Acadia_Script

November 19, 2024

[1]:
```
import pandas as pd
```

[2]:
```
file_path = "C:/Users/PC/OneDrive/Desktop/Data Science/Acadia_Assignment.xlsx"
excel_data = pd.read_excel(file_path, sheet_name = "Sheet1")
```

[4]:
```
excel_data.head()
```

[4]:

	CUSTOMERID	STATE	LCPCOUNT	PRIVATELABELTENDERFLAG	TENURE_IN_MONTHS	\
0	5001	TX	1	N	-9.0	
1	5002	OH	0	Y	9.0	
2	5003	TX	0	N	12.0	
3	5004	TN	0	N	-1.0	
4	5005	TX	0	N	16.0	

	CLOSESTSTOREDISTANCE	FEMALE	AGE	HS_DIPLOMA	SOME_COLLEGE	…	\
0	NaN	0	NaN	0	0	…	
1	8.728943	0	NaN	0	0	…	
2	NaN	0	NaN	0	0	…	
3	NaN	0	NaN	0	0	…	
4	NaN	0	NaN	0	0	…	

	MDAYREV_L3Y	MDAYREV_L4Y	MDAYQTY_L1Y	MDAYQTY_L2Y	MDAYQTY_L3Y	\
0	0.0	0.0	0	0	0	
1	0.0	0.0	0	0	0	
2	0.0	0.0	0	0	0	
3	0.0	0.0	0	0	0	
4	0.0	0.0	0	0	0	

	MDAYQTY_L4Y	MDAYSHOPPER_L1Y	MDAYSHOPPER_L2Y	MDAYSHOPPER_L3Y	\
0	0	0	0	0	
1	0	0	0	0	
2	0	0	0	0	
3	0	0	0	0	
4	0	0	0	0	

	MDAYSHOPPER_L4Y
0	0
1	0

```
2                0
3                0
4                0

[5 rows x 117 columns]
```

[5]:
```
excel_data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 10000 entries, 0 to 9999
Columns: 117 entries, CUSTOMERID to MDAYSHOPPER_L4Y
dtypes: float64(49), int64(65), object(3)
memory usage: 8.9+ MB
```

[60]:
```
from matplotlib.backends.backend_pdf import PdfPages
import matplotlib.pyplot as plt
import seaborn as sns

# Path for the output PDF
output_pdf = "C:/Users/PC/OneDrive/Desktop/Data Science/Missing_Values_Report.
 ↪pdf"

# Open a PDF file for saving plots
with PdfPages(output_pdf) as pdf:
    # 1. List columns with missing values
    missing_values = excel_data.isnull().sum()
    missing_columns = missing_values[missing_values > 0]
    # Plot missing values
    fig, ax = plt.subplots(figsize=(8, 6))
    ax.barh(missing_columns.index, missing_columns.values, color='skyblue')
    ax.set_title("Columns with Missing Values")
    ax.set_xlabel("Number of Missing Values")
    pdf.savefig(fig)
    plt.close(fig)
```

