```python
#Importing the libraries
import numpy as np
import pandas as pd
import seaborn as sns
import matplotlib.pyplot as plt
sns.set()
import warnings
warnings.filterwarnings('ignore')

#loading the dataset
df = pd.read_csv('Sleep_health_and_lifestyle_dataset.csv')
df.head()
```

```
   Person ID Gender  Age            Occupation  Sleep Duration  \
0          1   Male   27     Software Engineer             6.1
1          2   Male   28                Doctor             6.2
2          3   Male   28                Doctor             6.2
3          4   Male   28  Sales Representative             5.9
4          5   Male   28  Sales Representative             5.9

   Quality of Sleep  Physical Activity Level  Stress Level BMI
Category  \
0                 6                       42             6
Overweight
1                 6                       60             8
Normal
2                 6                       60             8
Normal
3                 4                       30             8
Obese
4                 4                       30             8
Obese

  Blood Pressure  Heart Rate  Daily Steps Sleep Disorder
0         126/83          77         4200            NaN
1         125/80          75        10000            NaN
2         125/80          75        10000            NaN
3         140/90          85         3000    Sleep Apnea
4         140/90          85         3000    Sleep Apnea
```

Some Numerical Information about the Data

```python
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 374 entries, 0 to 373
Data columns (total 13 columns):
 #   Column                   Non-Null Count  Dtype
---  ------                   --------------  -----
 0   Person ID                374 non-null    int64
```

```
 1   Gender                     374 non-null    object
 2   Age                        374 non-null    int64
 3   Occupation                 374 non-null    object
 4   Sleep Duration             374 non-null    float64
 5   Quality of Sleep           374 non-null    int64
 6   Physical Activity Level    374 non-null    int64
 7   Stress Level               374 non-null    int64
 8   BMI Category               374 non-null    object
 9   Blood Pressure             374 non-null    object
 10  Heart Rate                 374 non-null    int64
 11  Daily Steps                374 non-null    int64
 12  Sleep Disorder             155 non-null    object
dtypes: float64(1), int64(7), object(5)
memory usage: 38.1+ KB
```

```
df.nunique()
```

```
Person ID                  374
Gender                       2
Age                         31
Occupation                  11
Sleep Duration              27
Quality of Sleep             6
Physical Activity Level     16
Stress Level                 6
BMI Category                 4
Blood Pressure              25
Heart Rate                  19
Daily Steps                 20
Sleep Disorder               2
dtype: int64
```

Data Cleaning

```
# Fill NaN values with 'Healthy Sleep'
df['Sleep Disorder'].fillna('Healthy Sleep', inplace=True)
df['Sleep Disorder'].value_counts()
```

```
Sleep Disorder
Healthy Sleep    219
Sleep Apnea       78
Insomnia          77
Name: count, dtype: int64
```

```
# Create Age Group
df['Age'] = pd.cut(df['Age'], bins=[26, 30 ,35, 40, 45, 50, 55, 60],
labels=['26-30', '30-35', '35-40', '40-45', '45-50', '50-55', '55-
60'])
df['Age'].value_counts()
```

```
Age
40-45    99
35-40    71
30-35    62
50-55    43
45-50    34
55-60    33
26-30    32
Name: count, dtype: int64
```

```
company_dic = df['Occupation'].value_counts().head(6)
def occup(x, dic):
    if x in dic.keys():
        return x
    else :
        return 'Others'

df['Occupation'] = df['Occupation'].apply(lambda x : occup(x,
company_dic))
df['Occupation'].value_counts()
```

```
Occupation
Nurse          73
Doctor         71
Engineer       63
Lawyer         47
Others         43
Teacher        40
Accountant     37
Name: count, dtype: int64
```

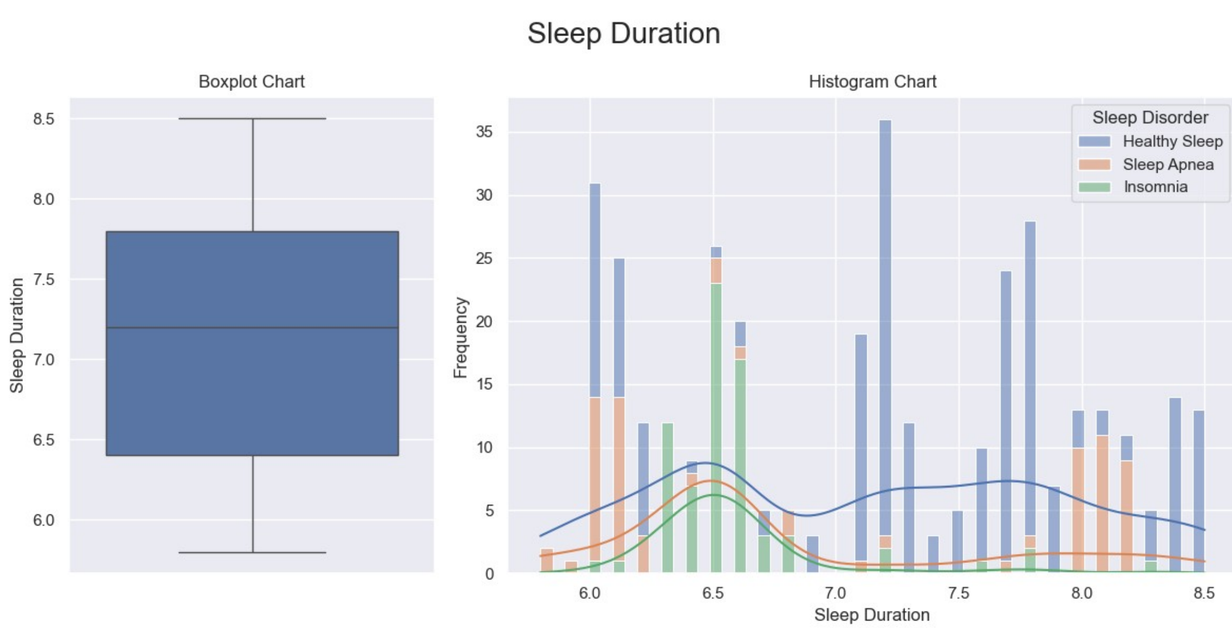
```
# Reduce unique values of BMI Category
df['BMI Category'] = df['BMI Category'].apply(lambda x : 'Normal' if x
== 'Normal Weight' else x)
df = df[df['BMI Category'] != 'Obese']
df['BMI Category'].value_counts()
```

