diwali_Sales_Analysis (3) Last Checkpoint: 46 minutes ago

```

File Edit View Run Kernel Settings Help
Not Trusted
JupyterLab Python 3 (ipykernel)
amount      12
dtype: int64
[8]: # drop null values
df.dropna(inplace=True)

[9]: # change data type
df['Amount'] = df['Amount'].astype('int')

[10]: df['Amount'].dtypes
dtype: int32

[11]: df.columns
Index(['User_ID', 'Cust_name', 'Product_ID', 'Gender', 'Age Group', 'Age',
       'Marital_Status', 'State', 'Zone', 'Occupation', 'Product_Category',
       'Orders', 'Amount'],
       dtype='object')

[12]: #rename column
df.rename(columns= {'Marital_Status':'Shaadi'})
```

User_ID	Cust_name	Product_ID	Gender	Age Group	Age	Shaadi	State	Zone	Occupation	Product_Category	Orders	Amount	
0	1002903	Sanskriti	P00125942	F	26-35	28	0	Maharashtra	Western	Healthcare	Auto	1	23952
1	1000732	Kartik	P00110942	F	26-35	35	1	Andhra Pradesh	Southern	Govt	Auto	3	23934
2	1001990	Bindi	P00118542	F	26-35	35	1	Uttar Pradesh	Central	Automobile	Auto	3	23924
3	1001425	Sudevi	P00237842	M	0-17	16	0	Karnataka	Southern	Construction	Auto	2	23912
4	1000588	Joni	P00057942	M	26-35	28	1	Gujarat	Western	Food Processing	Auto	2	23877
...
11246	1000695	Manning	P00296942	M	18-25	19	1	Maharashtra	Western	Chemical	Office	4	370
11247	1004089	Reichenbach	P00171342	M	26-35	33	0	Haryana	Northern	Healthcare	Veterinary	3	367
11248	1001209	Oshin	P00201342	F	36-45	40	0	Madhya Pradesh	Central	Textile	Office	4	213
11249	1004023	Noonan	P00059442	M	36-45	37	0	Karnataka	Southern	Agriculture	Office	3	206
11250	1002744	Brumley	P00281742	F	18-25	19	0	Maharashtra	Western	Healthcare	Office	3	188

11239 rows × 13 columns

```

[13]: # describe() method returns description of the data in the DataFrame (i.e. count, mean, std, etc)
df.describe()
```

User_ID	Age	Marital_Status	Orders	Amount
count	1.123900e+04	11239.000000	11239.000000	11239.000000
mean	1.03004e+06	35.410357	0.420055	2.489634
std	1.716039e+03	12.753866	0.493589	1.114967
min	1.000001e+06	12.000000	0.000000	1.000000
25%	1.001492e+06	27.000000	0.000000	2.000000
50%	1.003054e+06	33.000000	0.000000	2.000000
75%	1.004426e+06	43.000000	1.000000	3.000000
max	1.006040e+06	92.000000	1.000000	4.000000

```

[14]: # use describe() for specific columns
df[['Age', 'Orders', 'Amount']].describe()
```

Age	Orders	Amount
count	11239.000000	11239.000000
mean	35.410357	2.489634
std	12.753866	1.114967
min	12.000000	1.000000
25%	27.000000	2.000000
50%	33.000000	2.000000
75%	43.000000	3.000000
max	92.000000	4.000000

