habbar-2347129-neostatingestion-2

November 19, 2024

1 RAW DATA PREPROCESSING

[ ]:
```
!pip install ydata-profiling
```

```
Collecting ydata-profiling
  Downloading ydata_profiling-4.12.0-py2.py3-none-any.whl.metadata (20 kB)
Requirement already satisfied: scipy<1.14,>=1.4.1 in
/usr/local/lib/python3.10/dist-packages (from ydata-profiling) (1.13.1)
Requirement already satisfied: pandas!=1.4.0,<3,>1.1 in
/usr/local/lib/python3.10/dist-packages (from ydata-profiling) (2.2.2)
Requirement already satisfied: matplotlib<3.10,>=3.5 in
/usr/local/lib/python3.10/dist-packages (from ydata-profiling) (3.8.0)
Requirement already satisfied: pydantic>=2 in /usr/local/lib/python3.10/dist-
packages (from ydata-profiling) (2.9.2)
Requirement already satisfied: PyYAML<6.1,>=5.0.0 in
/usr/local/lib/python3.10/dist-packages (from ydata-profiling) (6.0.2)
Requirement already satisfied: jinja2<3.2,>=2.11.1 in
/usr/local/lib/python3.10/dist-packages (from ydata-profiling) (3.1.4)
Collecting visions<0.7.7,>=0.7.5 (from
visions[type_image_path]<0.7.7,>=0.7.5->ydata-profiling)
  Downloading visions-0.7.6-py3-none-any.whl.metadata (11 kB)
Requirement already satisfied: numpy<2.2,>=1.16.0 in
/usr/local/lib/python3.10/dist-packages (from ydata-profiling) (1.26.4)
Collecting htmlmin==0.1.12 (from ydata-profiling)
  Downloading htmlmin-0.1.12.tar.gz (19 kB)
  Preparing metadata (setup.py) … done
Collecting phik<0.13,>=0.11.1 (from ydata-profiling)
  Downloading
phik-0.12.4-cp310-cp310-manylinux_2_17_x86_64.manylinux2014_x86_64.whl.metadata
(5.6 kB)
Requirement already satisfied: requests<3,>=2.24.0 in
/usr/local/lib/python3.10/dist-packages (from ydata-profiling) (2.32.3)
Requirement already satisfied: tqdm<5,>=4.48.2 in
/usr/local/lib/python3.10/dist-packages (from ydata-profiling) (4.66.6)
Requirement already satisfied: seaborn<0.14,>=0.10.1 in
/usr/local/lib/python3.10/dist-packages (from ydata-profiling) (0.13.2)
Collecting multimethod<2,>=1.4 (from ydata-profiling)
  Downloading multimethod-1.12-py3-none-any.whl.metadata (9.6 kB)
```

```
Requirement already satisfied: statsmodels<1,>=0.13.2 in
/usr/local/lib/python3.10/dist-packages (from ydata-profiling) (0.14.4)
Requirement already satisfied: typeguard<5,>=3 in
/usr/local/lib/python3.10/dist-packages (from ydata-profiling) (4.4.1)
Collecting imagehash==4.3.1 (from ydata-profiling)
  Downloading ImageHash-4.3.1-py2.py3-none-any.whl.metadata (8.0 kB)
Requirement already satisfied: wordcloud>=1.9.3 in
/usr/local/lib/python3.10/dist-packages (from ydata-profiling) (1.9.4)
Collecting dacite>=1.8 (from ydata-profiling)
  Downloading dacite-1.8.1-py3-none-any.whl.metadata (15 kB)
Requirement already satisfied: numba<1,>=0.56.0 in
/usr/local/lib/python3.10/dist-packages (from ydata-profiling) (0.60.0)
Collecting PyWavelets (from imagehash==4.3.1->ydata-profiling)
  Downloading pywavelets-1.7.0-cp310-cp310-manylinux_2_17_x86_64.manylinux2014_x
86_64.whl.metadata (9.0 kB)
Requirement already satisfied: pillow in /usr/local/lib/python3.10/dist-packages
(from imagehash==4.3.1->ydata-profiling) (11.0.0)
Requirement already satisfied: MarkupSafe>=2.0 in
/usr/local/lib/python3.10/dist-packages (from jinja2<3.2,>=2.11.1->ydata-
profiling) (3.0.2)
Requirement already satisfied: contourpy>=1.0.1 in
/usr/local/lib/python3.10/dist-packages (from matplotlib<3.10,>=3.5->ydata-
profiling) (1.3.1)
Requirement already satisfied: cycler>=0.10 in /usr/local/lib/python3.10/dist-
packages (from matplotlib<3.10,>=3.5->ydata-profiling) (0.12.1)
Requirement already satisfied: fonttools>=4.22.0 in
/usr/local/lib/python3.10/dist-packages (from matplotlib<3.10,>=3.5->ydata-
profiling) (4.54.1)
Requirement already satisfied: kiwisolver>=1.0.1 in
/usr/local/lib/python3.10/dist-packages (from matplotlib<3.10,>=3.5->ydata-
profiling) (1.4.7)
Requirement already satisfied: packaging>=20.0 in
/usr/local/lib/python3.10/dist-packages (from matplotlib<3.10,>=3.5->ydata-
profiling) (24.2)
Requirement already satisfied: pyparsing>=2.3.1 in
/usr/local/lib/python3.10/dist-packages (from matplotlib<3.10,>=3.5->ydata-
profiling) (3.2.0)
Requirement already satisfied: python-dateutil>=2.7 in
/usr/local/lib/python3.10/dist-packages (from matplotlib<3.10,>=3.5->ydata-
profiling) (2.8.2)
Requirement already satisfied: llvmlite<0.44,>=0.43.0dev0 in
/usr/local/lib/python3.10/dist-packages (from numba<1,>=0.56.0->ydata-profiling)
(0.43.0)
Requirement already satisfied: pytz>=2020.1 in /usr/local/lib/python3.10/dist-
packages (from pandas!=1.4.0,<3,>1.1->ydata-profiling) (2024.2)
Requirement already satisfied: tzdata>=2022.7 in /usr/local/lib/python3.10/dist-
packages (from pandas!=1.4.0,<3,>1.1->ydata-profiling) (2024.2)
Requirement already satisfied: joblib>=0.14.1 in /usr/local/lib/python3.10/dist-
```

```
packages (from phik<0.13,>=0.11.1->ydata-profiling) (1.4.2)
Requirement already satisfied: annotated-types>=0.6.0 in
/usr/local/lib/python3.10/dist-packages (from pydantic>=2->ydata-profiling)
(0.7.0)
Requirement already satisfied: pydantic-core==2.23.4 in
/usr/local/lib/python3.10/dist-packages (from pydantic>=2->ydata-profiling)
(2.23.4)
Requirement already satisfied: typing-extensions>=4.6.1 in
/usr/local/lib/python3.10/dist-packages (from pydantic>=2->ydata-profiling)
(4.12.2)
Requirement already satisfied: charset-normalizer<4,>=2 in
/usr/local/lib/python3.10/dist-packages (from requests<3,>=2.24.0->ydata-
profiling) (3.4.0)
Requirement already satisfied: idna<4,>=2.5 in /usr/local/lib/python3.10/dist-
packages (from requests<3,>=2.24.0->ydata-profiling) (3.10)
Requirement already satisfied: urllib3<3,>=1.21.1 in
/usr/local/lib/python3.10/dist-packages (from requests<3,>=2.24.0->ydata-
profiling) (2.2.3)
Requirement already satisfied: certifi>=2017.4.17 in
/usr/local/lib/python3.10/dist-packages (from requests<3,>=2.24.0->ydata-
profiling) (2024.8.30)
Requirement already satisfied: patsy>=0.5.6 in /usr/local/lib/python3.10/dist-
packages (from statsmodels<1,>=0.13.2->ydata-profiling) (1.0.1)
Requirement already satisfied: attrs>=19.3.0 in /usr/local/lib/python3.10/dist-
packages (from
visions<0.7.7,>=0.7.5->visions[type_image_path]<0.7.7,>=0.7.5->ydata-profiling)
(24.2.0)
Requirement already satisfied: networkx>=2.4 in /usr/local/lib/python3.10/dist-
packages (from
visions<0.7.7,>=0.7.5->visions[type_image_path]<0.7.7,>=0.7.5->ydata-profiling)
(3.4.2)
Requirement already satisfied: six>=1.5 in /usr/local/lib/python3.10/dist-
packages (from python-dateutil>=2.7->matplotlib<3.10,>=3.5->ydata-profiling)
(1.16.0)
Downloading ydata_profiling-4.12.0-py2.py3-none-any.whl (390 kB)
                         390.6/390.6 kB
8.7 MB/s eta 0:00:00
Downloading ImageHash-4.3.1-py2.py3-none-any.whl (296 kB)
                         296.5/296.5 kB
17.7 MB/s eta 0:00:00
Downloading dacite-1.8.1-py3-none-any.whl (14 kB)
Downloading multimethod-1.12-py3-none-any.whl (10 kB)
Downloading
phik-0.12.4-cp310-cp310-manylinux_2_17_x86_64.manylinux2014_x86_64.whl (686 kB)
                         686.1/686.1 kB
31.3 MB/s eta 0:00:00
Downloading visions-0.7.6-py3-none-any.whl (104 kB)
                         104.8/104.8 kB
```

```
8.6 MB/s eta 0:00:00
Downloading
pywavelets-1.7.0-cp310-cp310-manylinux_2_17_x86_64.manylinux2014_x86_64.whl (4.5
MB)
                         4.5/4.5 MB
53.5 MB/s eta 0:00:00
Building wheels for collected packages: htmlmin
  Building wheel for htmlmin (setup.py) … done
  Created wheel for htmlmin: filename=htmlmin-0.1.12-py3-none-any.whl size=27081
sha256=cdebcbf0406f8edc17e51b85e3bf83cec19f8a6cee26817f93c3d99a0fa71dc1
  Stored in directory: /root/.cache/pip/wheels/dd/91/29/a79cecb328d01739e64017b6
fb9a1ab9d8cb1853098ec5966d
Successfully built htmlmin
Installing collected packages: htmlmin, PyWavelets, multimethod, dacite,
imagehash, visions, phik, ydata-profiling
Successfully installed PyWavelets-1.7.0 dacite-1.8.1 htmlmin-0.1.12
imagehash-4.3.1 multimethod-1.12 phik-0.12.4 visions-0.7.6 ydata-
profiling-4.12.0
```