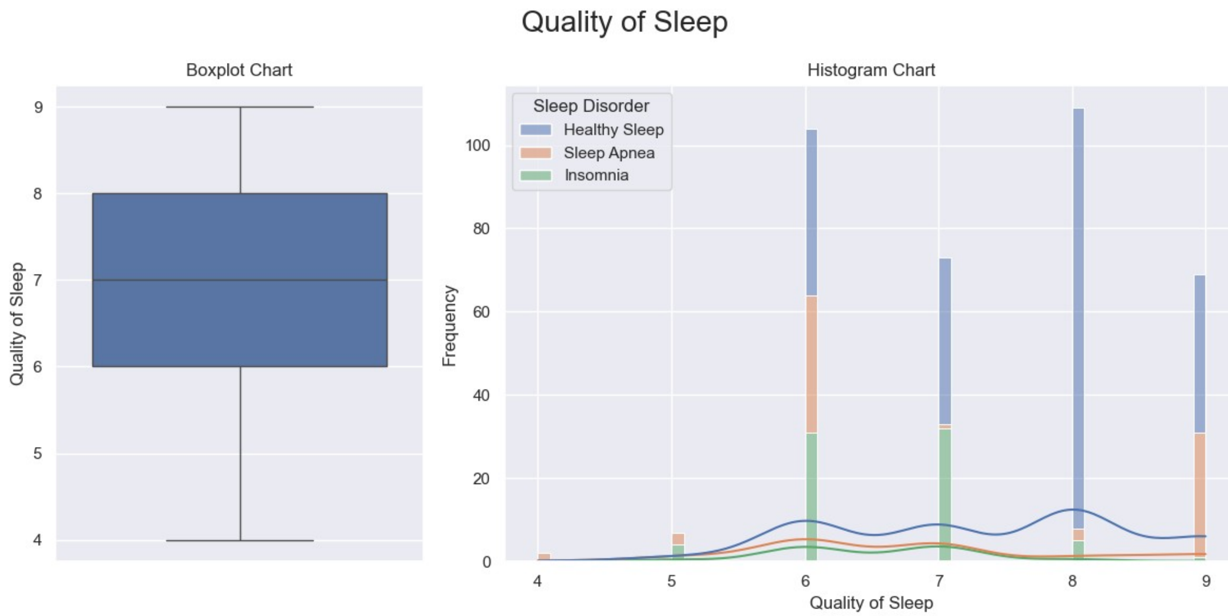
```
BMI Category
Normal         216
Overweight     148
Name: count, dtype: int64
```

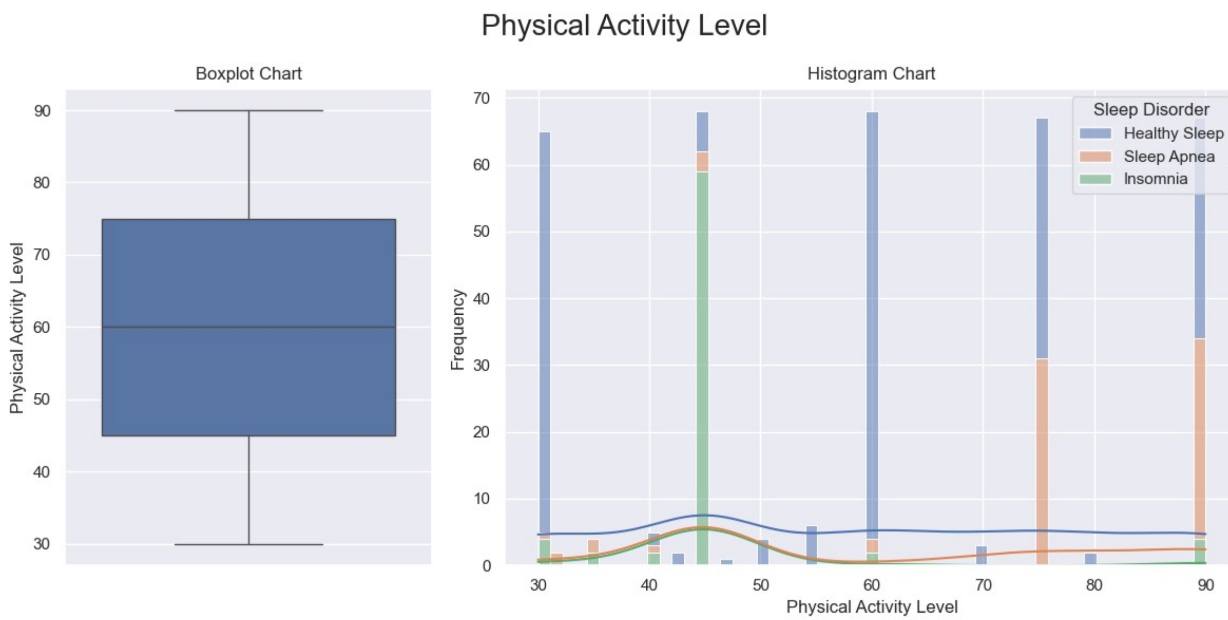
```
#spliting the blood pressure into two columns
df['Systolic BP'] = df['Blood Pressure'].apply(lambda x: x.split('/')
[0])
df['Diastolic BP'] = df['Blood Pressure'].apply(lambda x: x.split('/')
[1])
#droping the blood pressure column
df.drop('Blood Pressure', axis=1, inplace=True)
```

