Experiment 1 : Data Cleaning & EDA

```python
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
import warnings
```

```python
data = pd.read_csv("/content/data.csv")
```

```python
data.head(5)
```

	Country	Age	Salary	Purchased
0	France	44.0	72000.0	No
1	Spain	27.0	48000.0	Yes
2	Germany	30.0	54000.0	No
3	Spain	38.0	61000.0	No
4	Germany	40.0	NaN	Yes

```python
data.shape
```

```
(10, 4)
```

```python
pd.set_option('display.max_columns', None)
pd.set_option('display.max_rows', None)
```

```python
data.head(2)
```

	Country	Age	Salary	Purchased
0	France	44.0	72000.0	No
1	Spain	27.0	48000.0	Yes

```python
data.tail(2)
```

	Country	Age	Salary	Purchased
8	Germany	50.0	83000.0	No
9	France	37.0	67000.0	Yes

```python
data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 10 entries, 0 to 9
Data columns (total 4 columns):
 #   Column     Non-Null Count  Dtype  
---  ------     --------------  -----  
 0   Country    10 non-null     object 
 1   Age        9 non-null      float64
 2   Salary     9 non-null      float64
 3   Purchased  10 non-null     object 
```

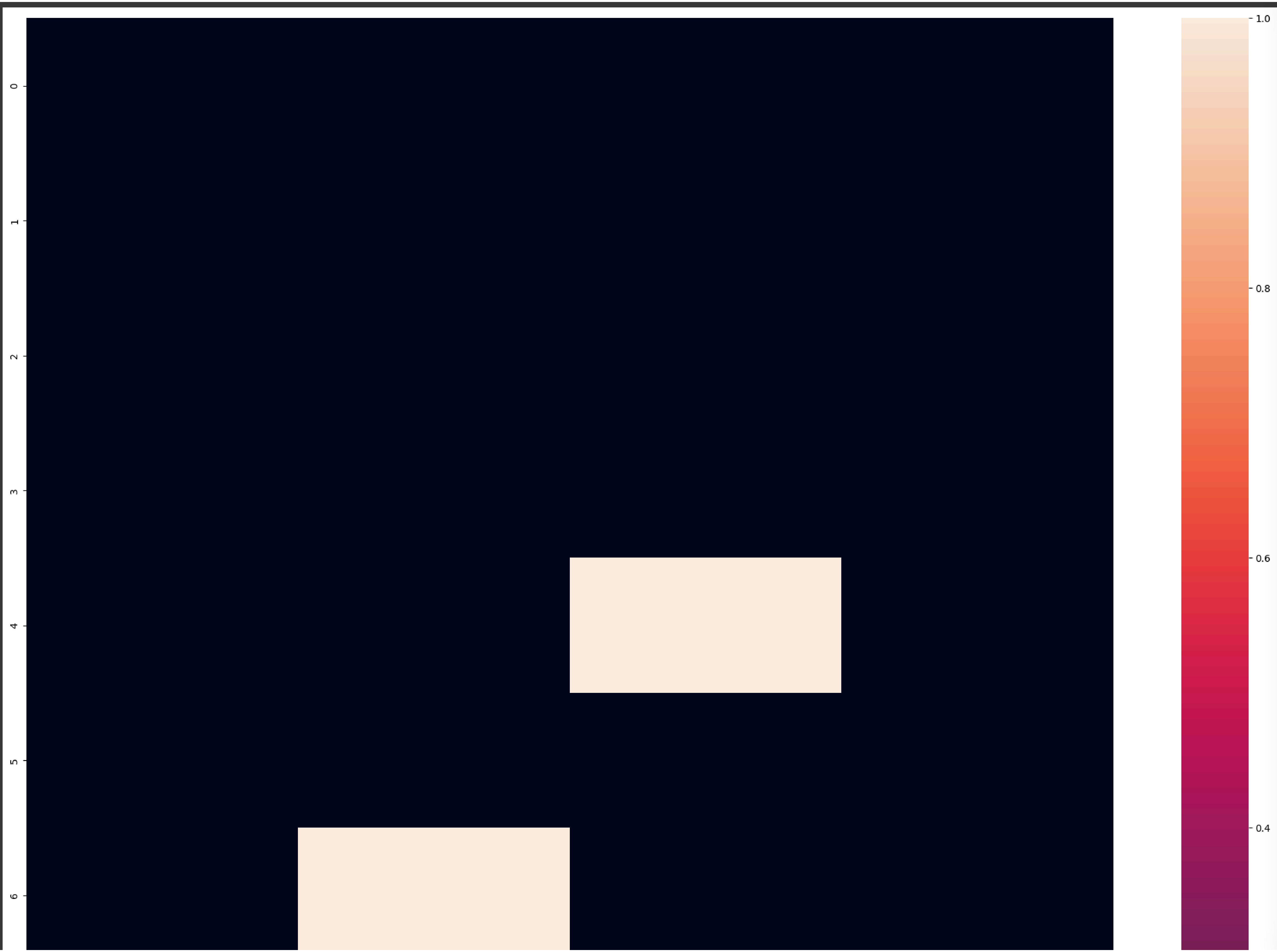
```
dtypes: float64(2), object(2)
memory usage: 448.0+ bytes
```

```
data.isnull().sum()
```