[ ]:
```python
from google.colab import drive
drive.mount('/content/drive')

# Step 2: Import necessary libraries
import pandas as pd
from ydata_profiling import ProfileReport

# Step 3: Specify the file path
# If the file is stored in Google Drive, specify the full path within your Drive
file_path = '/content/drive/MyDrive/neostat_data/sales_data.csv'  # Replace␣
 ↪with your actual folder name and file name

# Load the CSV file into a DataFrame
df = pd.read_csv(file_path)

# Step 4: Check for missing values
print("Missing values in each column:")
print(df.isnull().sum())

# Check for duplicate rows
print(f"Number of duplicate rows: {df.duplicated().sum()}")

# Step 5: Statistical summary
print("Statistical summary of the data:")
print(df.describe())

# Check data types of columns
print("Data types of columns:")
```

```python
print(df.dtypes)

# Step 6: Generate a Pandas Profiling Report
profile = ProfileReport(df, title='Pandas Profiling Report', explorative=True)

# Save the report to an HTML file
profile.to_file("/content/data_profile_report.html")
print("Pandas Profiling report generated successfully!")

# Step 7: Instructions to download the report
from google.colab import files
files.download('/content/data_profile_report.html')
```

```
Drive already mounted at /content/drive; to attempt to forcibly remount, call
drive.mount("/content/drive", force_remount=True).
Missing values in each column:
OrderID             0
CustomerName        0
PhoneNumber         0
Location            0
Country             0
StoreCode           0
Product             0
Quantity            0
Price               9
Date                0
CreditCardNumber    0
ExpiryDate          0
dtype: int64
Number of duplicate rows: 0
Statistical summary of the data:
         Quantity         Price
count   99.000000  9.000000e+01
mean    42.868687  8.813004e+04
std     52.973356  8.209713e+05
min      1.000000  1.659600e+02
25%      6.000000  5.212900e+02
50%      9.000000  9.728750e+02
75%     71.500000  2.805749e+03
max    162.000000  7.790000e+06
Data types of columns:
OrderID              object
CustomerName         object
PhoneNumber          object
Location             object
Country              object
StoreCode            object
```

```
Product              object
Quantity              int64
Price               float64
Date                 object
CreditCardNumber     object
ExpiryDate           object
dtype: object
```

```
Summarize dataset:   0%|          | 0/5 [00:00<?, ?it/s]
```

```
Generate report structure:   0%|          | 0/1 [00:00<?, ?it/s]
```

```
Render HTML:   0%|          | 0/1 [00:00<?, ?it/s]
```

```
Export report to file:   0%|          | 0/1 [00:00<?, ?it/s]
```

```
Pandas Profiling report generated successfully!
```

```
<IPython.core.display.Javascript object>
```

```
<IPython.core.display.Javascript object>
```