Data Visualization

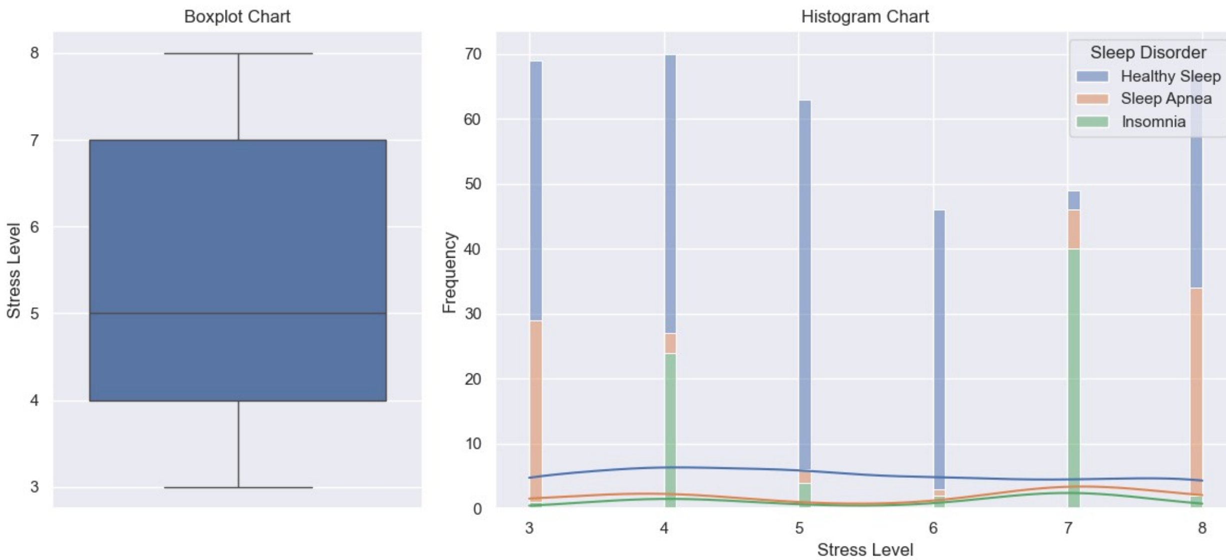
```
# Define list of Continuous columns Names
continuous = ['Sleep Duration', 'Quality of Sleep', 'Physical Activity
Level', 'Stress Level', 'Heart Rate', 'Daily Steps', 'Systolic BP',
'Diastolic BP']

# Distribution of Categorical Features
def plot_continious_distribution(df, column, hue):

    width_ratios = [2, 4]
    gridspec_kw = {'width_ratios':width_ratios}
    fig, ax = plt.subplots(1, 2, figsize=(12, 6), gridspec_kw =
gridspec_kw)
    fig.suptitle(f' {column} ', fontsize=20)

    sns.boxplot(df[column], ax=ax[0])
    ax[0].set_title('Boxplot Chart')
    ax[0].set_ylabel(column)

    sns.histplot(x = df[column], kde=True, ax=ax[1], hue=df[hue],
multiple = 'stack', bins=55)
    ax[1].set_title('Histogram Chart')
    ax[1].set_ylabel('Frequency')
    ax[1].set_xlabel(column)

    plt.tight_layout()
    plt.show()
for conti in continuous :
    plot_continious_distribution(df, conti, 'Sleep Disorder')
```



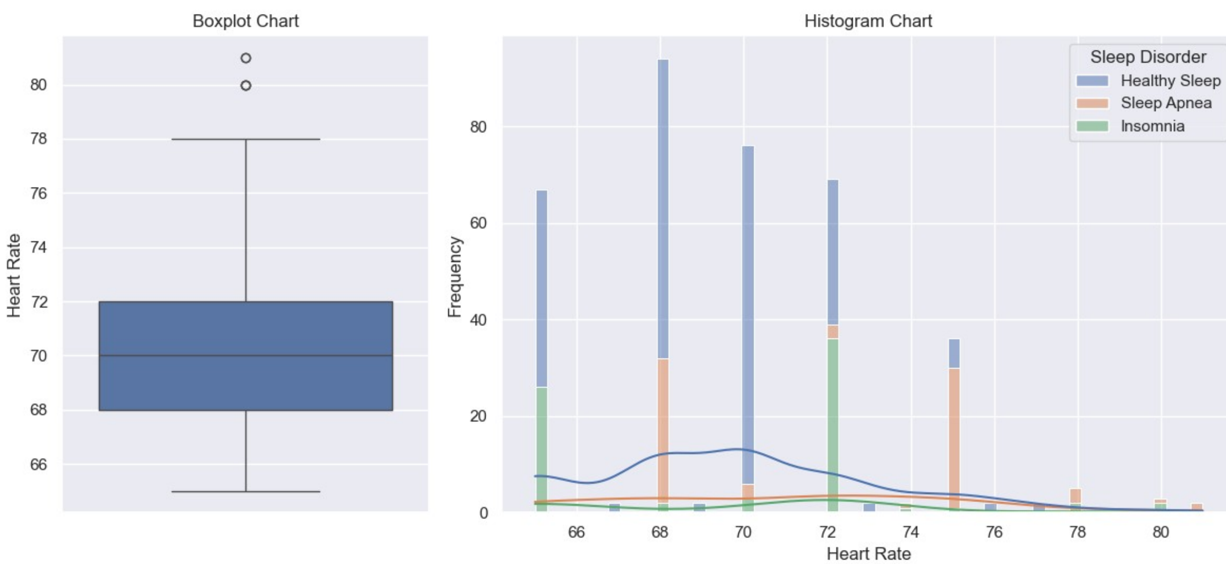

Quality of Sleep
Boxplot Chart
Quality of Sleep
9
8
7
6
5
4
Histogram Chart
Sleep Disorder
Healthy Sleep
Sleep Apnea
Insomnia
Frequency
100
80
60
40
20
0
4
5
6
7
8
9
Quality of Sleep