	0
Country	0
Age	1
Salary	1
Purchased	0

dtype: int64

```
plt.figure(figsize=(25,25))
sns.heatmap(data.isnull())
plt.show()
```


0
1
2
3
4
5
6
1.0
0.8
0.6
0.4


```
missing_value_percent = data.isnull().sum() / data.shape[0] * 100
print(missing_value_percent)
```

```
Country       0.0
Age          10.0
Salary       10.0
Purchased     0.0
dtype: float64
```

```
missing_value_column = missing_value_percent[missing_value_percent > 17].keys()
print(missing_value_column)
```

```
Index([], dtype='object')
```

```
data1 = data.drop(columns = missing_value_column)
```

```
data1.shape
```

```
(10, 4)
```

```
data2 = data1.dropna()
```

```
data2.shape
```

```
(8, 4)
```

```
plt.figure(figsize=(25,25))
sns.heatmap(data1.isnull())
plt.show()
```

0
6
12
18
24
30
36
42
48
54
60
66
72
78
84
90
96
102
108
114
120
126
132
138
144
150
156
162
168
174
180
186
192
198
204
210
216
222
228
234
240
246
252
258
264
270
276
282
288
294
300
306
312
318
324
330
336
342
348
354
360
366
372
378
384
390
396
402
408
414
420
426
432
438
444
450
456
462
468
474
480
486
492
498
504
510
516
522
528
534
540
0.100
0.075
0.050
0.025
0.000
−0.025


```
data2.isnull().sum().sum()
```

```
0
```