[ ]:
```
pip install azure-storage-blob
```

```
Collecting azure-storage-blob
  Downloading azure_storage_blob-12.24.0-py3-none-any.whl.metadata (26 kB)
Collecting azure-core>=1.30.0 (from azure-storage-blob)
  Downloading azure_core-1.32.0-py3-none-any.whl.metadata (39 kB)
Requirement already satisfied: cryptography>=2.1.4 in
/usr/local/lib/python3.10/dist-packages (from azure-storage-blob) (43.0.3)
Requirement already satisfied: typing-extensions>=4.6.0 in
/usr/local/lib/python3.10/dist-packages (from azure-storage-blob) (4.12.2)
Collecting isodate>=0.6.1 (from azure-storage-blob)
  Downloading isodate-0.7.2-py3-none-any.whl.metadata (11 kB)
Requirement already satisfied: requests>=2.21.0 in
/usr/local/lib/python3.10/dist-packages (from azure-core>=1.30.0->azure-storage-
blob) (2.32.3)
Requirement already satisfied: six>=1.11.0 in /usr/local/lib/python3.10/dist-
packages (from azure-core>=1.30.0->azure-storage-blob) (1.16.0)
Requirement already satisfied: cffi>=1.12 in /usr/local/lib/python3.10/dist-
packages (from cryptography>=2.1.4->azure-storage-blob) (1.17.1)
Requirement already satisfied: pycparser in /usr/local/lib/python3.10/dist-
packages (from cffi>=1.12->cryptography>=2.1.4->azure-storage-blob) (2.22)
Requirement already satisfied: charset-normalizer<4,>=2 in
/usr/local/lib/python3.10/dist-packages (from requests>=2.21.0->azure-
core>=1.30.0->azure-storage-blob) (3.4.0)
Requirement already satisfied: idna<4,>=2.5 in /usr/local/lib/python3.10/dist-
packages (from requests>=2.21.0->azure-core>=1.30.0->azure-storage-blob) (3.10)
Requirement already satisfied: urllib3<3,>=1.21.1 in
/usr/local/lib/python3.10/dist-packages (from requests>=2.21.0->azure-
core>=1.30.0->azure-storage-blob) (2.2.3)
```

```
Requirement already satisfied: certifi>=2017.4.17 in
/usr/local/lib/python3.10/dist-packages (from requests>=2.21.0->azure-
core>=1.30.0->azure-storage-blob) (2024.8.30)
Downloading azure_storage_blob-12.24.0-py3-none-any.whl (408 kB)
                         408.6/408.6 kB
11.1 MB/s eta 0:00:00
Downloading azure_core-1.32.0-py3-none-any.whl (198 kB)
                         198.9/198.9 kB
16.7 MB/s eta 0:00:00
Downloading isodate-0.7.2-py3-none-any.whl (22 kB)
Installing collected packages: isodate, azure-core, azure-storage-blob
Successfully installed azure-core-1.32.0 azure-storage-blob-12.24.0
isodate-0.7.2
```

2 DATA(raw) INGESTION TO AZURE

[ ]:
```python
from azure.storage.blob import BlobServiceClient
import os

# Connection string for the ADLS Gen2 account
connection_string = 'DefaultEndpointsProtocol=https;AccountName=salesdata2;
 ↪AccountKey=qmGm5qRmT45FAUNreFet0Tb+GQ7Hn8tFVGM6STDpN2h+IqG/
 ↪0HTPqpiSzf7io6InKhKZ/KgJxk86+AStA1wfHA==;EndpointSuffix=core.windows.net'␣
 ↪#my connection string

# Initialize BlobServiceClient
blob_service_client = BlobServiceClient.
 ↪from_connection_string(connection_string)

# Specify container and file details
container_name = 'salesdata11'
local_file_path = '/content/drive/MyDrive/neostat_data/sales_data.csv'
blob_name = 'sales_data.csv'

# Upload file to ADLS Gen2
def upload_to_adls():
    try:
        # Get the BlobClient
        blob_client = blob_service_client.
 ↪get_blob_client(container=container_name, blob=blob_name)

        # Upload the file
        with open(local_file_path, 'rb') as data:
            blob_client.upload_blob(data, overwrite=True)

        print(f"File '{blob_name}' uploaded successfully to container␣
 ↪'{container_name}'.")
    except Exception as e:
```

```
        print(f"Error uploading file: {e}")

# Call the function
upload_to_adls()
```

```
File 'sales_data.csv' uploaded successfully to container 'salesdata11'.
```