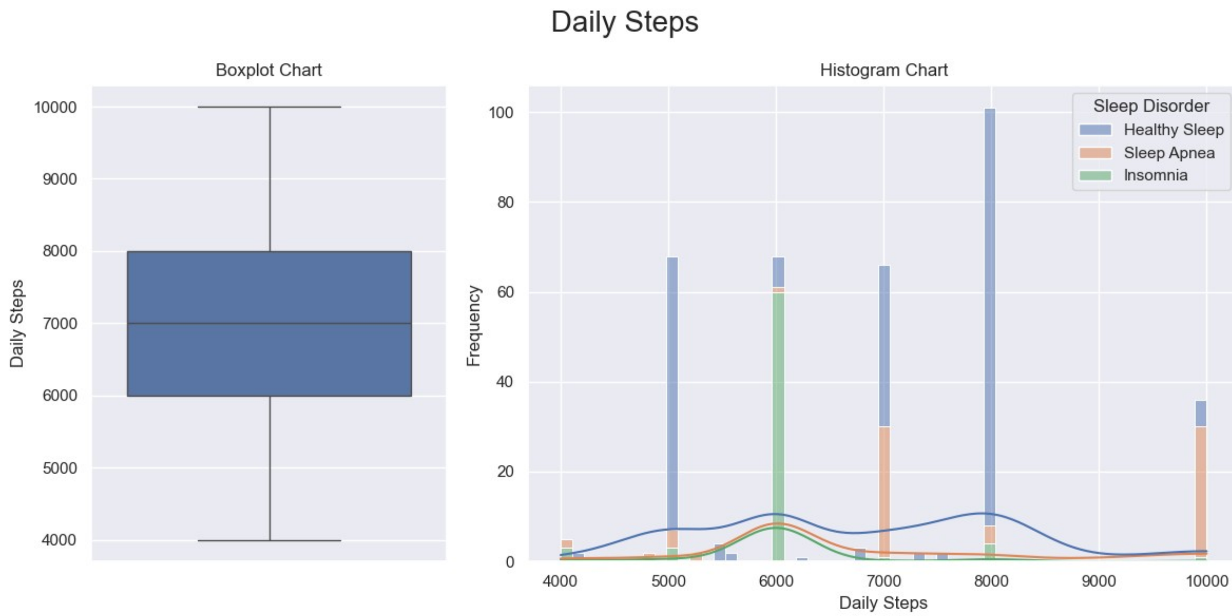

Physical Activity Level
Boxplot Chart
Physical Activity Level
90
80
70
60
50
40
30
Histogram Chart
Sleep Disorder
Healthy Sleep
Sleep Apnea
Insomnia
Frequency
70
60
50
40
30
20
10
0
30
40
50
60
70
80
90
Physical Activity Level

