

7. PREDICTING DIABETES

EX.N0 : 7	PREDICTING DIABETES
<u>DATE : 11/09/2024</u>	

PROBLEM STATEMENT: Predict the onset of diabetes based on medical measurements.

PYTHON CONCEPTS: Data structures, numeric types, functions.

VISUALIZATION: Scatter plots, heatmaps.

MULTIVARIATE ANALYSIS: Logistic regression, LDA.

DATASET: Pima Indians Diabetes Database

ALGORITHM:

Step 1: Start the program.

Step 2: Import necessary libraries.

Step 3: Load the dataset.

Step 4: Encode categorical variable, define feature & testing set.

Step 5: Split the dataset into training & testing set, create trained model.

Step 6: Print equal metric & test the cell.

PROGRAM:

```
import pandas as pd
import seaborn as sns
import matplotlib.pyplot as plt
from sklearn.model_selection import train_test_split
from sklearn.linear_model import LogisticRegression
from sklearn.metrics import classification_report, confusion_matrix, accuracy_score
url = https://raw.githubusercontent.com/jbrownlee/Datasets/master/pima-indians-diabetes.data.csv
columns = ['Pregnancies', 'Glucose', 'BloodPressure', 'SkinThickness', 'Insulin', 'BMI',
'DiabetesPedigreeFunction', 'Age', 'Outcome']
```

```

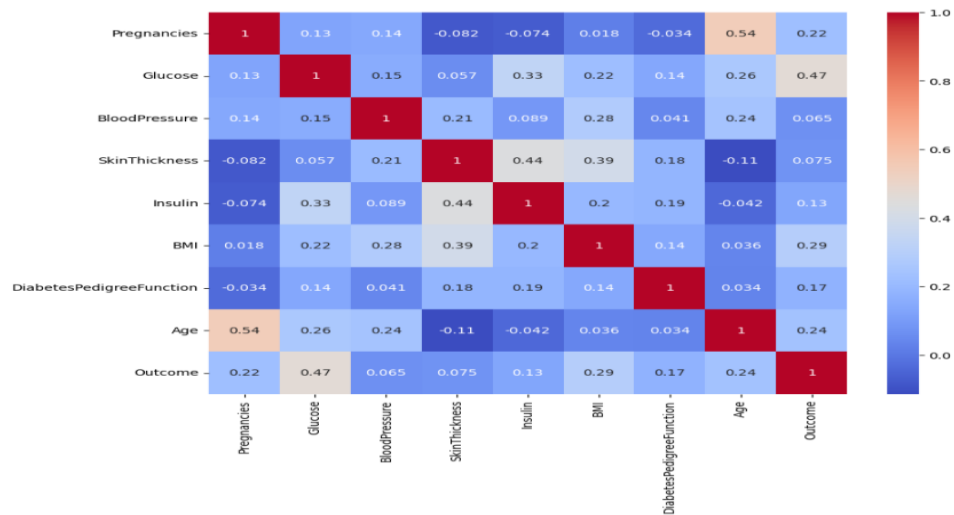
data = pd.read_csv(url, header=None, names=columns)
print("First 5 records:\n", data.head())
print("\nStatistical Summary:\n", data.describe())
print("\nDataset Info:\n")
print(data.info())
sns.pairplot(data, hue='Outcome')
plt.show()
correlation_matrix = data.corr()
plt.figure(figsize=(10, 8))
sns.heatmap(correlation_matrix, annot=True, cmap='coolwarm')
plt.show()
X = data.drop('Outcome', axis=1)
y = data['Outcome']
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.3, random_state=42)
model = LogisticRegression(max_iter=1000)
model.fit(X_train, y_train)
y_pred = model.predict(X_test)
print("Confusion Matrix:")
print(confusion_matrix(y_test, y_pred))
print("\nClassification Report:")
print(classification_report(y_test, y_pred))
accuracy = accuracy_score(y_test, y_pred)
print(f"\nModel Accuracy: {accuracy * 100:.2f}%")
sample = X_test.iloc[0].values.reshape(1, -1)
sample_prediction = model.predict(sample)
print(f"\nPrediction for sample case (1 = Diabetes, 0 = No Diabetes): {sample_prediction[0]}")

```

OUTPUT:

First 5 records:

	Pregnancies	Glucose	BloodPressure	SkinThickness	Insulin	BMI	\
0	6	148	72	35	0	33.6	
1	1	85	66	29	0	26.6	
2	8	183	64	0	0	23.3	
3	1	89	66	23	94	28.1	
4	0	137	40	35	168	43.1	



Confusion Matrix:

```
[[120 31]
 [ 30 50]]
```

Classification Report:

	precision	recall	f1-score	support
0	0.80	0.79	0.80	151
1	0.62	0.62	0.62	80
accuracy			0.74	231
macro avg	0.71	0.71	0.71	231
weighted avg	0.74	0.74	0.74	231

Model Accuracy: 73.59%

Prediction for sample case (1 = Diabetes, 0 = No Diabetes): 0

RESULT:

Thus, the program for predicting diabetes is executed successfully.

8. WINE QUALITY PREDICTION

EX.N0 : 8	WINE QUALITY PREDICTION
<u>DATE : 18/09/2024</u>	

PROBLEM STATEMENT: Predict the quality of wine based on various chemical properties.

PYTHON CONCEPTS: Classes, sequences, file handling.

VISUALIZATION: Histograms, box plots.

MULTIVARIATE ANALYSIS: Multiple regression, factor analysis.

DATASET: Wine Quality Dataset

ALGORITHM:

Step 1: Start the program.

Step 2: Import necessary libraries.

Step 3: Load the dataset.

Step 4: Encode categorical variable, define feature & testing set.

Step 5: Split the dataset into training & testing set, create trained model.

Step 6: Print equal metric & test the cell.