[61]:
```
# 2. Categorize columns by data type
output_pdf = "C:/Users/PC/OneDrive/Desktop/Data Science/Columns_Report.pdf"

# Open a PDF file for saving plots
with PdfPages(output_pdf) as pdf:
    numeric_columns = excel_data.select_dtypes(include=['float64', 'int64']).
 ↪columns.tolist()
    object_columns = excel_data.select_dtypes(include=['object']).columns.
 ↪tolist()
    boolean_columns = excel_data.select_dtypes(include=['bool']).columns.
 ↪tolist()
```

```
    datetime_columns = excel_data.select_dtypes(include=['datetime']).columns.
 ↪tolist()

# Plot column types
    fig, ax = plt.subplots(figsize=(8, 6))
    col_count = [len(numeric_columns), len(object_columns),␣
 ↪len(boolean_columns), len(datetime_columns)]
    ax.bar(["Numeric", "Object", "boolean", "datetime_columns" ], col_count ,␣
 ↪color=['blue', 'green', 'red', 'orange'])
    ax.set_title("Column Types")
    ax.set_ylabel("Count")

    for i, count in enumerate(col_count):
        ax.text(i, count + 1, str(count), ha='center', va='bottom',␣
 ↪fontsize=12, color='black')

    pdf.savefig(fig)
    plt.close(fig)

print("Numeric Columns:")
print(numeric_columns)
print("\nObject (String) Columns:")
print(object_columns)
```

```
Numeric Columns:
['CUSTOMERID', 'LCPCOUNT', 'TENURE_IN_MONTHS', 'CLOSESTSTOREDISTANCE', 'FEMALE',
'AGE', 'HS_DIPLOMA', 'SOME_COLLEGE', 'BACH_GRAD_DEG', 'LT_HS_DIPLOMA',
'MARRIED', 'MNGMNT_OFFICEADMIN', 'TECH_PROF', 'SALES_JOB', 'BLUE_COLLAR',
'FARMER', 'RETIRED', 'SFDU', 'MFDU', 'HOMEOWNER', 'INCOME', 'MAIL_RESP_MULTI',
'MAIL_RESP_SINGLE', 'LENGTH OF RESIDENCE', 'NUMBER OF PERSONS IN LIVING UNIT',
'NUMBER OF ADULTS IN LIVING UNIT', 'METRO', 'URBAN', 'MOR BANK: UPSCALE
MERCHANDISE BUYER', 'MOR BANK: MALE MERCHANDISE BUYER', 'MOR BANK: FEMALE
MERCHANDISE BUYER', 'MOR BANK: CRAFTS-HOBBY MERCHANDISE BUYER', 'MOR BANK:
GARDENING-FARMING BUYER', 'MOR BANK: BOOK BUYER', 'MOR BANK: COLLECT-SPECIAL
FOODS BUYER', 'MOR BANK: GIFTS AND GADGETS BUYER', 'MOR BANK: GENERAL
MERCHANDISE BUYER', 'MOR BANK: FAMILY AND GENERAL MAGAZINE', 'MOR BANK: FEMALE
ORIENTED MAGAZINE', 'MOR BANK: MALE SPORTS MAGAZINE', 'MOR BANK: RELIGIOUS
MAGAZINE', 'MOR BANK: GARDENING-FARMING MAGAZINE', 'MOR BANK: CULINARY INTERESTS
MAGAZINE', 'MOR BANK: HEALTH AND FITNESS MAGAZINE', 'MOR BANK: DO-IT-
YOURSELFERS', 'MOR BANK: NEWS AND FINANCIAL', 'MOR BANK: PHOTOGRAPHY', 'MOR
BANK: OPPORTUNITY SEEKERS AND CE', 'MOR BANK: RELIGIOUS CONTRIBUTOR', 'MOR BANK:
POLITICAL CONTRIBUTOR', 'MOR BANK: HEALTH AND INSTITUTION CONTRIBUTOR', 'MOR
BANK: GENERAL CONTRIBUTOR', 'MOR BANK: MISCELLANEOUS', 'MOR BANK: ODDS AND
ENDS', 'MOR BANK: DEDUPED CATEGORY HIT COUNT', 'MOR BANK: NON-DEDUPED CATEGORY
HIT COUNT', 'MORTGAGE-HOME PURCHASE: HOME PURCHASE PRICE', 'CHILDREN', 'CAPE:
AGE: POP: MEDIAN AGE', 'CAPE: AGE: POP: % 0-17', 'CAPE: AGE: POP: % 18-99+',
'CAPE: AGE: POP: % 65-99+', 'CAPE: ETHNIC: POP: % WHITE ONLY', 'CAPE: ETHNIC:
```

```
POP: % BLACK ONLY', 'CAPE: ETHNIC: POP: % ASIAN ONLY', 'CAPE: ETHNIC: POP: %
HISPANIC', 'CAPE: DENSITY: PERSONS PER HH FOR POP IN HH', 'CAPE: HHSIZE: HH:
AVERAGE HOUSEHOLD SIZE', 'CAPE: TYP: HH: % MARRIED COUPLE FAMILY', 'CAPE: CHILD:
HH: % WITH PERSONS LT18', 'CAPE: CHILD: HH: % MARR COUPLE FAMW- PERSONS LT18',
'CAPE: CHILD: HH: % MARR COUPLE FAMW-O PERSONS LT18', 'CAPE: LANG: HH: % SPANISH
SPEAKING', 'CAPE: EDUC: POP25+: MEDIAN EDUCATION ATTAINED', 'CAPE: HOMVAL: OOHU:
MEDIAN HOME VALUE', 'CAPE: BUILT: HU: MEDIAN HOUSING UNIT AGE', 'CAPE: TENANCY:
OCCHU: % OWNER OCCUPIED', 'CAPE: TENANCY: OCCHU: % RENTER OCCUPIED', 'CAPE:
EDUC: ISPSA', 'CAPE: EDUC: ISPSA DECILE', 'CAPE: INC: FAMILY INC STATE DECILE',
'CAPE: INC: HH: MEDIAN FAMILY HOUSEHOLD INCOME', 'FREQUENCY', 'QUANTITY',
'TOTALSALES', 'FREQUENCY_2Y', 'QUANTITY_2Y', 'TOTALSALES_2Y', '1-Engagement
Spend', '2-Wedding Bands Spend', '3-Fashion Diamonds Spend', '4-Fashion Jewelry
Spend', '5-Close Out Spend', '6-Promotional Items Spend', '7-Cost Only Spend',
'8-Marketing Premium SKUs Spend', '9-Repairs & Appraisals Spend', '10-Pre Owned
Spend', '11-Watches Spend', '12-Misc Merchandise Spend', '15-Store Events
Spend', '16-Single Stone Jewelry Spend', 'MDAYREV_L1Y', 'MDAYREV_L2Y',
'MDAYREV_L3Y', 'MDAYREV_L4Y', 'MDAYQTY_L1Y', 'MDAYQTY_L2Y', 'MDAYQTY_L3Y',
'MDAYQTY_L4Y', 'MDAYSHOPPER_L1Y', 'MDAYSHOPPER_L2Y', 'MDAYSHOPPER_L3Y',
'MDAYSHOPPER_L4Y']

Object (String) Columns:
['STATE', 'PRIVATELABELTENDERFLAG', 'MOSAIC']
```