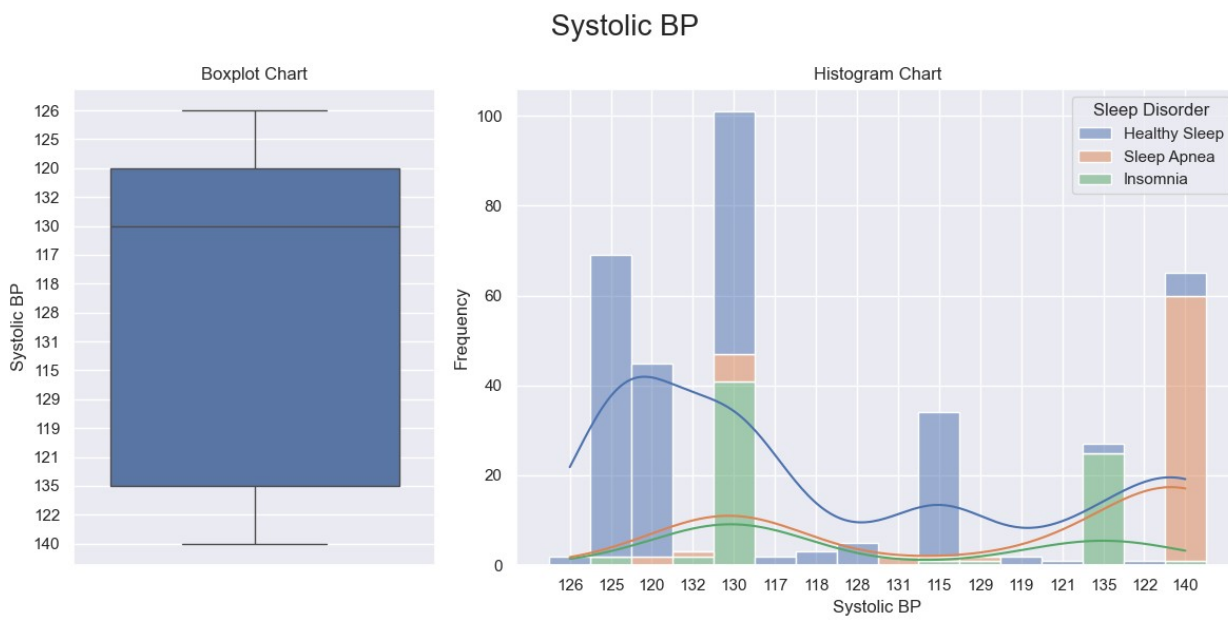
Stress Level

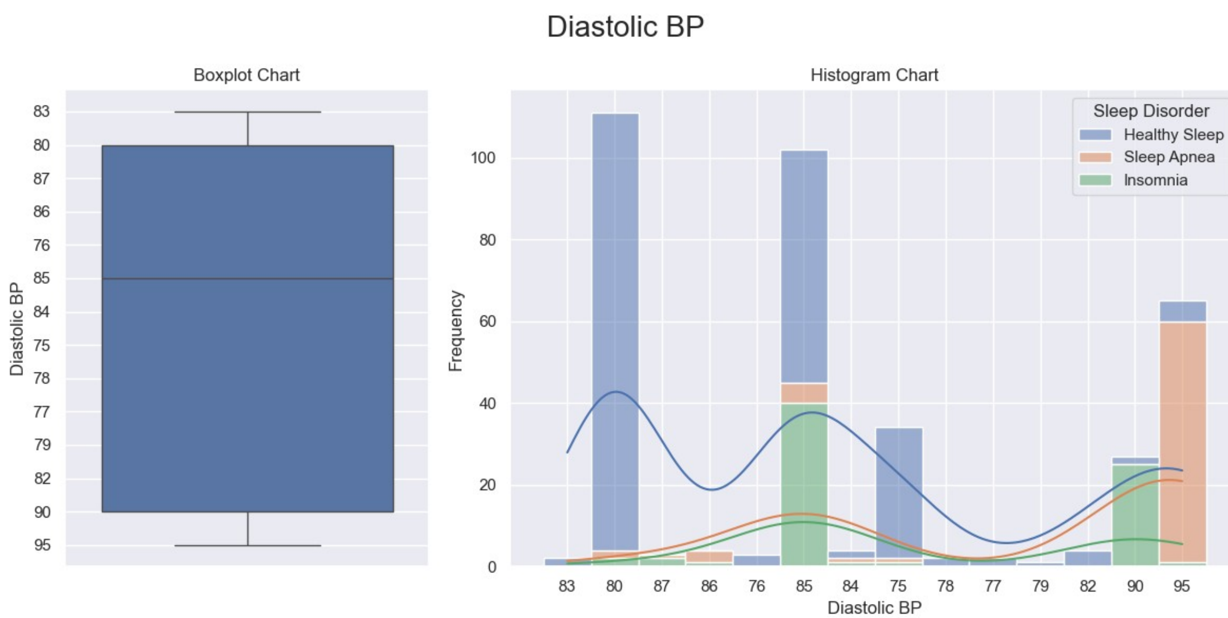


Heart Rate

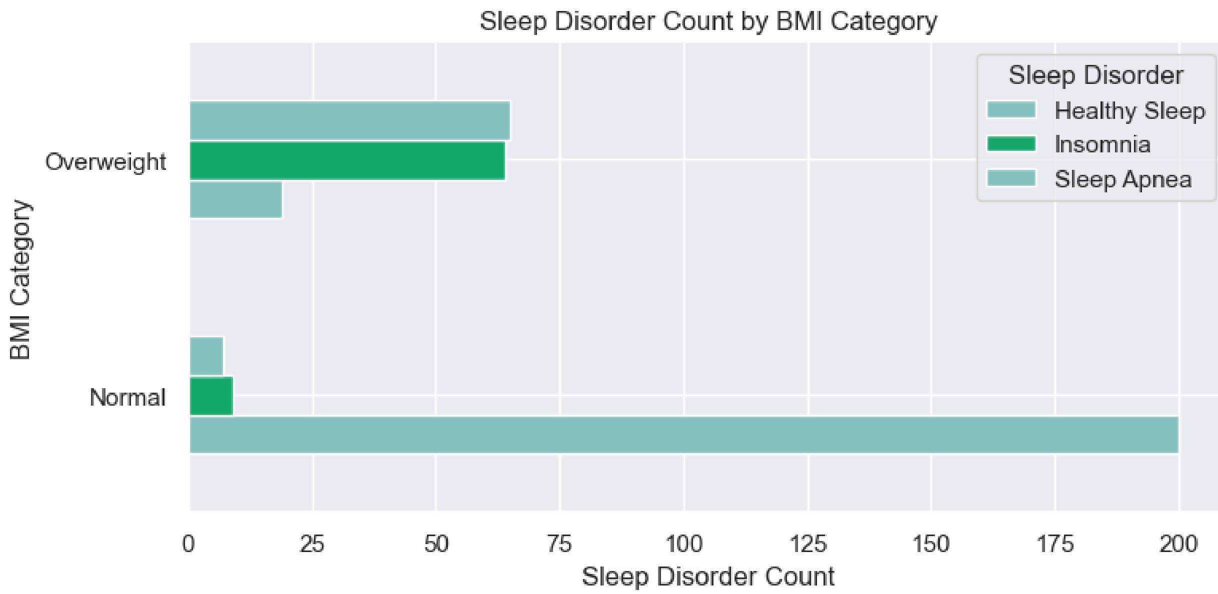


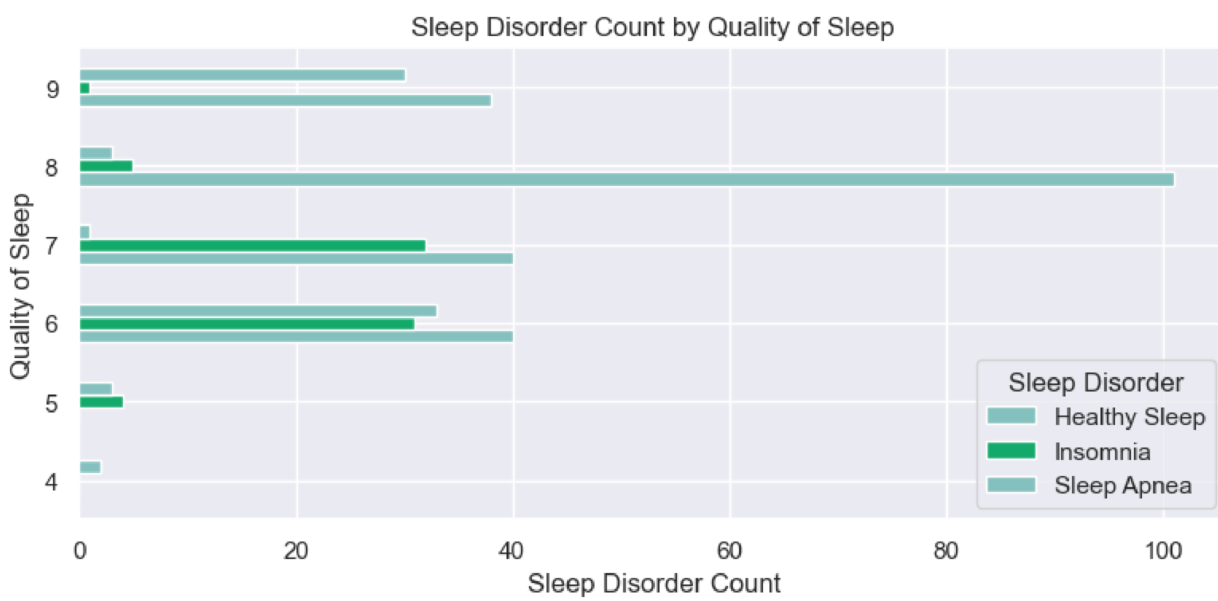

Daily Steps
Boxplot Chart
Daily Steps
10000
9000
8000
7000
6000
5000
4000
Histogram Chart
Sleep Disorder
Healthy Sleep
Sleep Apnea
Insomnia
Frequency
100
80
60
40
20
0