[ ]:
```
# from google.colab import drive
# drive.mount('/content/drive')
```

```
Drive already mounted at /content/drive; to attempt to forcibly remount, call
drive.mount("/content/drive", force_remount=True).
```

3 Automated Data Cleaning and Uploading to ADLS and Google Drive

[ ]:
```
!pip install azure-storage-file-datalake
```

```
Collecting azure-storage-file-datalake
  Downloading azure_storage_file_datalake-12.18.0-py3-none-any.whl.metadata (16
kB)
Requirement already satisfied: azure-core>=1.30.0 in
/usr/local/lib/python3.10/dist-packages (from azure-storage-file-datalake)
(1.32.0)
Requirement already satisfied: azure-storage-blob>=12.24.0 in
/usr/local/lib/python3.10/dist-packages (from azure-storage-file-datalake)
(12.24.0)
Requirement already satisfied: typing-extensions>=4.6.0 in
/usr/local/lib/python3.10/dist-packages (from azure-storage-file-datalake)
(4.12.2)
Requirement already satisfied: isodate>=0.6.1 in /usr/local/lib/python3.10/dist-
packages (from azure-storage-file-datalake) (0.7.2)
Requirement already satisfied: requests>=2.21.0 in
/usr/local/lib/python3.10/dist-packages (from azure-core>=1.30.0->azure-storage-
file-datalake) (2.32.3)
Requirement already satisfied: six>=1.11.0 in /usr/local/lib/python3.10/dist-
packages (from azure-core>=1.30.0->azure-storage-file-datalake) (1.16.0)
Requirement already satisfied: cryptography>=2.1.4 in
/usr/local/lib/python3.10/dist-packages (from azure-storage-
blob>=12.24.0->azure-storage-file-datalake) (43.0.3)
Requirement already satisfied: cffi>=1.12 in /usr/local/lib/python3.10/dist-
packages (from cryptography>=2.1.4->azure-storage-blob>=12.24.0->azure-storage-
file-datalake) (1.17.1)
Requirement already satisfied: charset-normalizer<4,>=2 in
/usr/local/lib/python3.10/dist-packages (from requests>=2.21.0->azure-
core>=1.30.0->azure-storage-file-datalake) (3.4.0)
Requirement already satisfied: idna<4,>=2.5 in /usr/local/lib/python3.10/dist-
packages (from requests>=2.21.0->azure-core>=1.30.0->azure-storage-file-
datalake) (3.10)
```

```
Requirement already satisfied: urllib3<3,>=1.21.1 in
/usr/local/lib/python3.10/dist-packages (from requests>=2.21.0->azure-
core>=1.30.0->azure-storage-file-datalake) (2.2.3)
Requirement already satisfied: certifi>=2017.4.17 in
/usr/local/lib/python3.10/dist-packages (from requests>=2.21.0->azure-
core>=1.30.0->azure-storage-file-datalake) (2024.8.30)
Requirement already satisfied: pycparser in /usr/local/lib/python3.10/dist-
packages (from cffi>=1.12->cryptography>=2.1.4->azure-storage-
blob>=12.24.0->azure-storage-file-datalake) (2.22)
Downloading azure_storage_file_datalake-12.18.0-py3-none-any.whl (258 kB)
                           258.4/258.4 kB
3.7 MB/s eta 0:00:00
Installing collected packages: azure-storage-file-datalake
Successfully installed azure-storage-file-datalake-12.18.0
```