[62]:
```
# 3. Identify and handle duplicate columns
output_pdf = "C:/Users/PC/OneDrive/Desktop/Data Science/Duplicates_Report.pdf"

# Open a PDF file for saving plots
with PdfPages(output_pdf) as pdf:
    duplicate_columns = excel_data.columns[excel_data.T.duplicated(keep=False)]
    before_removal = excel_data.shape[1]
    data_deduplicated = excel_data.loc[:, ~excel_data.T.
 ↪duplicated(keep='first')]
    after_removal = data_deduplicated.shape[1]

    # Plot duplicate columns removal
    fig, ax = plt.subplots(figsize=(8, 6))
    counts = [before_removal, after_removal]
    ax.bar(["Before", "After"], counts, color=['orange', 'purple'])
    ax.set_title("Duplicate Columns Removal")
    ax.set_ylabel("Column Count")

    for i, count in enumerate(counts):
        ax.text(i, count + 1, str(count), ha='center', va='bottom',␣
 ↪fontsize=12, color='black')

    pdf.savefig(fig)
    plt.close(fig)
```

```
print("Duplicate Columns:")
print(duplicate_columns.tolist())

# Before removing duplicates
print("\nBefore Removing Duplicates:")
print(f"Number of columns: {excel_data.shape[1]}")

# After removing duplicates
print("\nAfter Removing Duplicates:")
print(f"Number of columns: {data_deduplicated.shape[1]}")
```

```
Duplicate Columns:
['MARRIED', 'CHILDREN', 'CAPE: DENSITY: PERSONS PER HH FOR POP IN HH', 'CAPE:
HHSIZE: HH: AVERAGE HOUSEHOLD SIZE', '7-Cost Only Spend']

Before Removing Duplicates:
Number of columns: 117

After Removing Duplicates:
Number of columns: 114
```

[63]:
```
# 4. Identify and handle constant columns
output_pdf = "C:/Users/PC/OneDrive/Desktop/Data Science/constant_columns_Report.
 ↪pdf"

# Open a PDF file for saving plots
with PdfPages(output_pdf) as pdf:
    constant_columns = [col for col in data_deduplicated.columns if␣
 ↪data_deduplicated[col].nunique() == 1]
    before_removal = data_deduplicated.shape[1]
    data_without_constants = data_deduplicated.drop(columns=constant_columns,␣
 ↪errors='ignore')
    after_removal = data_without_constants.shape[1]

    # Plot constant columns removal
    fig, ax = plt.subplots(figsize=(8, 6))
    constant_count = [before_removal, after_removal]
    ax.bar(["Before", "After"], constant_count, color=['red', 'green'])
    ax.set_title("Constant Columns Removal")
    ax.set_ylabel("Column Count")

    for i, count in enumerate(constant_count):
        ax.text(i, count + 1, str(count), ha='center', va='bottom',␣
 ↪fontsize=12, color='black')

    pdf.savefig(fig)
```

```
    plt.close(fig)

# Print constant columns
print("Constant Columns:")
print(constant_columns)

# Before removing constant columns
print("\nBefore Removing Constant Columns:")
print(f"Number of columns: {data_deduplicated.shape[1]}")

# After removing constant columns
print("\nAfter Removing Constant Columns:")
print(f"Number of columns: {data_without_constants.shape[1]}")
```