4000
5000
6000
7000
8000
9000
10000
Daily Steps

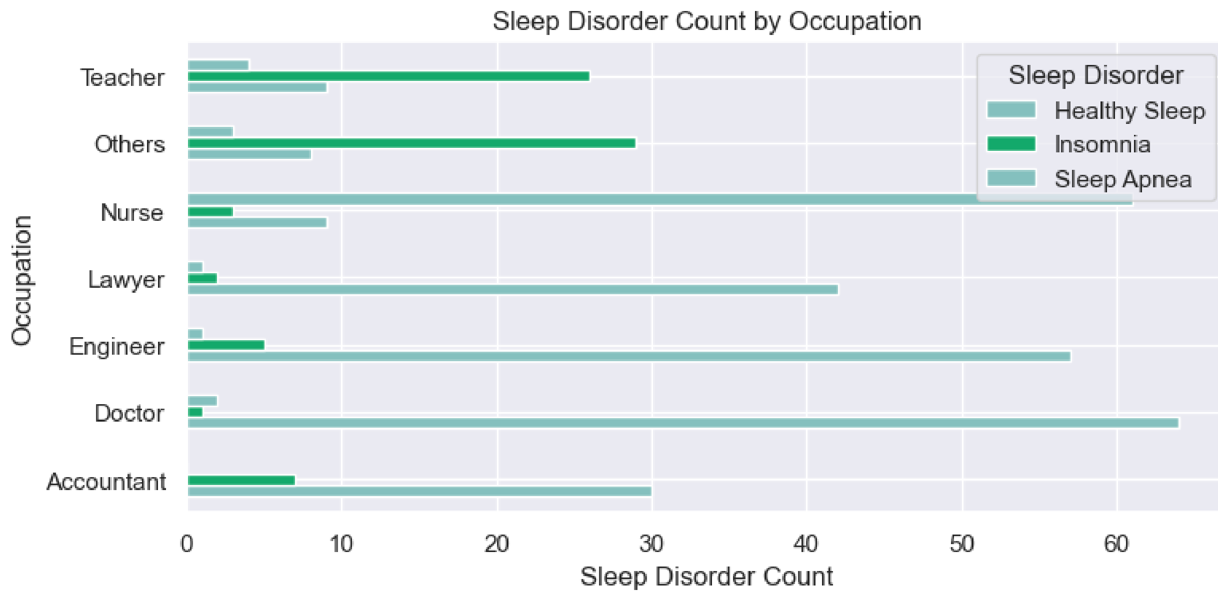

Systolic BP
Boxplot Chart
Systolic BP
126
125
120
132
130
117
118
128
131
115
129
119
121
135
122
140
Histogram Chart
Sleep Disorder
Healthy Sleep
Sleep Apnea
Insomnia
Frequency
100
80
60
40
20
0
126 125 120 132 130 117 118 128 131 115 129 119 121 135 122 140
Systolic BP