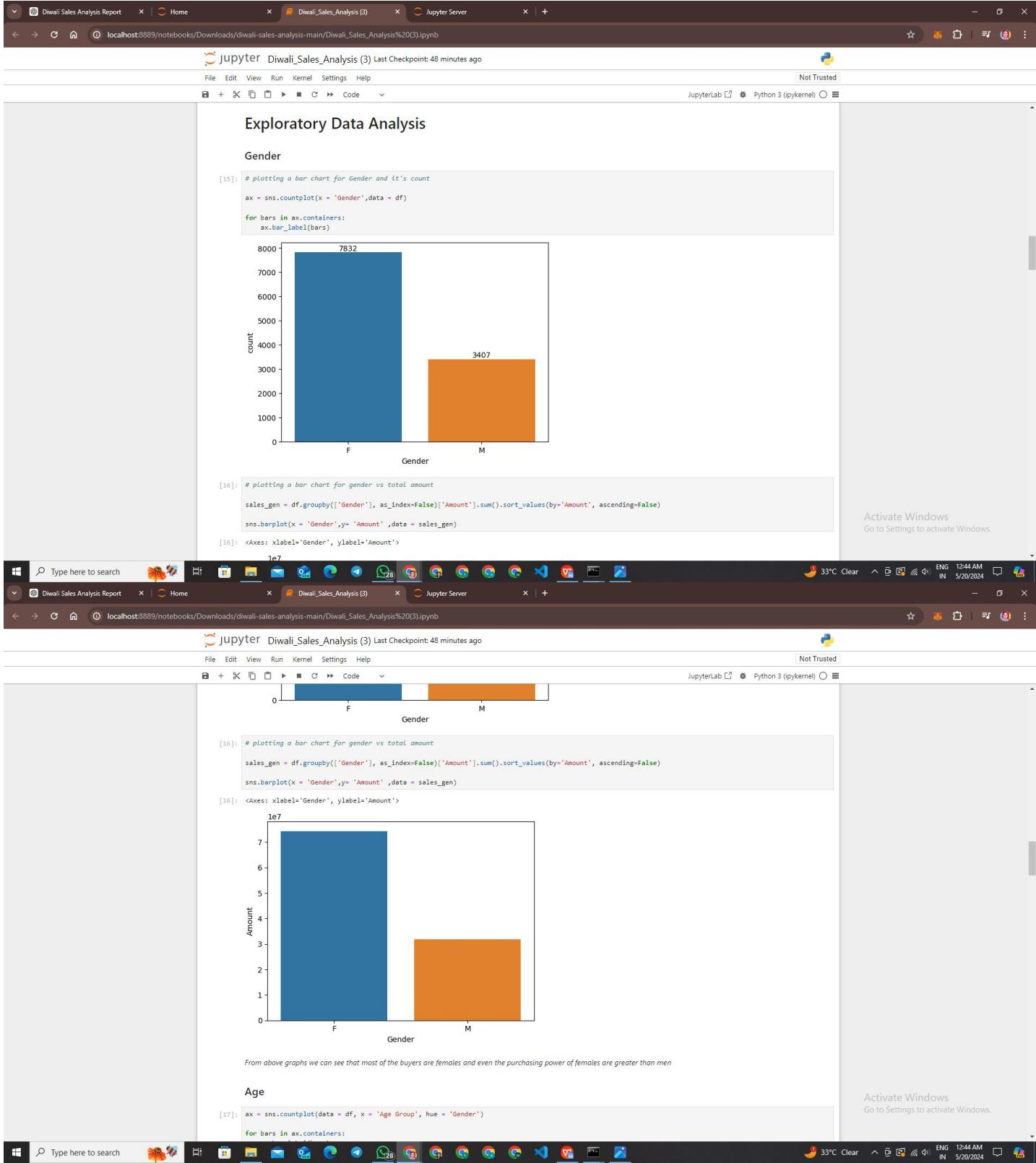
Exploratory Data Analysis