PROGRAM:

```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
from sklearn.model_selection import train_test_split
from sklearn.linear_model import LinearRegression
```

```

from sklearn.metrics import mean_squared_error, r2_score
class WineQualityPredictor:
def __init__(self, num_samples=1000):
self.num_samples = num_samples
self.data = None
self.model = None
def generate_data(self):
np.random.seed(42)
quality = np.random.randint(3, 9, self.num_samples) # Quality scores between 3 and 8
fixed_acidity = np.random.uniform(4.6, 15.9, self.num_samples)
volatile_acidity = np.random.uniform(0.12, 1.58, self.num_samples)
citric_acid = np.random.uniform(0, 1, self.num_samples)
residual_sugar = np.random.uniform(1.9, 15.5, self.num_samples)
chlorides = np.random.uniform(0.012, 0.1, self.num_samples)
free_sulfur_dioxide = np.random.uniform(1, 72, self.num_samples)
total_sulfur_dioxide = np.random.uniform(6, 289, self.num_samples)
density = np.random.uniform(0.99007, 1.00369, self.num_samples)
pH = np.random.uniform(2.74, 4.01, self.num_samples)
sulfur_dioxide = np.random.uniform(10, 60, self.num_samples)
alcohol = np.random.uniform(8.0, 14.9, self.num_samples)
self.data = pd.DataFrame({
'fixed acidity': fixed_acidity, 'volatile acidity': volatile_acidity, 'citric acid': citric_acid,
'residual sugar': residual_sugar, 'chlorides': chlorides, 'free sulfur dioxide': free_sulfur_dioxide,
'total sulfur dioxide': total_sulfur_dioxide, 'density': density, 'pH': pH,
'sulphur dioxide': sulfur_dioxide, 'alcohol': alcohol, 'quality': quality })
print(f"Synthetic Data Generated: {self.data.shape[0]} rows and {self.data.shape[1]} columns")
def visualize_data(self):
self.data.hist(bins=15, figsize=(15, 10))
plt.suptitle('Histograms of Wine Quality Features')
plt.show() plt.figure(figsize=(10, 6))
sns.boxplot(x='quality', y='fixed acidity', data=self.data)
plt.title('Box Plot of Fixed Acidity by Quality')
plt.show() def preprocess_data(self):
X = self.data.drop('quality', axis=1)
y = self.data['quality']

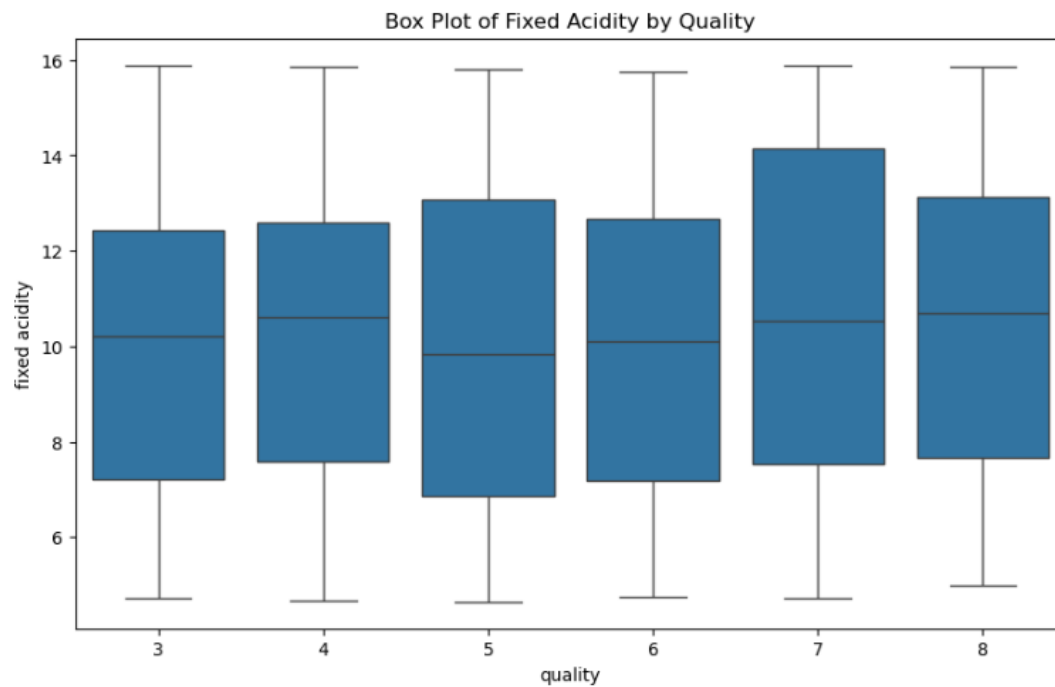
```

```

return X, y
def train_model(self, X, y):
    X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, random_state=42)
    self.model = LinearRegression()
    self.model.fit(X_train, y_train)
    y_pred = self.model.predict(X_test)
    return y_train, y_test, y_pred
def evaluate_model(self, y_test, y_pred):
    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}')
def predict_quality(self, input_features):
    input_df = pd.DataFrame([input_features], columns=self.data.columns[:-1])
    prediction = self.model.predict(input_df) return prediction[0]
def run(self): self.generate_data() self.visualize_data()
X, y = self.preprocess_data()
y_train, y_test, y_pred = self.train_model(X, y)
self.evaluate_model(y_test, y_pred)
if __name__ == "__main__":
    wine_predictor = WineQualityPredictor(num_samples=1000)
    wine_predictor.run()
    example_features = {
        'fixed acidity': 7.4, 'volatile acidity': 0.7, 'citric acid': 0.0,
        'residual sugar': 1.9, 'chlorides': 0.076, 'free sulfur dioxide': 11.0,
        'total sulfur dioxide': 34.0, 'density': 0.9978, 'pH': 3.51,
        'sulphur dioxide': 45.0, 'alcohol': 9.4 }
    predicted_quality = wine_predictor.predict_quality(example_features)
    print(f'Predicted Wine Quality: {predicted_quality:.2f}')

```

OUTPUT:



Mean Squared Error: 2.8525212491984275
R² Score: -0.0010251435985495494
Predicted Wine Quality: 5.51

RESULT:

Thus, the program for wine quality prediction is executed successfully.

9. HEART DISEASE PREDICTION

EX.N0 : 9	HEART DISEASE PREDICTION
<u>DATE : 07/10/2024</u>	

PROBLEM STATEMENT: Predict heart disease based on clinical parameters

PYTHON CONCEPTS: Functions, data structures.

VISUALIZATION: Pair plots, ROC curve.

MULTIVARIATE ANALYSIS: Logistic regression, PCA.

DATASET: Heart Disease Dataset

ALGORITHM:

Step 1: Start the program.

Step 2: Import necessary libraries.

Step 3: Load the dataset.

Step 4: Encode categorical variable, define feature & testing set.

Step 5: Split the dataset into training & testing set, create trained model.

Step 6: Print equal metric & test the cell.