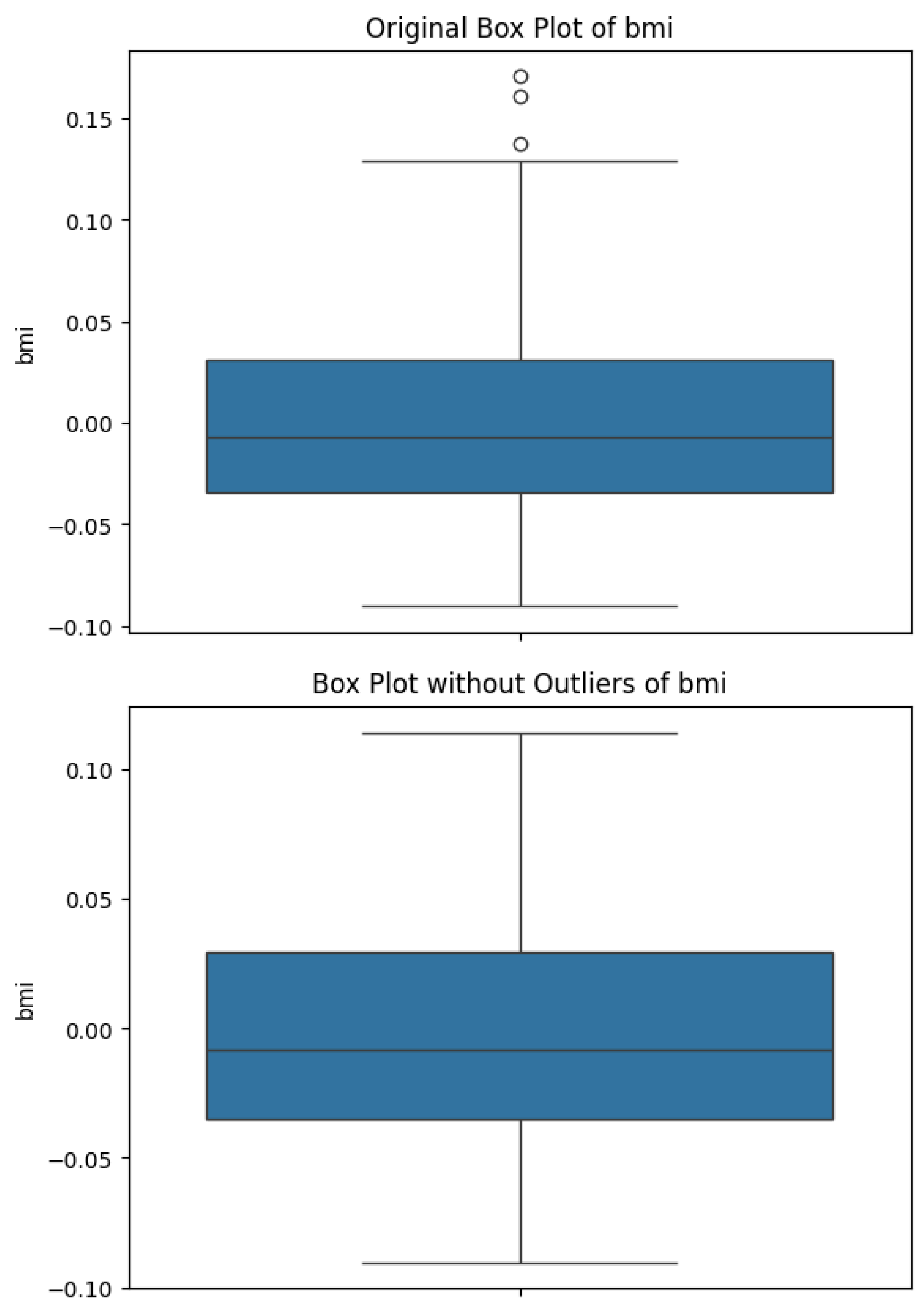
Experiment 2: Outliers estimation & Plot it through violen/whisker

```
# Importing
import sklearn
from sklearn.datasets import load_diabetes
import pandas as pd
import matplotlib.pyplot as plt

# Load the dataset
diabetics = load_diabetes()

# Create the dataframe
column_name = diabetics.feature_names
df_diabetics = pd.DataFrame(diabetics.data)
df_diabetics.columns = column_name
print(df_diabetics.head())