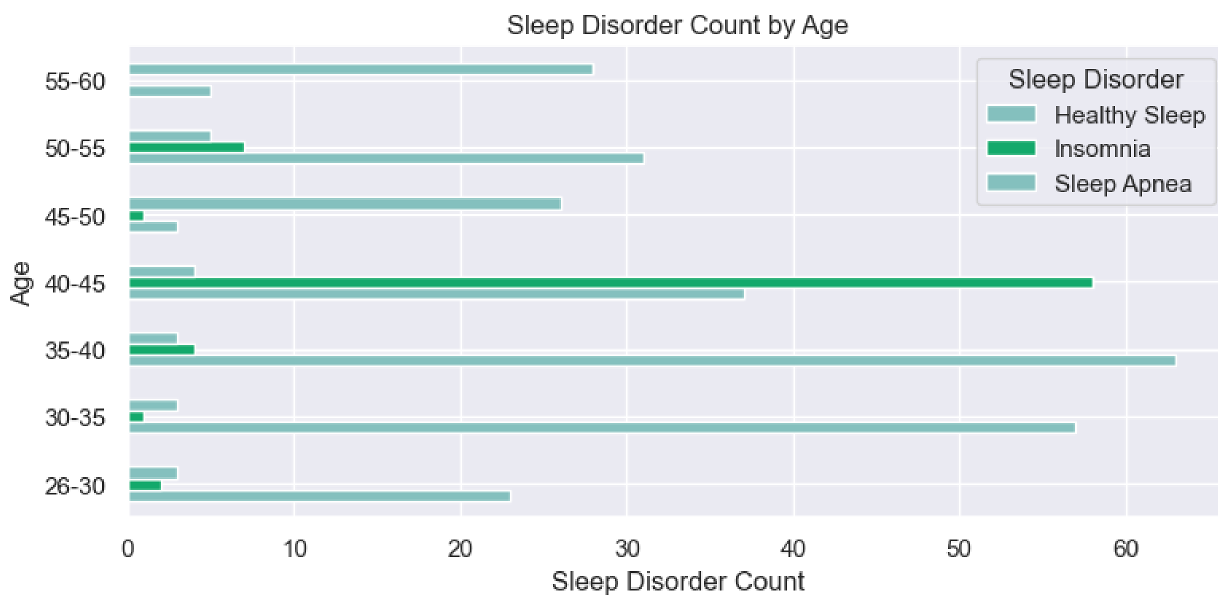



```
# Define a Function for Barh Plot
def bar_plot(x, y, df):
    barh = df.groupby([x, y]).size().unstack()
    barh.plot(kind='barh',  color = ['#84c0be', '#13a96b'],
figsize=(8,4))
    plt.title(f'{y} Count by {x}')
    plt.xlabel(f'{y} Count')
    plt.ylabel(x)

    plt.tight_layout()
    plt.show()

bar_plot('BMI Category', 'Sleep Disorder', df)
bar_plot('Quality of Sleep', 'Sleep Disorder', df)
bar_plot('Occupation', 'Sleep Disorder', df)
bar_plot('Age', 'Sleep Disorder', df)
```


Sleep Disorder Count by BMI Category
Sleep Disorder
Healthy Sleep
Insomnia
Sleep Apnea
Overweight
Normal
BMI Category
0
25
50
75
100
125
150
175
200
Sleep Disorder Count


Sleep Disorder Count by Quality of Sleep
9
8
7
6
5
4
Quality of Sleep
Sleep Disorder
Healthy Sleep
Insomnia
Sleep Apnea
0
20
40
60
80
100
Sleep Disorder Count





Data Preprocessing

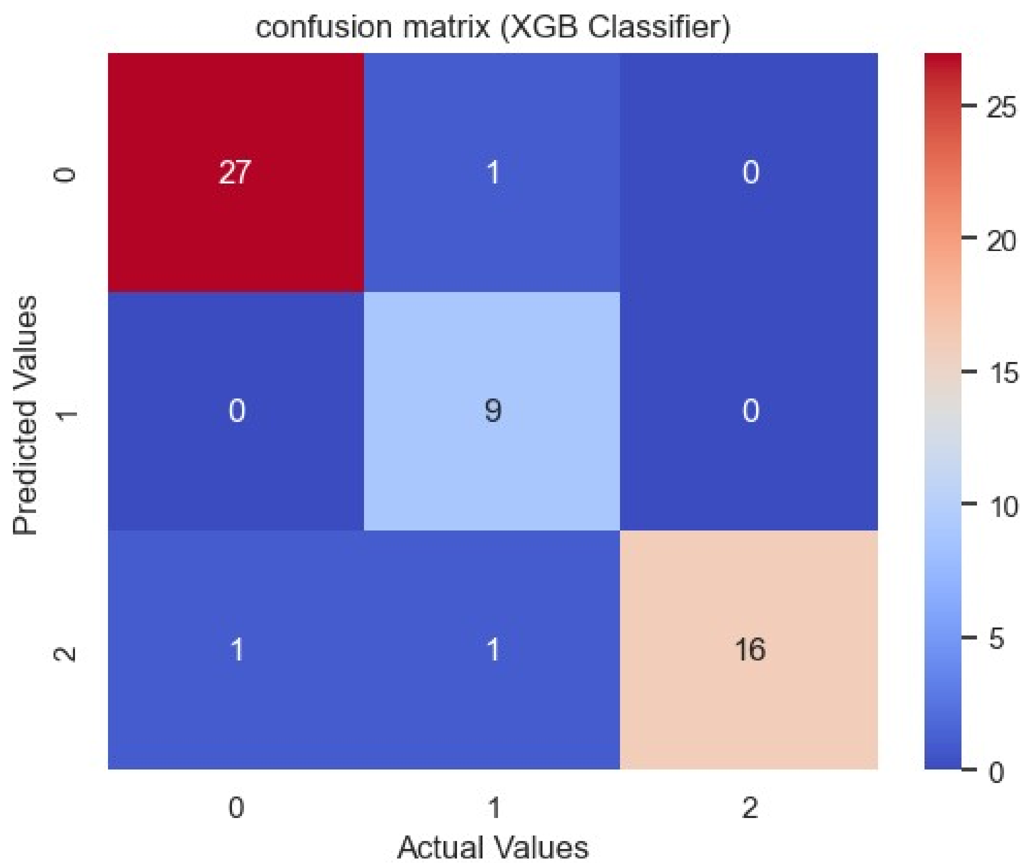
```
from sklearn.preprocessing import StandardScaler, LabelEncoder

# Initialize StandardScaler
stc = StandardScaler()
# Initialize Label Encoder
le = LabelEncoder()

stc_cols = ['Sleep Duration', 'Quality of Sleep', 'Physical Activity
Level', 'Stress Level', 'systolic_bp', 'diastolic_bp', 'Heart Rate',
'Daily Steps']
dum_cols= ['Age', 'Occupation', 'BMI Category']
```

```python
le_cols = ['Gender', 'Sleep Disorder']

# Apply Standard Scaler to the selected columns
df[stc_cols] = stc.fit_transform(df[stc_cols])

# Apply Label Encoder to the selected columns
for col in le_cols :
    df[col] = le.fit_transform(df[col])

# Apply get_dummies to the selected columns
df = pd.get_dummies(df, columns=dum_cols)
```