PROGRAM:

```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
from sklearn.model_selection import train_test_split
from sklearn.preprocessing import StandardScaler
```



```

from sklearn.linear_model import LogisticRegression
from sklearn.metrics import accuracy_score, confusion_matrix, classification_report
np.random.seed(42) # For reproducibility
num_samples = 1000
age = np.random.randint(30, 80, num_samples)
sex = np.random.randint(0, 2, num_samples)
cp = np.random.randint(0, 4, num_samples)
trestbps = np.random.randint(90, 200, num_samples)
chol = np.random.randint(150, 300, num_samples)
fbs = np.random.randint(0, 2, num_samples)
restecg = np.random.randint(0, 2, num_samples)
thalach = np.random.randint(60, 200, num_samples)
exang = np.random.randint(0, 2, num_samples)
oldpeak = np.random.uniform(0, 6, num_samples)
slope = np.random.randint(0, 3, num_samples)
ca = np.random.randint(0, 4, num_samples)
thal = np.random.randint(1, 4, num_samples)
target = np.random.randint(0, 2, num_samples)
data = pd.DataFrame({
    'age': age, 'sex': sex, 'cp': cp,
    'trestbps': trestbps, 'chol': chol,
    'fbs': fbs, 'restecg': restecg, 'thalach': thalach, 'exang': exang,
    'oldpeak': oldpeak, 'slope': slope, 'ca': ca,
    'thal': thal, 'target': target})
X = data.drop('target', axis=1)
y = data['target']
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, random_state=42)
scaler = StandardScaler()
X_train = scaler.fit_transform(X_train)
X_test = scaler.transform(X_test)
model = LogisticRegression()
model.fit(X_train, y_train)
y_pred = model.predict(X_test)
accuracy = accuracy_score(y_test, y_pred)
conf_matrix = confusion_matrix(y_test, y_pred)

```

```

class_report = classification_report(y_test, y_pred)
print(f'Accuracy: {accuracy:.2f}')
print('Confusion Matrix:')
print(conf_matrix)
print('Classification Report:')
print(class_report)
plt.figure(figsize=(8, 6))
sns.heatmap(conf_matrix, annot=True, fmt='d', cmap='Blues', xticklabels=['No Disease',
'Disease'], yticklabels=['No Disease', 'Disease'])
plt.title('Confusion Matrix')
plt.xlabel('Predicted')
plt.ylabel('Actual')
plt.show()
importance = model.coef_[0]
features = X.columns
importance_df = pd.DataFrame({'Feature': features, 'Importance': importance})
importance_df = importance_df.sort_values(by='Importance', ascending=False)
plt.figure(figsize=(10, 6))
sns.barplot(data=importance_df, x='Importance', y='Feature', palette='viridis')
plt.title('Feature Importance')
plt.xlabel('Coefficient Value')
plt.ylabel('Features')
plt.axvline(0, color='red', linestyle='--') # Adding a vertical line at 0
plt.show()

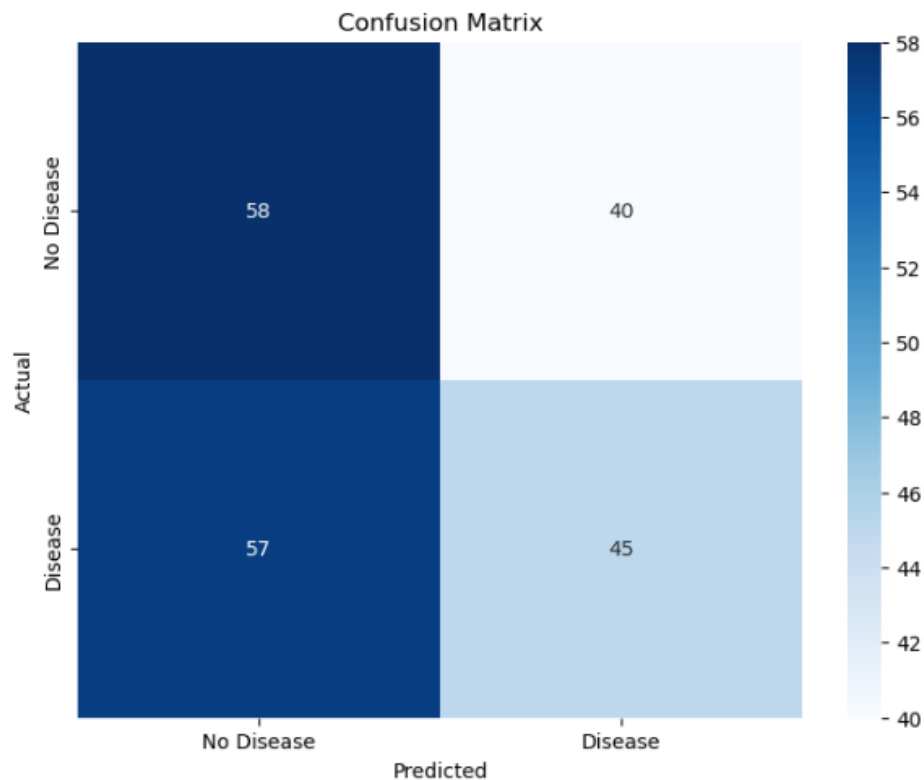
```