```

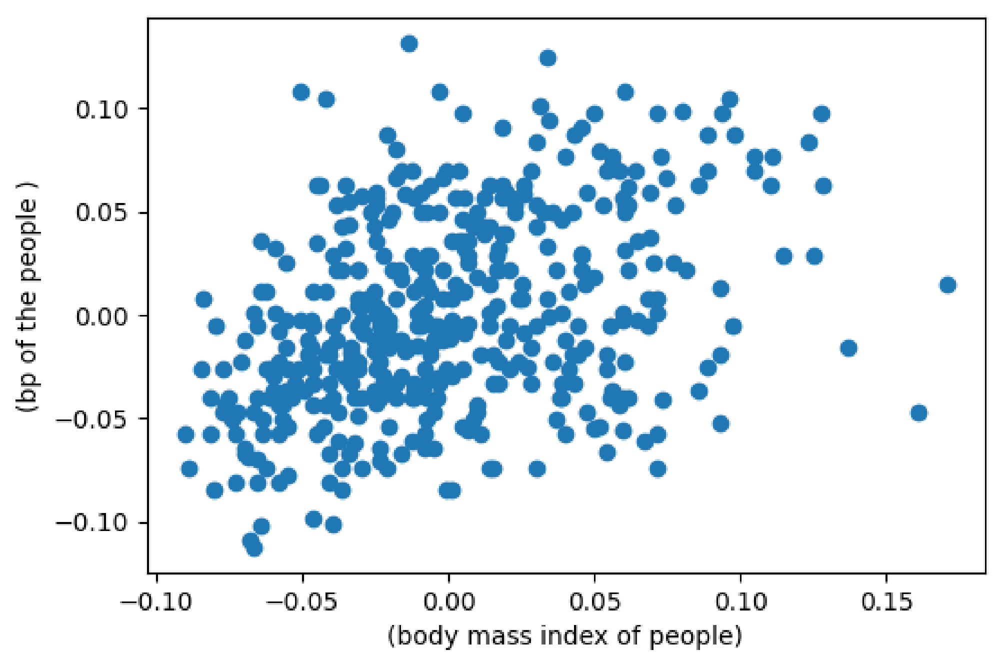
```
        age       sex       bmi        bp        s1        s2        s3  \
0  0.038076  0.050680  0.061696  0.021872 -0.044223 -0.034821 -0.043401
1 -0.001882 -0.044642 -0.051474 -0.026328 -0.008449 -0.019163  0.074412
2  0.085299  0.050680  0.044451 -0.005670 -0.045599 -0.034194 -0.032356
3 -0.089063 -0.044642 -0.011595 -0.036656  0.012191  0.024991 -0.036038
4  0.005383 -0.044642 -0.036385  0.021872  0.003935  0.015596  0.008142

         s4        s5        s6
0 -0.002592  0.019907 -0.017646
1 -0.039493 -0.068332 -0.092204
2 -0.002592  0.002861 -0.025930
3  0.034309  0.022688 -0.009362
4 -0.002592 -0.031988 -0.046641
```

```
import seaborn as sns
import matplotlib.pyplot as plt


def removal_box_plot(df, column, threshold):
    sns.boxplot(df[column])
    plt.title(f'Original Box Plot of {column}')
    plt.show()

    removed_outliers = df[df[column] <= threshold]

    sns.boxplot(removed_outliers[column])
    plt.title(f'Box Plot without Outliers of {column}')
    plt.show()
    return removed_outliers
```

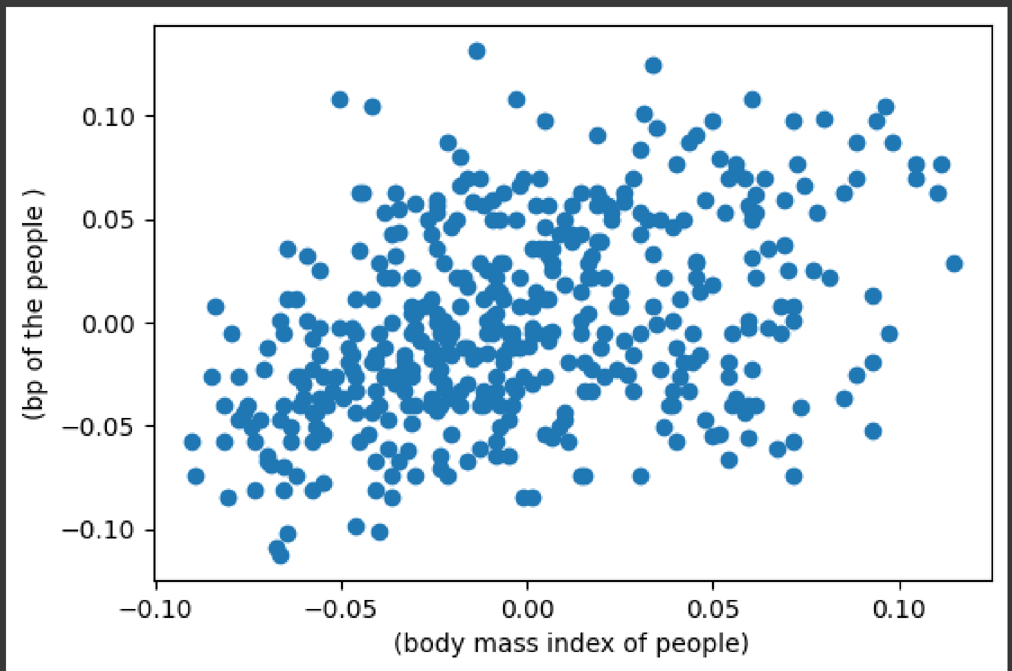
```python


threshold_value = 0.12

no_outliers = removal_box_plot(df_diabetics, 'bmi', threshold_value)