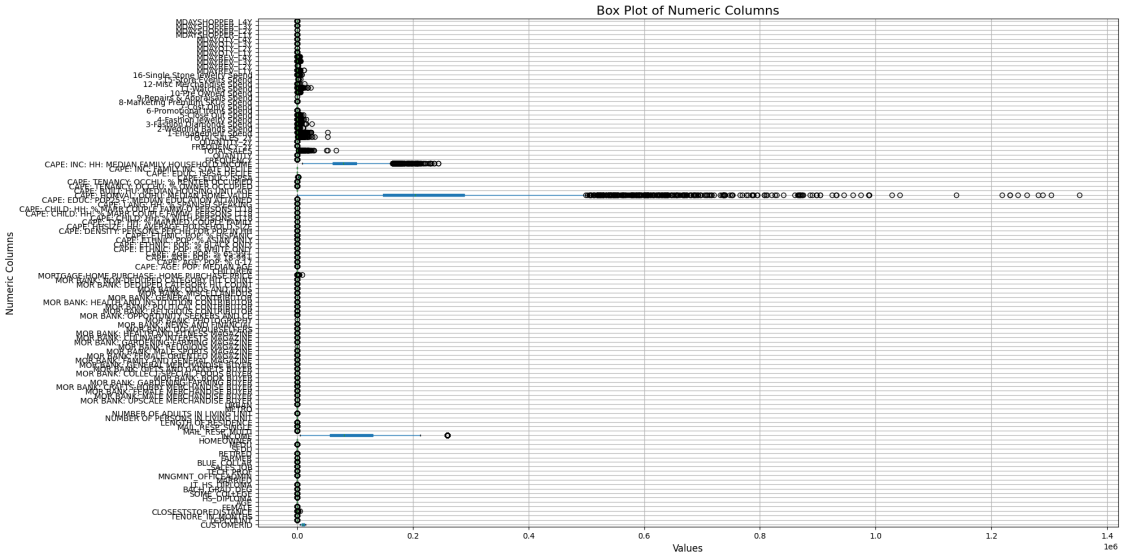
```
Constant Columns:
['MARRIED']

Before Removing Constant Columns:
Number of columns: 114

After Removing Constant Columns:
Number of columns: 113
```

[64]:
```
# 5. Create box plots for all numeric columns
output_pdf = "C:/Users/PC/OneDrive/Desktop/Data Science/Numeric_boxplot.pdf"

# Open a PDF file for saving plots
with PdfPages(output_pdf) as pdf:
    fig, ax = plt.subplots(figsize=(20, 10))
    excel_data[numeric_columns].boxplot(ax=ax, vert=False, grid=True,␣
 ↪patch_artist=True)
    ax.set_title("Box Plot of Numeric Columns", fontsize=16)
    ax.set_xlabel("Values", fontsize=12)
    ax.set_ylabel("Numeric Columns", fontsize=12)
    plt.tight_layout()
    plt.show()
    pdf.savefig(fig)
    plt.close(fig)
```



[65]:
```
# 5. Create box plots for 6 numeric columns
output_pdf = "C:/Users/PC/OneDrive/Desktop/Data Science/6Numeric_boxplot.pdf"

# Open a PDF file for saving plots
with PdfPages(output_pdf) as pdf:
    numeric_columns = data_without_constants.select_dtypes(include=['float64',␣
 ↪'int64']).columns
    for col in numeric_columns[:6]:  # Plot first 6 numeric columns as examples
        fig, ax = plt.subplots(figsize=(8, 6))
        sns.boxplot(x=data_without_constants[col], ax=ax, color='skyblue')
        ax.set_title(f"Box Plot: {col}")
        pdf.savefig(fig)
        plt.close(fig)
```

[66]:
```
# 6. Create distribution plots for 6 columns
output_pdf = "C:/Users/PC/OneDrive/Desktop/Data Science/Distribution_charts.pdf"

# Open a PDF file for saving plots
with PdfPages(output_pdf) as pdf:
        for col in numeric_columns[:6]:  # Plot first 6 numeric columns as␣
 ↪examples
            fig, ax = plt.subplots(figsize=(8, 6))
            sns.histplot(data_without_constants[col], kde=True, ax=ax,␣
 ↪color='green')
            ax.set_title(f"Distribution Plot: {col}")
            pdf.savefig(fig)
            plt.close(fig)
```