[11]:
```python
from azure.storage.filedatalake import DataLakeServiceClient
import pandas as pd
from io import BytesIO

# Connection string for the ADLS Gen2 account
connection_string = 'DefaultEndpointsProtocol=https;AccountName=salesdata2;
 ↪AccountKey=qmGm5qRmT45FAUNreFet0Tb+GQ7Hn8tFVGM6STDpN2h+IqG/
 ↪0HTPqpiSzf7io6InKhKZ/KgJxk86+AStA1wfHA==;EndpointSuffix=core.windows.net'  #␣
 ↪Replace with your connection string

# File and container details
container_name = 'salesdata11'
file_path = 'sales_data.csv'  # Input file
cleaned_file_path = 'cleaneddataset.csv'  # Cleaned output file
google_drive_path = '/content/drive/My Drive/neostat_data/cleaneddataset.csv'

# Initialize DataLakeServiceClient
datalake_service_client = DataLakeServiceClient.
 ↪from_connection_string(connection_string)

def fetch_data():
    try:
        # Get file system client
        file_system_client = datalake_service_client.
 ↪get_file_system_client(container_name)

        # Fetch the file from ADLS
        file_client = file_system_client.get_file_client(file_path)
        download = file_client.download_file()
        downloaded_bytes = download.readall()

        # Load the file into a pandas DataFrame
```

```
        df = pd.read_csv(BytesIO(downloaded_bytes))
        print("Data fetched successfully.")
        return df
    except Exception as e:
        print(f"Error fetching data: {e}")
        return None

# Data quality checks
def check_missing_values(data):
    missing_values = data.isnull().sum()
    print("\nMissing Values:")
    print(missing_values)
    return missing_values

def check_duplicates(data):
    duplicates = data.duplicated().sum()
    print("\nNumber of Duplicate Rows: ", duplicates)
    return duplicates

def check_data_types(data):
    print("\nData Types:")
    print(data.dtypes)

def check_outliers(data, column_name):
    Q1 = data[column_name].quantile(0.25)
    Q3 = data[column_name].quantile(0.75)
    IQR = Q3 - Q1
    lower_bound = Q1 - 1.5 * IQR
    upper_bound = Q3 + 1.5 * IQR
    outliers = data[(data[column_name] < lower_bound) | (data[column_name] >␣
 ↪upper_bound)]
    print(f"\nOutliers in {column_name}:")
    print(outliers)
    return outliers

def check_invalid_data(data):
    # Example: Check if phone number format is valid (basic validation)
    if 'PhoneNumber' in data.columns:
        invalid_phones = data[~data['PhoneNumber'].str.match(r'^\+1␣
 ↪\d{3}-\d{3}-\d{4}$', na=False)]
        print("\nInvalid Phone Numbers:")
        print(invalid_phones[['PhoneNumber']])

    # Example: Check if 'Date' column has any invalid dates
    if 'Date' in data.columns:
        invalid_dates = data[pd.to_datetime(data['Date'], errors='coerce').
 ↪isnull()]
```

```
        print("\nInvalid Dates:")
        print(invalid_dates[['Date']])

def check_data_quality(data):
    # Check missing values
    missing_values = check_missing_values(data)
    if missing_values.any():
        print("\nMissing values detected! You may want to fill or drop them.")

    # Check for duplicates
    duplicates = check_duplicates(data)
    if duplicates > 0:
        print("\nDuplicates detected! You may want to remove them.")

    # Check data types
    check_data_types(data)

    # Check for outliers in 'Price' and 'Quantity' (example columns)
    if 'Price' in data.columns:
        check_outliers(data, 'Price')
    if 'Quantity' in data.columns:
        check_outliers(data, 'Quantity')

    # Check for invalid phone numbers and dates
    check_invalid_data(data)

    print("\nData check completed.")

def clean_data(data):
    print("Performing data cleaning...")

    # Check and print missing values before cleaning
    print("\nMissing values before cleaning:")
    print(data.isnull().sum())

    # Iterate through all columns to handle missing values
    for column in data.columns:
        if data[column].dtype == 'object':  # For categorical (object) data
            data[column].fillna("Unknown", inplace=True)
        elif pd.api.types.is_numeric_dtype(data[column]):  # For numeric data
            data[column].fillna(data[column].mean(), inplace=True)  # Fill with␣
 ↪mean
        elif pd.api.types.is_datetime64_any_dtype(data[column]):  # For␣
 ↪datetime data
            data[column].fillna(pd.Timestamp('2000-01-01'), inplace=True)  #␣
 ↪Fill with default date
```

```
    # Check and print missing values after cleaning
    print("\nMissing values after cleaning:")
    print(data.isnull().sum())

    # Ensure 'Quantity' and 'Price' are numeric (if these columns exist)
    if 'Quantity' in data.columns:
        data['Quantity'] = pd.to_numeric(data['Quantity'], errors='coerce')
    if 'Price' in data.columns:
        data['Price'] = pd.to_numeric(data['Price'], errors='coerce')

    # Ensure 'Date' is in datetime format (if 'Date' exists)
    if 'Date' in data.columns:
        data['Date'] = pd.to_datetime(data['Date'], errors='coerce')

    print("Data cleaning completed.")
    return data

def upload_cleaned_data(df):
    try:
        # Convert cleaned DataFrame to bytes
        output_buffer = BytesIO()
        df.to_csv(output_buffer, index=False)
        output_buffer.seek(0)

        # Get the file client for cleaned file
        file_client = datalake_service_client.
 ↪get_file_system_client(container_name).get_file_client(cleaned_file_path)

        # Upload the cleaned file to ADLS
        file_client.upload_data(output_buffer, overwrite=True)
        print(f"Cleaned dataset '{cleaned_file_path}' uploaded successfully.")
    except Exception as e:
        print(f"Error uploading cleaned dataset: {e}")
def save_cleaned_data_to_google_drive(df):
    try:
        # Save cleaned DataFrame to Google Drive
        df.to_csv(google_drive_path, index=False)
        print(f"Cleaned dataset saved successfully to Google Drive at␣
 ↪'{google_drive_path}'.")
    except Exception as e:
        print(f"Error saving cleaned dataset to Google Drive: {e}")


# Main workflow
if __name__ == "__main__":
    # Fetch data
    raw_data = fetch_data()
```

```
    if raw_data is not None:
        # Perform data quality checks
        check_data_quality(raw_data)

        # Clean data
        cleaned_data = clean_data(raw_data)

        # Upload cleaned data back to ADLS
        upload_cleaned_data(cleaned_data)
        # Save cleaned data to Google Drive
        save_cleaned_data_to_google_drive(cleaned_data)
```

```
Data fetched successfully.

Missing Values:
OrderID             0
CustomerName        0
PhoneNumber         0
Location            0
Country             0
StoreCode           0
Product             0
Quantity            0
Price               9
Date                0
CreditCardNumber    0
ExpiryDate          0
dtype: int64

Missing values detected! You may want to fill or drop them.

Number of Duplicate Rows:  0

Data Types:
OrderID              object
CustomerName         object
PhoneNumber          object
Location             object
Country              object
StoreCode            object
Product              object
Quantity              int64
Price               float64
Date                 object
CreditCardNumber     object
ExpiryDate           object
dtype: object
```

```
Outliers in Price:
   OrderID   CustomerName      PhoneNumber Location Country StoreCode Product  \
38   DRTYF  Test User1001  +1 657-683-1988   Mumbai   India     IN444   Phone

    Quantity      Price        Date     CreditCardNumber ExpiryDate
38         9  7790000.0  26-01-2023  4222 8888 6654 8876     Dec-24

Outliers in Quantity:
Empty DataFrame
Columns: [OrderID, CustomerName, PhoneNumber, Location, Country, StoreCode,
Product, Quantity, Price, Date, CreditCardNumber, ExpiryDate]
Index: []

Invalid Phone Numbers:
Empty DataFrame
Columns: [PhoneNumber]
Index: []

Invalid Dates:
Empty DataFrame
Columns: [Date]
Index: []

Data check completed.
Performing data cleaning…

Missing values before cleaning:
OrderID             0
CustomerName        0
PhoneNumber         0
Location            0
Country             0
StoreCode           0
Product             0
Quantity            0
Price               9
Date                0
CreditCardNumber    0
ExpiryDate          0
dtype: int64

Missing values after cleaning:
OrderID             0
CustomerName        0
PhoneNumber         0
Location            0
Country             0
```

```
StoreCode           0
Product             0
Quantity            0
Price               0
Date                0
CreditCardNumber    0
ExpiryDate          0
dtype: int64
Data cleaning completed.

<ipython-input-11-5fa4d614faf3>:71: UserWarning: Parsing dates in %d-%m-%Y
format when dayfirst=False (the default) was specified. Pass `dayfirst=True` or
specify a format to silence this warning.
  invalid_dates = data[pd.to_datetime(data['Date'], errors='coerce').isnull()]
<ipython-input-11-5fa4d614faf3>:110: FutureWarning: A value is trying to be set
on a copy of a DataFrame or Series through chained assignment using an inplace
method.
The behavior will change in pandas 3.0. This inplace method will never work
because the intermediate object on which we are setting values always behaves as
a copy.

For example, when doing 'df[col].method(value, inplace=True)', try using
'df.method({col: value}, inplace=True)' or df[col] = df[col].method(value)
instead, to perform the operation inplace on the original object.


  data[column].fillna("Unknown", inplace=True)
<ipython-input-11-5fa4d614faf3>:112: FutureWarning: A value is trying to be set
on a copy of a DataFrame or Series through chained assignment using an inplace
method.
The behavior will change in pandas 3.0. This inplace method will never work
because the intermediate object on which we are setting values always behaves as
a copy.

For example, when doing 'df[col].method(value, inplace=True)', try using
'df.method({col: value}, inplace=True)' or df[col] = df[col].method(value)
instead, to perform the operation inplace on the original object.


  data[column].fillna(data[column].mean(), inplace=True)  # Fill with mean
<ipython-input-11-5fa4d614faf3>:128: UserWarning: Parsing dates in %d-%m-%Y
format when dayfirst=False (the default) was specified. Pass `dayfirst=True` or
specify a format to silence this warning.
  data['Date'] = pd.to_datetime(data['Date'], errors='coerce')

Cleaned dataset 'cleaneddataset.csv' uploaded successfully.
Cleaned dataset saved successfully to Google Drive at '/content/drive/My
Drive/neostat_data/cleaneddataset.csv'.
```