```




```python
fig, ax = plt.subplots(figsize=(6, 4))
ax.scatter(df_diabetics['bmi'], df_diabetics['bp'])
ax.set_xlabel('(body mass index of people)')
ax.set_ylabel('(bp of the people )')
plt.show()

```




```
import numpy as np
import seaborn as sns
import matplotlib.pyplot as plt

outlier_indices = np.where((df_diabetics['bmi'] > 0.12) &
 (df_diabetics['bp'] < 0.8))

no_outliers = df_diabetics.drop(outlier_indices[0])

# Scatter plot without outliers
fig, ax_no_outliers = plt.subplots(figsize=(6, 4))
ax_no_outliers.scatter(no_outliers['bmi'], no_outliers['bp'])
ax_no_outliers.set_xlabel('(body mass index of people)')
ax_no_outliers.set_ylabel('(bp of the people )')
plt.show()

```




```
import numpy as np

threshold_z = 2
```

```python

outlier_indices = np.where(z > threshold_z)[0]
no_outliers = df_diabetics.drop(outlier_indices)
print("Original DataFrame Shape:", df_diabetics.shape)
print("DataFrame Shape after Removing Outliers:", no_outliers.shape)
```

```
Original DataFrame Shape: (442, 10)
DataFrame Shape after Removing Outliers: (426, 10)
```

```python
# IQR
Q1 = np.percentile(df_diabetics['bmi'], 25, method='midpoint')
Q3 = np.percentile(df_diabetics['bmi'], 75, method='midpoint')
IQR = Q3 - Q1
print(IQR)
```

```
0.06520763046978838
```

```python
# Above Upper bound
upper = Q3+1.5*IQR
upper_array = np.array(df_diabetics['bmi'] >= upper)
print("Upper Bound:", upper)
print(upper_array.sum())

# Below Lower bound
lower = Q1-1.5*IQR
lower_array = np.array(df_diabetics['bmi'] <= lower)
print("Lower Bound:", lower)
print(lower_array.sum())
```

```
Upper Bound: 0.12879000811776306
3
Lower Bound: -0.13204051376139045
0
```

```python
# Importing
import sklearn
from sklearn.datasets import load_diabetes
import pandas as pd

# Load the dataset
diabetes = load_diabetes()

# Create the dataframe
column_name = diabetes.feature_names
df_diabetes = pd.DataFrame(diabetes.data)
df_diabetes .columns = column_name
df_diabetes .head()
print("Old Shape: ", df_diabetes.shape)

''' Detection '''
# IQR
# Calculate the upper and lower limits
Q1 = df_diabetes['bmi'].quantile(0.25)
Q3 = df_diabetes['bmi'].quantile(0.75)
IQR = Q3 - Q1
lower = Q1 - 1.5*IQR
upper = Q3 + 1.5*IQR

# Create arrays of Boolean values indicating the outlier rows
upper_array = np.where(df_diabetes['bmi'] >= upper)[0]
```

```
lower_array = np.where(df_diabetes['bmi'] <= lower)[0]

# Removing the outliers
df_diabetes.drop(index=upper_array, inplace=True)
df_diabetes.drop(index=lower_array, inplace=True)

# Print the new shape of the DataFrame
print("New Shape: ", df_diabetes.shape)