OUTPUT:

```
Accuracy: 0.52
Confusion Matrix:
[[58 40]
 [57 45]]
Classification Report:
      precision    recall  f1-score   support

     0       0.50      0.59      0.54        98
     1       0.53      0.44      0.48       102

 accuracy          0.52          200
 macro avg         0.52          200
 weighted avg      0.52          200
```



RESULT:

Thus, the program for heart disease prediction is executed successfully.

10. BREAST CANCER DIAGNOSIS

EX.N0 : 10	Breast Cancer Diagnosis
<u>DATE : 09/10/2024</u>	

PROBLEM STATEMENT: Classify tumors as benign or malignant based on features.

PYTHON CONCEPTS: Classes, sequences.

VISUALIZATION: Confusion matrix, bar plots.

MULTIVARIATE ANALYSIS: LDA, logistic regression.

DATASET: Breast Cancer Wisconsin Dataset

ALGORITHM:

Step 1: Start the program.

Step 2: Import necessary libraries.

Step 3: Load the dataset.

Step 4: Encode categorical variable, define feature & testing set.

Step 5: Split the dataset into training & testing set, create trained model.

Step 6: Print equal metric & test the cell.

PROGRAM:

```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
from sklearn.model_selection import train_test_split
from sklearn.preprocessing import StandardScaler
```

```

from sklearn.linear_model import LogisticRegression
from sklearn.metrics import accuracy_score, confusion_matrix, classification_report
np.random.seed(42) # For reproducibility
num_samples = 1000
age = np.random.randint(30, 80, num_samples)
sex = np.random.randint(0, 2, num_samples)
cp = np.random.randint(0, 4, num_samples)
trestbps = np.random.randint(90, 200, num_samples)
chol = np.random.randint(150, 300, num_samples)
fbs = np.random.randint(0, 2, num_samples)
restecg = np.random.randint(0, 2, num_samples)
thalach = np.random.randint(60, 200, num_samples)
exang = np.random.randint(0, 2, num_samples)
oldpeak = np.random.uniform(0, 6, num_samples)
slope = np.random.randint(0, 3, num_samples)
ca = np.random.randint(0, 4, num_samples)
thal = np.random.randint(1, 4, num_samples)
target = np.random.randint(0, 2, num_samples)
data = pd.DataFrame({
    'age': age, 'sex': sex, 'cp': cp,
    'trestbps': trestbps, 'chol': chol,
    'fbs': fbs, 'restecg': restecg, 'thalach': thalach, 'exang': exang,
    'oldpeak': oldpeak, 'slope': slope, 'ca': ca,
    'thal': thal, 'target': target})
X = data.drop('target', axis=1)
y = data['target']
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, random_state=42)
scaler = StandardScaler()
X_train = scaler.fit_transform(X_train)
X_test = scaler.transform(X_test)
model = LogisticRegression()
model.fit(X_train, y_train)
y_pred = model.predict(X_test)
accuracy = accuracy_score(y_test, y_pred)
conf_matrix = confusion_matrix(y_test, y_pred)