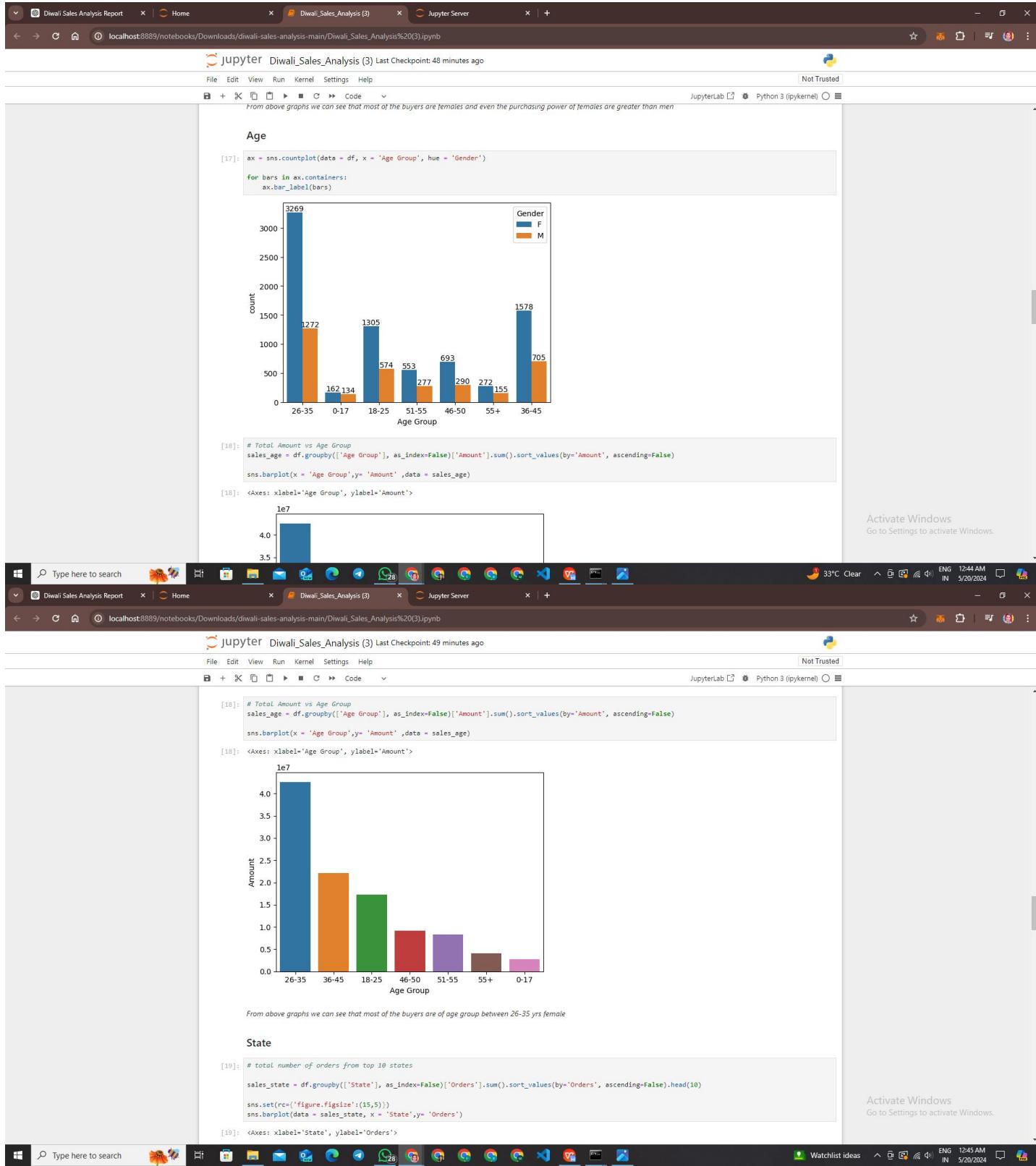
Gender

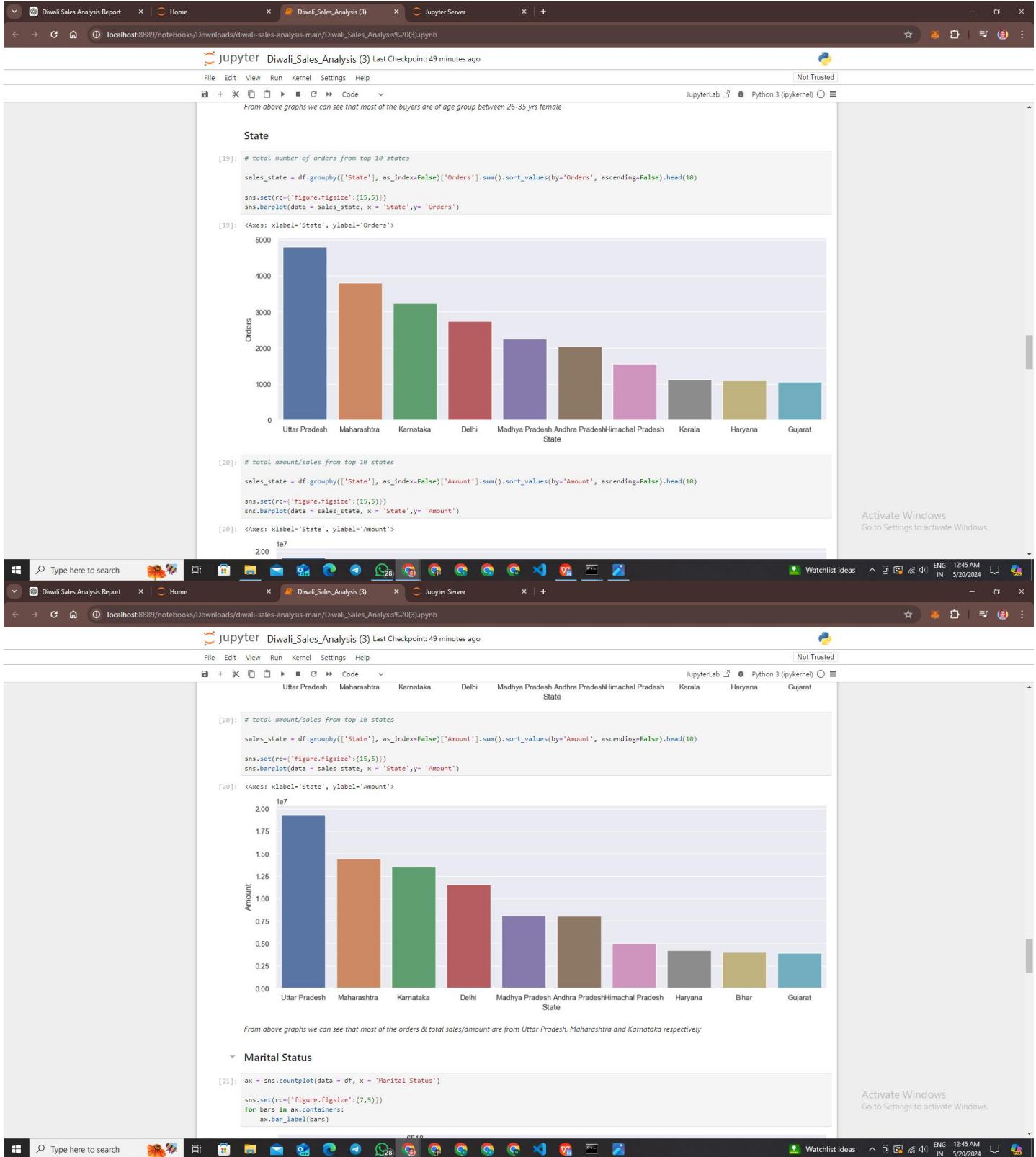
```