```

```
Old Shape:  (442, 10)
New Shape:  (439, 10)
```

Experiment 3: Imputation of Missing Values KNN, Interpolation,Min-Max/Z-score.

```
# import necessary libraries
import numpy as np
import pandas as pd

# import the KNNimputer class
from sklearn.impute import KNNImputer


# create dataset for marks of a student
dict = {'Maths': [80, 90, np.nan, 95],
        'Chemistry': [60, 65, 56, np.nan],
        'Physics': [np.nan, 57, 80, 78],
        'Biology': [78, 83, 67, np.nan]}

# creating a data frame from the list
Before_imputation = pd.DataFrame(dict)
# print dataset before imputation
print("Data Before performing imputation\n", Before_imputation)

# create an object for KNNImputer
imputer = KNNImputer(n_neighbors=2)
After_imputation = imputer.fit_transform(Before_imputation)
# print dataset after performing the operation
print("\n\nAfter performing imputation\n", After_imputation)

```

```
Data Before performing imputation
    Maths  Chemistry  Physics  Biology
0   80.0       60.0      NaN     78.0
1   90.0       65.0     57.0     83.0
2    NaN       56.0     80.0     67.0
3   95.0        NaN     78.0      NaN


After performing imputation
 [[80.  60.  68.5 78. ]
 [90.  65.  57.  83. ]
 [87.5 56.  80.  67. ]
 [95.  58.  78.  72.5]]
```

```
import pandas as pd
import numpy as np
a=pd.Series([0, 1, np.nan, 3,4,5,7])
a.interpolate()
```

	0
0	0.0
1	1.0
2	2.0
3	3.0
4	4.0
5	5.0
6	7.0

dtype: float64

Experiment 4: Pivot table, Melt function.

```
import pandas as pd
import numpy as np
from sklearn.datasets import fetch_openml

X,y = fetch_openml("autos", version=1, as_frame=True, return_X_y=True)
data = X
data['target'] = y
```

```
pivot = np.round(pd.pivot_table(data, values='price',
                                index='num-of-doors',
                                columns='fuel-type',
                                aggfunc=np.mean),2)
pivot
```

```
<ipython-input-2-3c77819066fb>:1: FutureWarning: The default value of observed=False is deprecated and will change to observed=True in a future version of pandas. Specify observed=False to silence this warning and r
  pivot = np.round(pd.pivot_table(data, values='price',
<ipython-input-2-3c77819066fb>:1: FutureWarning: The provided callable <function mean at 0x7f58e7b6c280> is currently using DataFrameGroupBy.mean. In a future version of pandas, the provided callable will be used di
  pivot = np.round(pd.pivot_table(data, values='price',
```

fuel-type	diesel	gas
num-of-doors		
four	16432.38	13092.81
two	14350.00	12762.76

```
pivot = np.round(pd.pivot_table(data, values='price',
                                index=['num-of-doors', 'body-style'],
                                columns=['fuel-type', 'fuel-system'],
                                aggfunc=np.mean,
                                fill_value=0),2)
pivot
```

```
<ipython-input-3-14e7dc7c7159>:1: FutureWarning: The default value of observed=False is deprecated and will change to observed=True in a future version of pandas. Specify observed=False to silence this warning and r
  pivot = np.round(pd.pivot_table(data, values='price',
<ipython-input-3-14e7dc7c7159>:1: FutureWarning: The provided callable <function mean at 0x7f58e7b6c280> is currently using DataFrameGroupBy.mean. In a future version of pandas, the provided callable will be used di
  pivot = np.round(pd.pivot_table(data, values='price',
```