Data Fetched Successfully The data from Azure Data Lake Storage (ADLS) was successfully retrieved and loaded into the program.

Missing Values

The Price column has 9 missing values, indicating some rows do not have a price listed. All other columns do not have any missing values.

Duplicates There are no duplicate rows in the data, meaning there are no repeated records.

Data Types The columns have the correct data types. For example, the Price column is of type float, and the Quantity column is of type integer. However, the Date column is currently in text format and will need to be converted to a date format.

Outliers The Price column contains one extreme value (7790000), which is considered an outlier. The Quantity column does not contain any outliers.

Invalid Data There are no invalid phone numbers, and the phone numbers appear to follow the correct format. There are no invalid dates in the Date column, but a warning indicates that the date format may need adjustment for future versions of pandas.

Data Cleaning Missing values in the Price column were filled with the average price of the column. Missing categorical data was filled with the word "Unknown". Missing date values were replaced with a default date (2000-01-01). After cleaning, all columns now have no missing values.

Data Upload

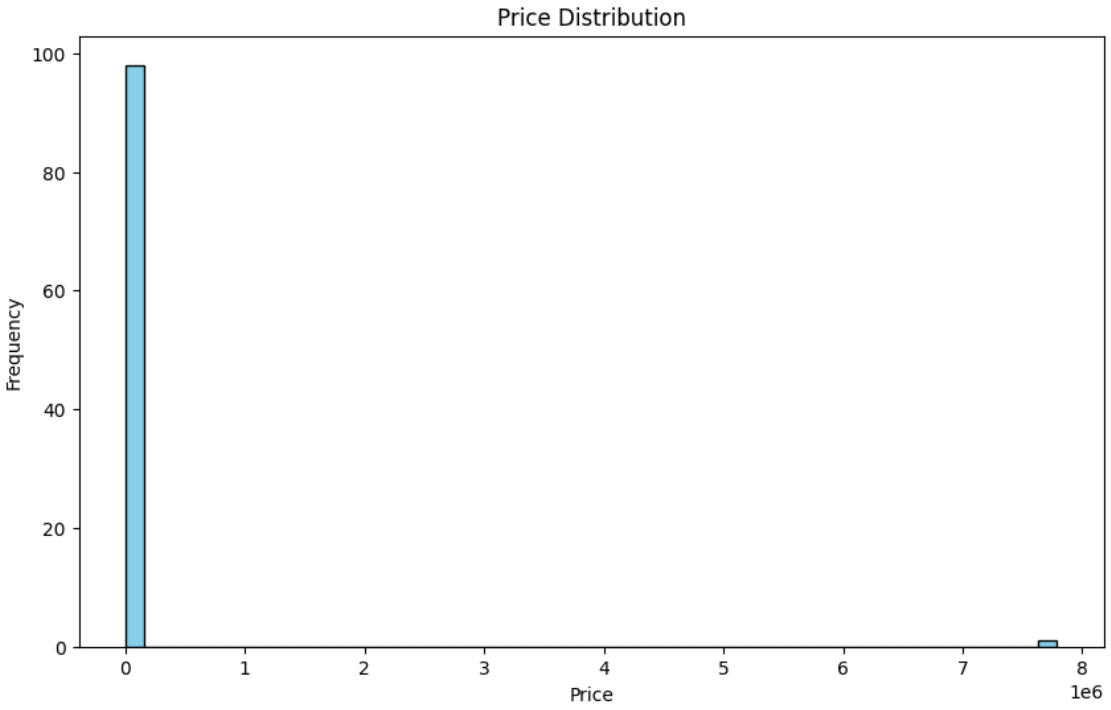
The cleaned data was successfully uploaded to both Azure Data Lake Storage (ADLS) and saved to Google Drive.