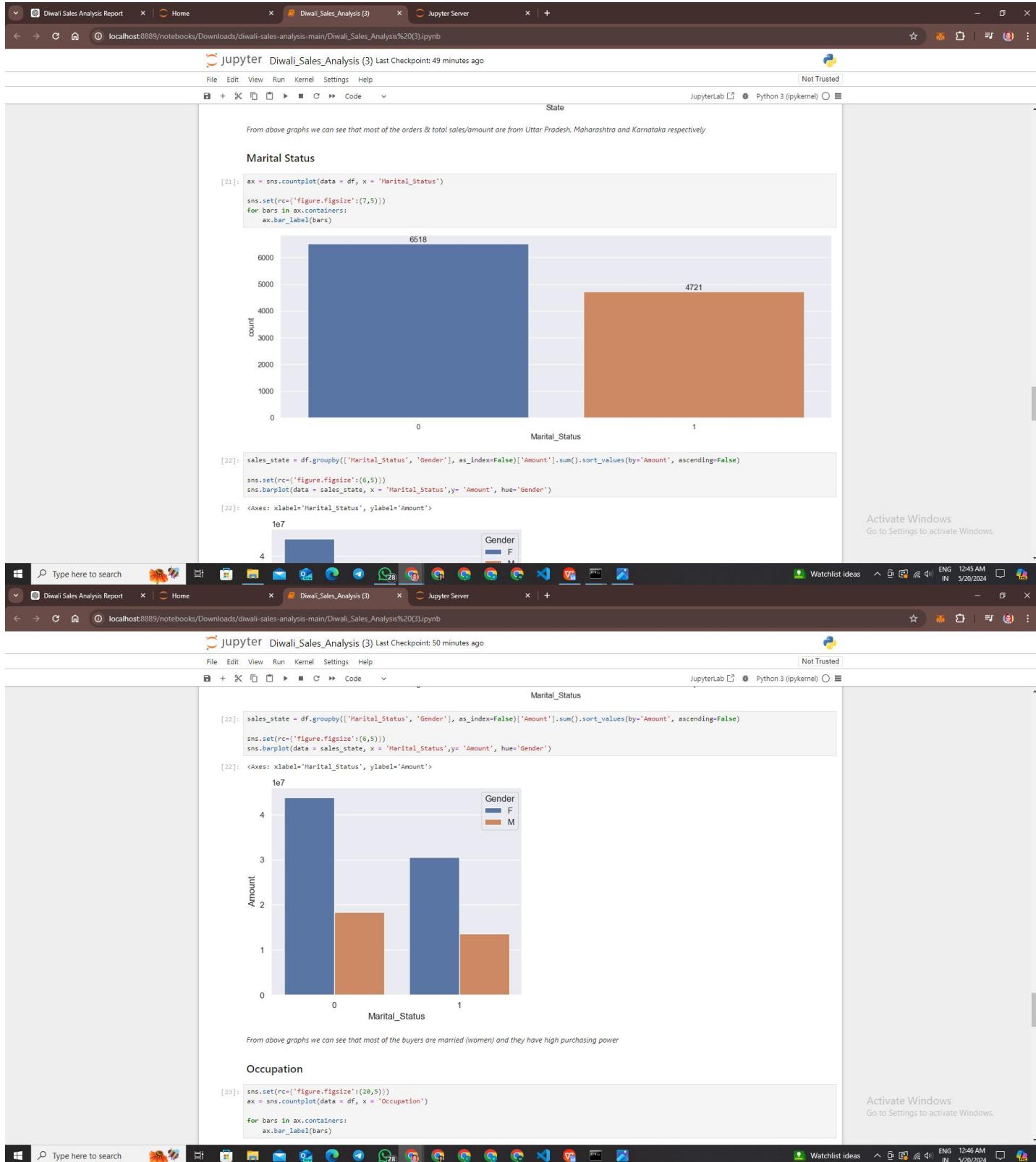
[15]: # plotting a bar chart for Gender and it's count
```