```

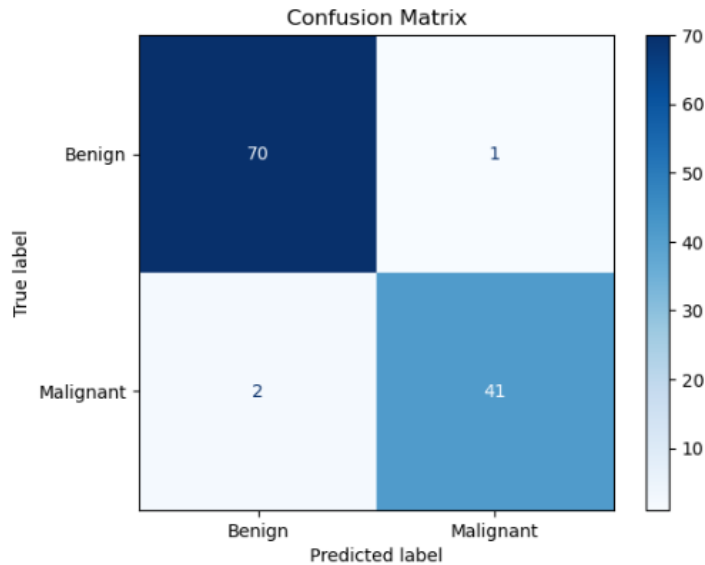
```

class_report = classification_report(y_test, y_pred)
print(f'Accuracy: {accuracy:.2f}')
print('Confusion Matrix:')
print(conf_matrix)
print('Classification Report:')
print(class_report)
plt.figure(figsize=(8, 6))
sns.heatmap(conf_matrix, annot=True, fmt='d', cmap='Blues', xticklabels=['No Disease',
'Disease'], yticklabels=['No Disease', 'Disease'])
plt.title('Confusion Matrix')
plt.xlabel('Predicted')
plt.ylabel('Actual')
plt.show()
importance = model.coef_[0]
features = X.columns
importance_df = pd.DataFrame({'Feature': features, 'Importance': importance})
importance_df = importance_df.sort_values(by='Importance', ascending=False)
plt.figure(figsize=(10, 6))
sns.barplot(data=importance_df, x='Importance', y='Feature', palette='viridis')
plt.title('Feature Importance')
plt.xlabel('Coefficient Value')
plt.ylabel('Features')
plt.axvline(0, color='red', linestyle='--') # Adding a vertical line at 0
plt.show()

```

OUTPUT:

	precision	recall	f1-score	support
0	0.97	0.99	0.98	71
1	0.98	0.95	0.96	43
accuracy			0.97	114
macro avg	0.97	0.97	0.97	114
weighted avg	0.97	0.97	0.97	114



```
Enter the following features for prediction: compactness_se: 0.03
radius_mean: 14.5 concavity_se: 0.03
texture_mean: 20.0 concave points_se: 0.02
perimeter_mean: 90.0 symmetry_se: 0.02
area_mean: 560.0 fractal_dimension_se: 0.003
smoothness_mean: 0.1 radius_worst: 16.0
compactness_mean: 0.15 texture_worst: 25.0
concavity_mean: 0.2 perimeter_worst: 100.0
concave points_mean: 0.1 area_worst: 800.0
symmetry_mean: 0.18 smoothness_worst: 0.14
fractal_dimension_mean: 0.06 compactness_worst: 0.25
radius_se: 0.6 concavity_worst: 0.3
texture_se: 1.2 concave points_worst: 0.15
perimeter_se: 10.0 symmetry_worst: 0.25
area_se: 40.0 fractal_dimension_worst: 0.08
smoothness_se: 0.007
```

The tumor is predicted to be: Malignant
Based on the symptoms provided, the person may be at risk.

RESULT:

Thus, the program for breast cancer diagnosis is executed successfully.

11. PREDICTING FLIGHT DELAYS

EX.N0 : 11	PREDICTING FLIGHT DELAYS
<u>DATE : 16/10/2024</u>	

PROBLEM STATEMENT: Predict flight delays based on historical data.

PYTHON CONCEPTS: File reading/writing, functions.

VISUALIZATION: Line plots, scatter plots.

MULTIVARIATE ANALYSIS: Regression, clustering.

DATASET: Flight Delay Dataset

ALGORITHM:

Step 1: Start the program.

Step 2: Import necessary libraries.

Step 3: Load the dataset.

Step 4: Encode categorical variable, define feature & testing set.

Step 5: Split the dataset into training & testing set, create trained model.

Step 6: Print equal metric & test the cell.