Training and Evaluating Different Models

```python
from sklearn.model_selection import train_test_split

x = df.drop(['Sleep Disorder', 'Person ID'], axis=1)
y = df['Sleep Disorder']  # Target Variable

x_train, x_test, y_train, y_test = train_test_split(x, y,
test_size=0.15, random_state=12)

#Importing the Libraries
from sklearn.ensemble import  GradientBoostingClassifier
from sklearn.linear_model import LogisticRegression
from sklearn.ensemble import RandomForestClassifier
from sklearn.neighbors import KNeighborsClassifier
from sklearn.linear_model import LinearRegression
from sklearn.model_selection import GridSearchCV
from sklearn.tree import DecisionTreeClassifier
from sklearn.ensemble import VotingClassifier
from sklearn.metrics import accuracy_score
from xgboost import XGBClassifier

# List of Models to Try
models = [
    ('Gradient Boosting', GradientBoostingClassifier()),
    ('K-Nearest Neighbors', KNeighborsClassifier()),
    ('Random Forest', RandomForestClassifier()),
    ('Decision Tree', DecisionTreeClassifier()),
    ('XGB Classifier', XGBClassifier())
]

# Train and evaluate each model
for name, model in models:
    model.fit(x_train, y_train)
    y_pred = model.predict(x_test)
    print(f'Training accuracy: {name}', model.score(x_train, y_train))
    print(f'Test accuracy: {name}', accuracy_score(y_test, y_pred))
    print()
```

```
Training accuracy: Gradient Boosting 0.9255663430420712
Test accuracy: Gradient Boosting 0.9454545454545454

Training accuracy: K-Nearest Neighbors 0.9061488673139159
Test accuracy: K-Nearest Neighbors 0.9090909090909091

Training accuracy: Random Forest 0.9255663430420712
Test accuracy: Random Forest 0.9454545454545454

Training accuracy: Decision Tree 0.9255663430420712
Test accuracy: Decision Tree 0.9454545454545454

Training accuracy: XGB Classifier 0.9255663430420712
Test accuracy: XGB Classifier 0.9454545454545454


xgb = XGBClassifier()
xgb.fit(x_train, y_train)
xgb_pred = xgb.predict(x_test)

accuracy = accuracy_score(y_test, xgb_pred)
print(f'R-squared (XGB Classifier): {round(accuracy, 3)}')

R-squared (XGB Classifier): 0.945

from sklearn.metrics import confusion_matrix, classification_report
sns.heatmap(confusion_matrix(y_test,xgb_pred),annot= True, cmap =
'coolwarm', fmt='.0f')
plt.ylabel('Predicted Values')
plt.xlabel('Actual Values')
plt.title('confusion matrix (XGB Classifier)')
plt.show()
```




```
# Visualize Classification report for XGB Classifier
print(classification_report(y_test,xgb_pred))
```

```
              precision    recall  f1-score   support

           0       0.96      0.96      0.96        28
           1       0.82      1.00      0.90         9
           2       1.00      0.89      0.94        18

    accuracy                           0.95        55
   macro avg       0.93      0.95      0.94        55
weighted avg       0.95      0.95      0.95        55
```

Summary and Conclusion

In this project, I focused on predicting sleep disorders using a variety of data preprocessing and machine learning techniques. The steps and methodologies employed are as follows:

1. Data Cleaning and Preprocessing:
   - Handling Missing Values: Missing values were filled in a way that preserved the distribution of the data, maintaining the integrity of the dataset.
2. Categorical Encoding and Feature Engineering:

- Age Categorization: The age of individuals was converted into categorical variables to enhance model performance.
- Occupation Simplification: The occupation feature, which had many unique values, was simplified to reduce complexity.
- Blood Pressure Columns: The single blood pressure column was split into two separate columns for more detailed analysis.
- BMI Categorization: The BMI index was converted from three categories into two for better model accuracy.

3. Data Visualization:
   - Appropriate visualizations were created to explore and understand the data patterns and relationships.
4. Data Standardization and Labeling:
   - Data standardization was performed to normalize the features, and label encoding was applied to convert categorical variables into numerical format.
5. Model Training and Evaluation:
   - An XGBoost (XGB) model was trained on the processed dataset, achieving an accuracy of 94.5%.

These steps ensured a comprehensive analysis and model training process, leading to a highly accurate prediction model for sleep disorders.

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