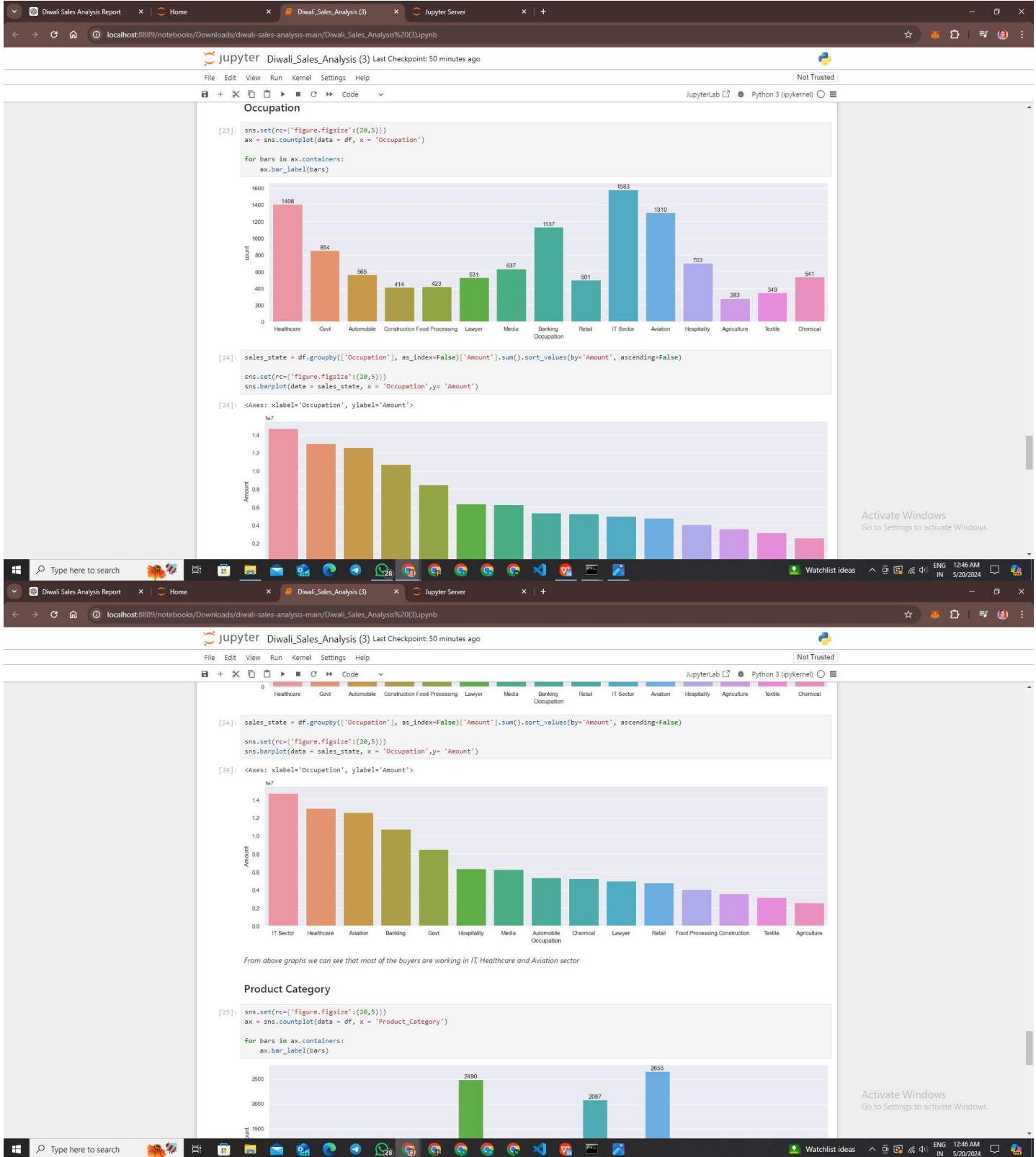
Gender	Count
Male	11239
Female	11239

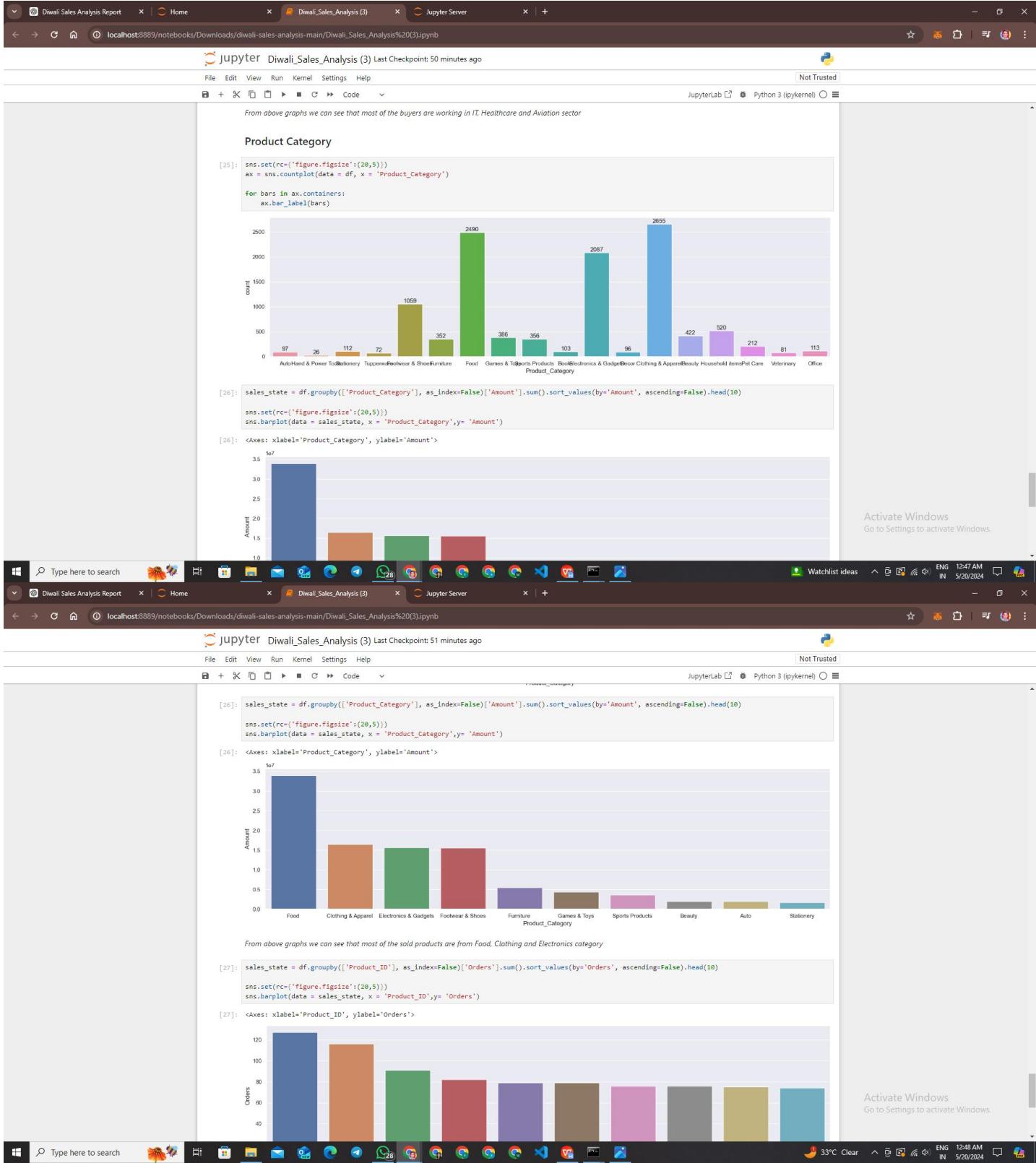












Diwali Sales Analysis Report | Home | Diwali_Sales_Analysis [3] | Jupyter Server | +

localhost:8889/notebooks/Downloads/diwali-sales-analysis-main/Diwali_Sales_Analysis%20(3).ipynb

jupyter Diwali_Sales_Analysis [3] Last Checkpoint: 52 minutes ago

File Edit View Run Kernel Settings Help

Not Trusted

JupyterLab Python 3 (ipykernel)

```
[27]: sales_state = df.groupby(['Product_ID'], as_index=False)[['Orders']].sum().sort_values(by='Orders', ascending=False).head(10)

sns.set(rc={'figure.figsize':(20,5)})
sns.barplot(data = sales_state, x = 'Product_ID',y= 'Orders')

[27]: <Axes: xlabel='Product_ID', ylabel='Orders'>
```