4 Data visualization and analysis:

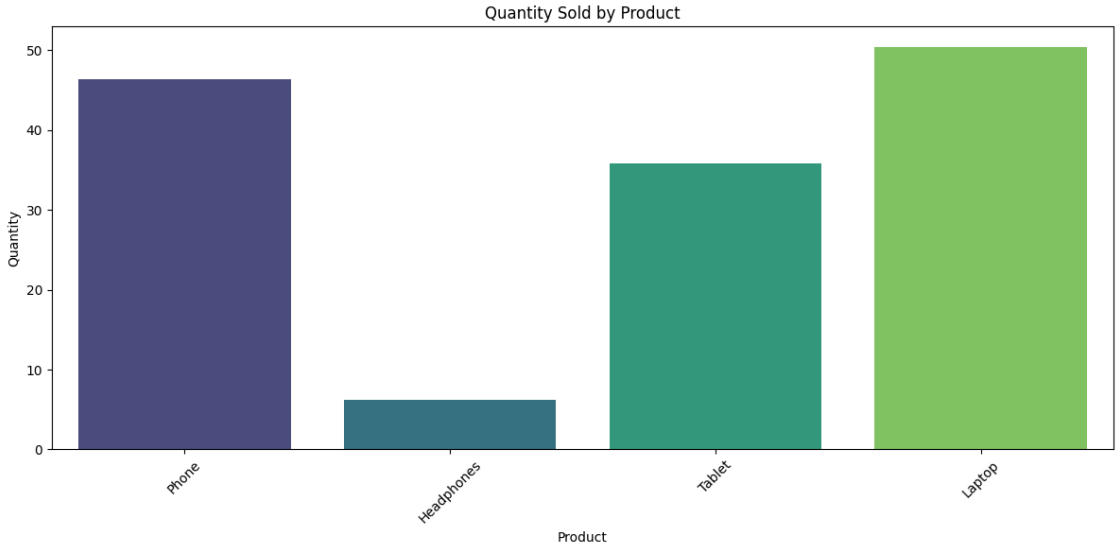
[14]:
```
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
from google.colab import drive

# Mount Google Drive
drive.mount('/content/drive')

# Path to the cleaned dataset in Google Drive
cleaned_data_path = '/content/drive/My Drive/neostat_data/cleaneddataset.csv'

# Step 1: Load the cleaned data
try:
    data = pd.read_csv(cleaned_data_path)
    print("Cleaned data loaded successfully.")
except Exception as e:
    print(f"Error loading cleaned data: {e}")

# Step 2: Histogram for Price Distribution
plt.figure(figsize=(10, 6))
```

```
plt.hist(data['Price'], bins=50, color='skyblue', edgecolor='black')
plt.title('Price Distribution')
plt.xlabel('Price')
plt.ylabel('Frequency')
plt.show()

# Step 3: Bar Plot for Quantity Sold by Product
plt.figure(figsize=(12, 6))
sns.barplot(x='Product', y='Quantity', data=data, palette='viridis', ci=None)
plt.title('Quantity Sold by Product')
plt.xlabel('Product')
plt.ylabel('Quantity')
plt.xticks(rotation=45)
plt.tight_layout()  # Adjust layout to prevent label cutoff
plt.show()

# Step 4: Group Data by Location and Calculate Total Sales
location_sales = data.groupby('Location')['Price'].sum().reset_index()

# Step 5: Bar Plot for Total Sales by Location
plt.figure(figsize=(10, 6))
sns.barplot(x='Location', y='Price', data=location_sales, palette='Blues',␣
 ↪ci=None)
plt.title('Total Sales by Location')
plt.xlabel('Location')
plt.ylabel('Total Sales')
plt.xticks(rotation=45)
plt.tight_layout()  # Adjust layout to prevent label cutoff
plt.show()

# Step 6: Display Basic Statistics
print("Basic Statistics:\n", data.describe())

# Step 7: Check for Missing Values
missing_values = data.isnull().sum()
print("\nMissing Values:\n", missing_values)

# Step 8: Heatmap for Missing Data Visualization (Optional)
plt.figure(figsize=(10, 6))
sns.heatmap(data.isnull(), cbar=False, cmap="viridis")
plt.title("Missing Data Heatmap")
plt.show()
```

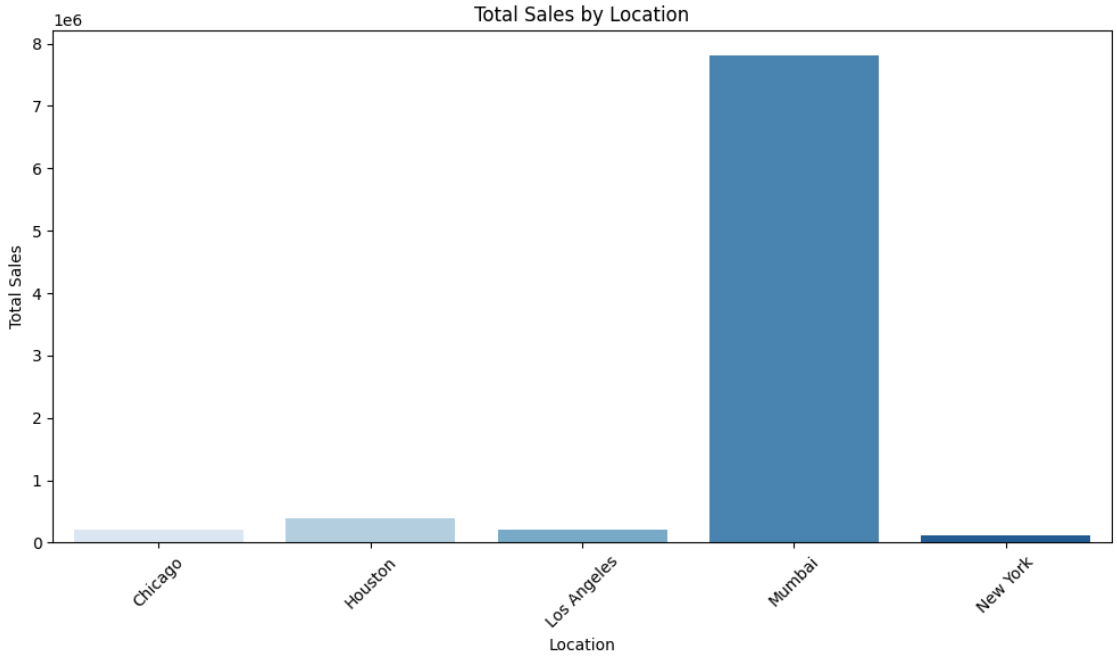
```
Drive already mounted at /content/drive; to attempt to forcibly remount, call
drive.mount("/content/drive", force_remount=True).
Cleaned data loaded successfully.
```