	fuel-type	diesel	gas						
	fuel-system	idi	1bbl	2bbl	4bbl	mfi	mpfi	spdi	spfi
num-of-doors	body-style								
four	hatchback	7788.00	0.00	7813.71	0.0	0.0	10618.00	0.00	0.0
	sedan	16328.92	8811.67	7711.19	0.0	0.0	18425.68	9279.00	0.0
	wagon	19727.67	7295.00	8028.89	0.0	0.0	14213.42	0.00	0.0
two	convertible	0.00	0.00	0.00	0.0	0.0	21890.50	0.00	0.0
	hardtop	28176.00	0.00	8249.00	0.0	0.0	23540.50	0.00	0.0
	hatchback	0.00	7054.43	6701.67	12145.0	12964.0	14581.50	11479.43	11048.0
	sedan	7437.00	0.00	7570.00	0.0	0.0	21034.00	0.00	0.0

```
np.round(pd.pivot_table(data, values='price',
                                index=['body-style'],
                                columns=['num-of-doors'],
                                aggfunc=[np.mean, np.median],
                                fill_value=0),2)
```

```
<ipython-input-4-18854bd411ba>:1: FutureWarning: The default value of observed=False is deprecated and will change to observed=True in a future version of pandas. Specify observed=False to silence this warning and r
  np.round(pd.pivot_table(data, values='price',
<ipython-input-4-18854bd411ba>:1: FutureWarning: The provided callable <function mean at 0x7f58e7b6c280> is currently using DataFrameGroupBy.mean. In a future version of pandas, the provided callable will be used di
  np.round(pd.pivot_table(data, values='price',
<ipython-input-4-18854bd411ba>:1: FutureWarning: The default value of observed=False is deprecated and will change to observed=True in a future version of pandas. Specify observed=False to silence this warning and r
  np.round(pd.pivot_table(data, values='price',
<ipython-input-4-18854bd411ba>:1: FutureWarning: The provided callable <function median at 0x7f58e755b910> is currently using DataFrameGroupBy.median. In a future version of pandas, the provided callable will be use
  np.round(pd.pivot_table(data, values='price',
```

	mean		median	
num-of-doors	four	two	four	two
body-style				
convertible	0.00	21890.50	0.0	17084.5
hardtop	0.00	22208.50	0.0	19687.5
hatchback	8372.00	10230.79	8073.0	8970.0
sedan	14614.13	14283.00	12555.0	8678.0
wagon	12371.96	0.00	11694.0	0.0

```
import pandas as pd
d1 = {"Name": ["Tom", "Jerry", "Spike"], "ID": [1, 2, 3],
      "Role": ["Cat", "Mouse", "Dog"]}
df = pd.DataFrame(d1)
print(df)

df_melted = pd.melt(df, id_vars=["ID"], value_vars=["Name", "Role"])
print(df_melted)
```

```
    Name  ID   Role
0    Tom   1    Cat
```

```
1  Jerry   2  Mouse
2  Spike   3    Dog
   ID variable  value
0   1     Name    Tom
1   2     Name  Jerry
2   3     Name  Spike
3   1     Role    Cat
4   2     Role  Mouse
5   3     Role    Dog
```

```
#multiple columns as id_vars
df_melted = pd.melt(df, id_vars=["ID", "Name"], value_vars=["Role"])
print(df_melted)
```

```
   ID   Name variable  value
0   1    Tom     Role    Cat
1   2  Jerry     Role  Mouse
2   3  Spike     Role    Dog
```

```
#skipping columns in melt function
df_melted = pd.melt(df, id_vars=["Name"], value_vars=["Role"])
print(df_melted)
```