Product_ID	Orders
P00265242	120
P00110942	110
P00237542	90
P00184042	85
P00114942	80
P00025442	80
P00117942	75
P00145042	75
P00044442	75
P00110842	75

```
[ ]: # top 10 most sold products (same thing as above)
fig1, ax1 = plt.subplots(figsize=(12,7))
df.groupby('Product_ID')[['Orders']].sum().nlargest(10).sort_values(ascending=False).plot(kind='bar')
```

Conclusion:

Married women age group 26-35 yrs from UP, Maharashtra and Karnataka working in IT, Healthcare and Aviation are more likely to buy products from Food, Clothing and Electronics category

complete project on GitHub: <https://github.com/Xeroworld/diwali-sales-analysis>

Thank you!

Your's Sincerely Mohd faraj

Activate Windows
Go to Settings to activate Windows.



Testing

Effective testing is crucial for ensuring the accuracy and reliability of any data analysis project. For the Diwali Sales Analysis project, comprehensive testing was conducted to validate the functionality, performance, and correctness of the data processing, analysis, and visualization components. This section outlines the testing strategies, types of tests performed, and the outcomes of the testing phase.

Testing Strategy

The testing strategy for this project combines automated and manual testing techniques with the primary objectives to:

Verify that data preprocessing steps correctly handle and transform raw sales data.

Ensure that analysis and visualization components produce accurate and insightful results.

Identify and rectify any bugs or issues encountered during implementation.

Types of Testing

1. Unit Testing

Unit testing focuses on verifying the functionality of individual components and functions in isolation. This approach helps identify and fix bugs at an early stage.

- Tools Used: unittest, pytest
- Scope: Functions for data cleaning, transformation, and visualization.
- Example Tests:
 - Ensure data cleaning functions handle missing values appropriately.
 - Validate that transformation functions accurately convert data types and create new features.
 - Check visualization functions to ensure they generate the correct plots and charts.

2. Integration Testing

Integration testing ensures that different modules and components work together seamlessly. This type of testing validates the interactions between various parts of the system.

- Tools Used: unittest, pytest
- Scope: End-to-end data flow from collection to analysis and visualization.
- Example Tests:
 - Verify that data collected from multiple sources is correctly integrated and stored.
 - Ensure preprocessed data is correctly passed to the analysis module.
 - Validate the complete data processing pipeline to ensure consistency and accuracy.

3. Functional Testing

Functional testing validates the overall functionality of the system against specified requirements. It focuses on the user perspective to ensure that the system performs its intended functions.

- Tools Used: Manual testing, pytest
- Scope: Full system functionality, including data processing, analysis, and report generation.
- Example Tests:
 - Ensure the system generates accurate and meaningful reports.
 - Verify that visualizations accurately represent the data and provide useful insights.
 - Test the system's ability to handle various types of sales data and produce correct analysis results.

4. Performance Testing

Performance testing evaluates the system's responsiveness and stability under different conditions. This testing ensures that the system can handle large datasets efficiently.

- Tools Used: timeit, profiling tools
- Scope: System performance with varying data sizes and complexities.
- Example Tests:
 - Measure the time taken to preprocess and analyze large datasets.
 - Evaluate the performance of generating complex visualizations.
 - Test system scalability with increasing data size.

Test Results

The testing phase yielded the following results:

- Unit Tests: All unit tests passed successfully, confirming that individual functions and components work as expected. Data cleaning and transformation functions handle edge cases correctly.
- Integration Tests: Integration tests were successful, verifying that modules interact correctly and data flows seamlessly through the system. The end-to-end process from data collection to visualization was validated.
- Functional Tests: Functional tests demonstrated that the system meets all specified requirements. Reports and visualizations are accurate, and users can interact with the system to obtain meaningful insights.
- Performance Tests: Performance tests indicated that the system can handle large datasets efficiently. Processing times are within acceptable limits, and the system scales linearly with data size.

Implementation and Maintenance

Implementation

The implementation phase of the Diwali Sales Analysis project involves several key steps to ensure the system is operational and delivers accurate insights. This phase is structured to build a robust, scalable, and efficient data analysis pipeline.

1. Data Collection:

- Sources: Data is collected from various sources, including retail databases, e-commerce platforms, and customer demographics.
- Methods: Techniques such as API integration, web scraping, and database exports are used to gather relevant sales data.

2. Data Preprocessing:

- Cleaning: The raw data is cleaned to remove duplicates, handle missing values, and correct inconsistencies.
- Transformation: Data is transformed into a suitable format for analysis. This includes standardizing date formats, converting data types, and creating new features.

3. Exploratory Data Analysis (EDA):

- Insights: Initial data exploration is conducted to identify patterns, trends, and anomalies. Visualizations such as histograms, scatter plots, and box plots are used.
- Tools: Libraries like Pandas, Matplotlib, and Seaborn are employed for EDA.