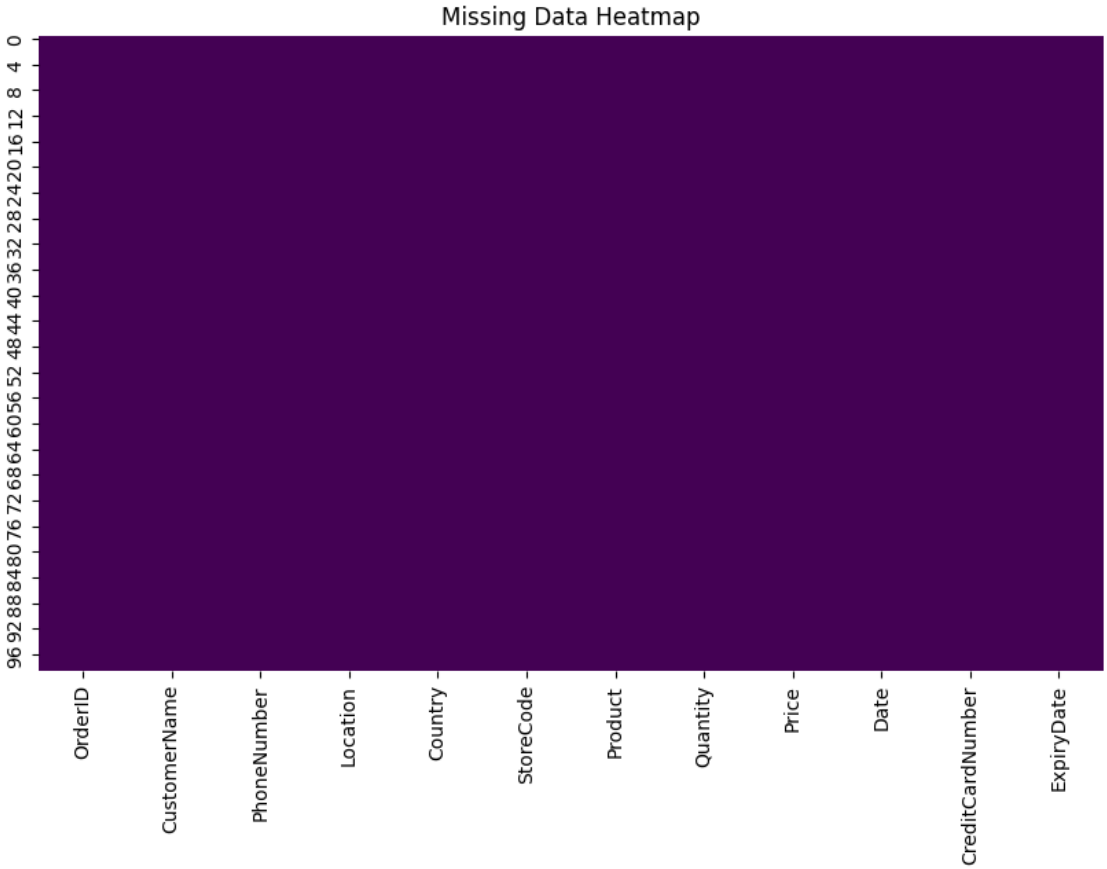

```
<ipython-input-14-116e26eb4543>:29: FutureWarning:

The `ci` parameter is deprecated. Use `errorbar=None` for the same effect.

  sns.barplot(x='Product', y='Quantity', data=data, palette='viridis', ci=None)
<ipython-input-14-116e26eb4543>:29: FutureWarning:

Passing `palette` without assigning `hue` is deprecated and will be removed in
v0.14.0. Assign the `x` variable to `hue` and set `legend=False` for the same
effect.

  sns.barplot(x='Product', y='Quantity', data=data, palette='viridis', ci=None)
```




```
<ipython-input-14-116e26eb4543>:42: FutureWarning:

The `ci` parameter is deprecated. Use `errorbar=None` for the same effect.

  sns.barplot(x='Location', y='Price', data=location_sales, palette='Blues',
ci=None)
<ipython-input-14-116e26eb4543>:42: FutureWarning:

Passing `palette` without assigning `hue` is deprecated and will be removed in
v0.14.0. Assign the `x` variable to `hue` and set `legend=False` for the same
effect.

  sns.barplot(x='Location', y='Price', data=location_sales, palette='Blues',
ci=None)
```




```
Basic Statistics:
          Quantity         Price
count   99.000000  9.900000e+01
mean    42.868687  8.813004e+04
std     52.973356  7.823660e+05
min      1.000000  1.659600e+02
25%      6.000000  5.699500e+02
50%      9.000000  1.183510e+03
75%     71.500000  3.248177e+03
max    162.000000  7.790000e+06

Missing Values:
 OrderID             0
CustomerName         0
PhoneNumber          0
Location             0
Country              0
StoreCode            0
Product              0
Quantity             0
Price                0
Date                 0
CreditCardNumber     0
ExpiryDate           0
dtype: int64
```


Missing Data Heatmap
0
4
8
12
16
20
24
28
32
36
40
44
48
52
56
60
64
68
72
76
80
84
88
92
96
OrderID
CustomerName
PhoneNumber
Location
Country
StoreCode
Product
Quantity
Price
Date
CreditCardNumber
ExpiryDate