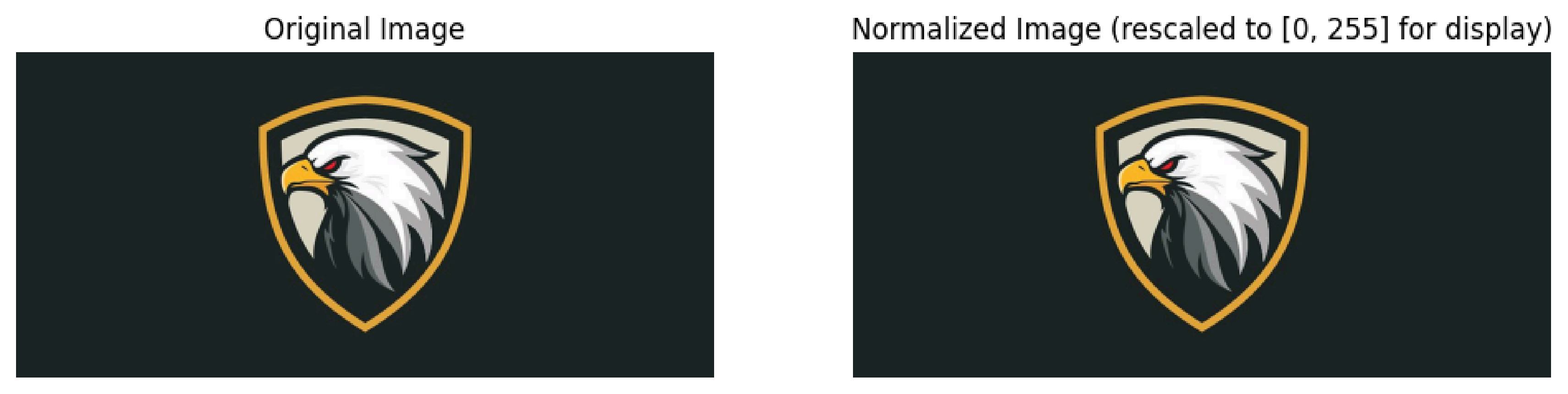
```
    Name variable  value
0    Tom     Role    Cat
1  Jerry     Role  Mouse
2  Spike     Role    Dog
```

Experiment 5: Image normalization (rescale -1,1).

```
import numpy as np
from PIL import Image
import matplotlib.pyplot as plt

# Load an image
image_path = r"/content/mascot-logo-design_P1_900x420.jpg"

try:
    image = Image.open(image_path)
    image = image.convert('RGB')  # Ensure image is in RGB format
except FileNotFoundError:
    print(f"File not found: {image_path}")
    raise
except Exception as e:
    print(f"Error occurred: {e}")
    raise

# Convert image to numpy array
image_array = np.array(image).astype('float32')

# Normalize the image to the range [-1, 1]
normalized_image_array = (image_array / 127.5) - 1

# Verify normalization
print(f"Min value in normalized image: {np.min(normalized_image_array)}")
print(f"Max value in normalized image: {np.max(normalized_image_array)}")

# Convert normalized image back to the range [0, 255] for visualization
denormalized_image_array = (normalized_image_array + 1) * 127.5
denormalized_image_array = denormalized_image_array.astype('uint8')

# Display the original and normalized images
```

```python
fig, axes = plt.subplots(1, 2, figsize=(12, 6))

axes[0].imshow(image)
axes[0].set_title("Original Image")
axes[0].axis('off')

axes[1].imshow(denormalized_image_array)
axes[1].set_title("Normalized Image (rescaled to [0, 255] for display)")
axes[1].axis('off')

plt.show()

```

```
Min value in normalized image: -1.0
Max value in normalized image: 1.0
```



Experiment 6: Linear regression and Logistic regression.

```python
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
from sklearn.model_selection import train_test_split
from sklearn.linear_model import LinearRegression
from sklearn.metrics import mean_squared_error, r2_score

# Create a synthetic dataset for linear regression
np.random.seed(0)
X = 2 * np.random.rand(100, 1)
y = 4 + 3 * X + np.random.randn(100, 1)

# Split the dataset into training and testing sets
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2
                                                    random_state=0)

# Create and train the linear regression model
lin_reg = LinearRegression()
lin_reg.fit(X_train, y_train)

# Predict on the test set
y_pred = lin_reg.predict(X_test)

# Evaluate the model
mse = mean_squared_error(y_test, y_pred)
r2 = r2_score(y_test, y_pred)

print(f"Mean Squared Error: {mse}")
print(f"R^2 Score: {r2}")

# Plot the results
```

```python
plt.scatter(X_test, y_test, color='blue', label='Actual')
plt.plot(X_test, y_pred, color='red', label='Predicted')
plt.xlabel("X")
plt.ylabel("y")
plt.title("Linear Regression")
plt.legend()
plt.show()
```

```
Mean Squared Error: 1.0434333815695171
```