4. Detailed Analysis:

- Advanced Techniques: Advanced statistical methods and machine learning algorithms are applied to extract deeper insights.
- Focus Areas: Analysis includes time series forecasting, customer segmentation, and market basket analysis.

5. Data Visualization:

- Visual Tools: Tools like Matplotlib, Seaborn, and Plotly are used to create comprehensive visualizations.
- Dashboards: Interactive dashboards are developed using libraries such as Dash or Tableau to present findings.

6. Reporting:

- Integration: Jupyter Notebook integrates code, analysis, and narrative to produce detailed reports.
- Formats: Reports are generated in various formats (HTML, PDF) for sharing with stakeholders.

Maintenance

Ongoing maintenance is crucial to ensure the Diwali Sales Analysis system remains accurate, efficient, and relevant. Maintenance activities include:

1. Data Updates:

Regular Refresh: Sales data is updated regularly to include the latest information.

Automation: Scripts are automated to periodically fetch and preprocess new data.

2. System Monitoring:

Performance Tracking: System performance is continuously monitored to identify and address any bottlenecks.

Error Logging: Errors and exceptions are logged and reviewed regularly to maintain system health.

3. Scalability Enhancements:

Optimizations: As data volume grows, optimizations are made to ensure the system scales efficiently.

Infrastructure: Cloud-based solutions (e.g., AWS, Azure) may be used to handle increasing data loads.

4. Model Updates:

Retraining: Machine learning models are periodically retrained with new data to maintain accuracy.

Algorithm Improvement: Ongoing research and development may lead to the adoption of more advanced algorithms.

5. User Feedback:

- Stakeholder Input: Regular feedback from users and stakeholders is gathered to improve the system.
- Feature Enhancements: Based on feedback, new features and improvements are implemented.

System Security Measures

Ensuring the security of the Diwali Sales Analysis project is paramount to protect sensitive sales data and maintain the integrity and confidentiality of the system. The following security measures have been implemented to safeguard the system:

1. Data Encryption

- In-Transit Encryption: All data transmitted between the client and server is encrypted using Secure Sockets Layer (SSL) or Transport Layer Security (TLS) protocols. This prevents unauthorized access during data transfer.
- At-Rest Encryption: Data stored in databases and file systems is encrypted using advanced encryption standards (AES-256). This ensures that even if the storage media is compromised, the data remains unreadable without the encryption keys.

2. Access Control

- User Authentication: Strong authentication mechanisms, such as multi-factor authentication (MFA), are implemented to verify the identity of users accessing the system. This adds an extra layer of security beyond just a username and password.
- Role-Based Access Control (RBAC): Users are assigned specific roles with defined permissions, ensuring that they can only access data and perform actions relevant to their role. This minimizes the risk of unauthorized access and data manipulation.

3. Secure Coding Practices

- Code Reviews: Regular code reviews are conducted to identify and fix security vulnerabilities such as SQL injection, cross-site scripting (XSS), and other common threats.
- Static Analysis Tools: Automated tools are used to scan the codebase for potential security issues. These tools help identify vulnerabilities early in the development process.

4. Data Anonymization

- Personally Identifiable Information (PII): Any PII in the sales data is anonymized to protect customer privacy. Techniques such as data masking and pseudonymization are employed to ensure that sensitive information cannot be traced back to individual customers.
- Aggregation: Data is aggregated where possible to reduce the granularity of sensitive information, thus minimizing privacy risks while still providing valuable insights.

5. Network Security

- Firewalls: Firewalls are configured to block unauthorized access to the network. They are set up to allow only legitimate traffic to reach the servers hosting the sales analysis system.
- Intrusion Detection Systems (IDS): IDS are deployed to monitor network traffic for suspicious activities and potential security breaches. Alerts are generated for any unusual activity, allowing for quick response and mitigation.

6. Regular Security Audits

- Penetration Testing: Regular penetration testing is performed to identify and address vulnerabilities. Ethical hackers simulate attacks to uncover weaknesses in the system.
- Compliance Audits: The system undergoes periodic audits to ensure compliance with industry standards and regulations, such as GDPR for data protection.

7. Backup and Recovery

- Regular Backups: Data is backed up regularly to secure offsite locations. This ensures that in the event of a data breach or system failure, data can be restored with minimal loss.
- Disaster Recovery Plan: A comprehensive disaster recovery plan is in place to ensure business continuity. This plan includes procedures for data restoration, system recovery, and communication with stakeholders during an incident.

8. User Education

- Security Training: Regular training sessions are conducted for users and developers to raise awareness about security best practices and the importance of protecting sensitive data.
- Incident Response Plan: Users are educated on the incident response plan, ensuring that they know how to report potential security incidents and what actions to take in the event of a breach.

Future Scope of the Project

The Diwali Sales Analysis project lays the groundwork for further exploration and enhancement in several areas. Below are some potential avenues for future development and expansion:

1. Predictive Modeling

Implement machine learning algorithms to develop predictive models for forecasting Diwali sales trends. Explore time series forecasting techniques such as ARIMA, SARIMA, or Prophet to predict future sales volumes. Integrate external factors such as economic indicators, weather patterns, and social trends to improve prediction accuracy.

2. Customer Segmentation

Conduct more granular analysis of customer demographics to identify distinct segments based on purchasing behavior, preferences, and engagement levels. Develop personalized marketing strategies and targeted promotions tailored to specific customer segments to enhance customer satisfaction and loyalty.

3. Real-time Analysis

Explore real-time data streaming technologies to analyze sales data as it becomes available, enabling retailers to make timely decisions and respond quickly to market changes during the Diwali season. Implement interactive dashboards and visualizations that update dynamically to provide real-time insights into sales performance.

4. Market Basket Analysis

Conduct market basket analysis to identify product associations and patterns in customer purchasing behavior during Diwali. Generate insights into cross-selling opportunities, product bundling strategies, and optimizing product placements to increase basket sizes and revenue.

5. Geographic Expansion

Expand the scope of analysis to include sales data from different regions and cities to understand regional variations in consumer behavior and preferences. Tailor marketing strategies and product offerings based on regional insights to better cater to diverse customer needs and preferences.

6. Integration with Retail Operations

Integrate analysis findings with retail operations systems such as inventory management, supply chain logistics, and pricing strategies to optimize overall business performance. Develop automated decision support systems that leverage analysis insights to streamline operations and improve efficiency.

7. Enhanced Data Visualization

Experiment with advanced visualization techniques such as interactive maps, network graphs, and 3D visualizations to present sales data in innovative and engaging ways. Incorporate storytelling elements into visualizations to convey insights more effectively and make the analysis findings more compelling.

8. Collaboration and Knowledge Sharing

Foster collaboration with other retail industry stakeholders, academia, and research organizations to share insights, best practices, and emerging trends in Diwali sales analysis. Contribute to open-source projects and participate in industry conferences and workshops to showcase project findings and foster knowledge exchange.

Glossary

1. Diwali:

Also known as the Festival of Lights, Diwali is one of the most significant Hindu festivals celebrated with great enthusiasm across India and other parts of the world. It symbolizes the victory of light over darkness, good over evil, and knowledge over ignorance.

2. Sales Analysis:

The process of analyzing sales data to gain insights into sales trends, patterns, and performance. It involves examining sales volumes, revenue, customer behavior, and other factors to inform decision-making and optimize sales strategies.

3. Data Preprocessing:

The initial step in data analysis that involves cleaning, transforming, and preparing raw data for analysis. It includes tasks such as removing duplicates, handling missing values, standardizing formats, and creating new features.

4. Exploratory Data Analysis (EDA):

An approach to analyzing data sets to summarize their main characteristics, often with visual methods. EDA helps uncover patterns, detect anomalies, and formulate hypotheses, providing insights into the underlying structure of the data.

5. Data Visualization:

The graphical representation of data to facilitate understanding, analysis, and communication of insights. It encompasses various techniques such as charts, graphs, maps, and dashboards to visually present patterns, trends, and relationships in the data.

6. Predictive Modeling:

The process of using historical data to predict future outcomes. Predictive models leverage statistical algorithms and machine learning techniques to identify patterns and relationships in data and make predictions about future events or behaviors.

7. Customer Segmentation:

The division of customers into distinct groups based on shared characteristics such as demographics, purchasing behavior, and preferences. Customer segmentation enables targeted marketing efforts, personalized messaging, and tailored product offerings.

8. Market Basket Analysis:

A data mining technique used to identify relationships between products frequently purchased together by customers. Market basket analysis helps retailers understand consumer purchasing patterns and optimize product placement, cross-selling, and promotions.

9. Time Series Analysis:

A statistical technique used to analyze time-ordered data to identify patterns, trends, and seasonality. Time series analysis is commonly used in forecasting future values based on historical data and understanding the underlying patterns in time-varying phenomena.

10. Machine Learning:

A branch of artificial intelligence that enables computers to learn from data and make predictions or decisions without being explicitly programmed. Machine learning algorithms learn patterns and relationships in data to make predictions or take actions, often used in predictive modeling and pattern recognition tasks.

BIBLIOGRAPHY

VanderPlas, Jake. "Python Data Science Handbook." O'Reilly Media, 2016.

This book provides comprehensive coverage of data science tools and techniques in Python, including NumPy, Pandas, Matplotlib, and Scikit-learn, which are essential for data analysis and machine learning.

McKinney, Wes. "Python for Data Analysis." O'Reilly Media, 2017.

Another valuable resource authored by Wes McKinney, the creator of Pandas library, focusing specifically on data manipulation and analysis using Python's Pandas library.

Seaborn Documentation. <https://seaborn.pydata.org/>

The official documentation for Seaborn library, offering detailed explanations, tutorials, and examples for creating attractive and informative statistical visualizations.

Matplotlib Documentation. <https://matplotlib.org/>

The official documentation for Matplotlib library, providing comprehensive guides and examples for creating various types of plots and charts for data visualization.

GitHub Repository: Various repositories containing code snippets, examples, and tutorials related to data analysis, machine learning, and visualization techniques in Python.

YouTube Tutorials: Various YouTube channels offering tutorials and demonstrations on Python programming, data analysis, and machine learning techniques, which may have provided additional guidance and insights for your project.

Coursera Courses: Online courses on data analysis, machine learning, and related topics available on platforms like Coursera, which may have provided theoretical knowledge and practical skills applicable to your project.

Jupyter Notebook Documentation. <https://jupyter.org/>

The official documentation for Jupyter Notebook, providing guidance on using this interactive computing environment for writing code, visualizing data, and documenting analysis processes.

These sources likely contributed to my project by providing guidance, tutorials, documentation, and examples for using Python, Jupyter Notebook, data analysis libraries, and machine learning techniques.

Thank You for your time