PROGRAM:

```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
from sklearn.model_selection import train_test_split
from sklearn.linear_model import LinearRegression
```



```

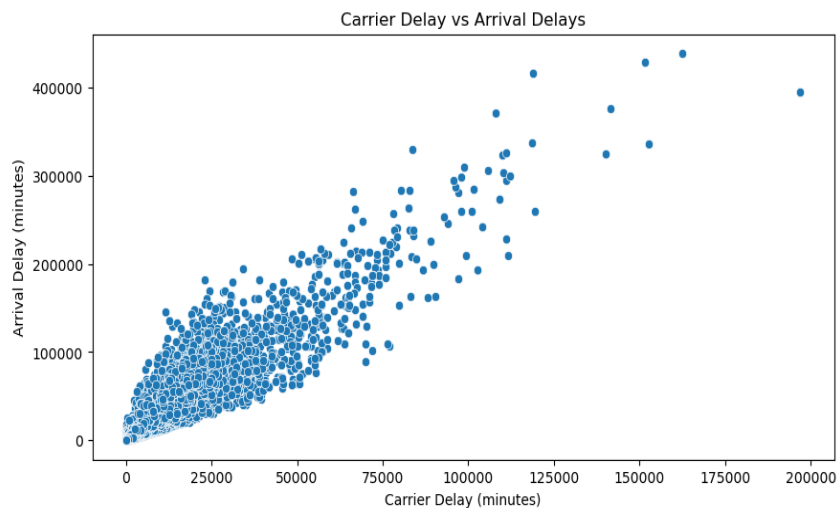
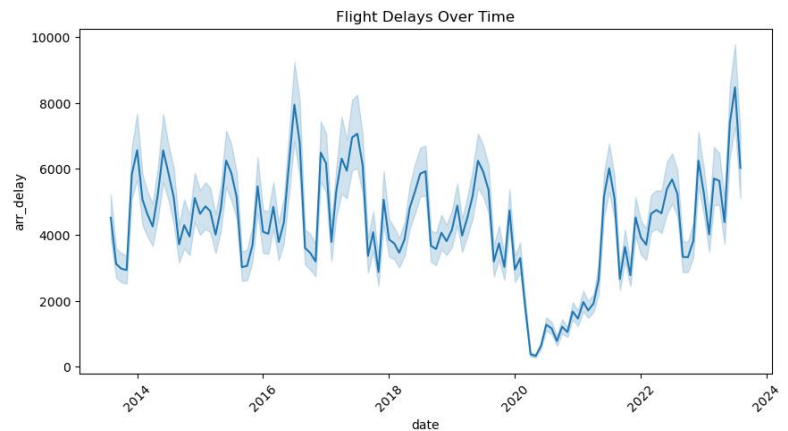
from sklearn.metrics import mean_absolute_error, mean_squared_error, r2_score
df = pd.read_csv('C:/Users/APPU/Downloads/Airline_Delay_Cause.csv')
print(df.columns)
print(df.isnull().sum())
df.dropna(inplace=True) # or df.fillna(method='ffill', inplace=True)
if 'year' in df.columns and 'month' in df.columns:
df['date'] = pd.to_datetime(df[['year', 'month']].assign(day=1))
plt.figure(figsize=(10, 5))
sns.lineplot(data=df, x='date', y='arr_delay') # Adjust if necessary
plt.title('Flight Delays Over Time')
plt.xticks(rotation=45)
plt.show()
delay_column = 'arr_delay' # Using 'arr_delay' for now
if 'carrier_delay' in df.columns and delay_column in df.columns:
plt.figure(figsize=(10, 5))
sns.scatterplot(data=df, x='carrier_delay', y=delay_column) # Adjust as needed
plt.title('Carrier Delay vs Arrival Delays') plt.xlabel('Carrier Delay (minutes)')
plt.ylabel('Arrival Delay (minutes)') plt.show()
else: print("Check the delay columns: 'carrier_delay' or 'arr_delay' do not exist in the
DataFrame.")
df['day_of_week'] = df['date'].dt.dayofweek # Monday=0, Sunday=6
features = ['day_of_week', 'arr_flights', 'carrier_ct'] # Modify as needed
X = df[features] y = df[delay_column]
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, random_state=42)
model = LinearRegression()
model.fit(X_train, y_train)
predictions = model.predict(X_test)
print('Mean Absolute Error:', mean_absolute_error(y_test, predictions))
print('Mean Squared Error:', mean_squared_error(y_test, predictions))
print('R-squared:', r2_score(y_test, predictions))
plt.figure(figsize=(10, 5)) plt.scatter(y_test, predictions)
plt.plot([min(y_test), max(y_test)], [min(y_test), max(y_test)], color='red', linewidth=2) # Line
of equality
plt.title('Predictions vs Actual Delays') plt.xlabel('Actual Delays')
plt.ylabel('Predicted Delays') plt.show()

```

OUTPUT:

```
Index(['year', 'month', 'carrier', 'carrier_name', 'airport', 'airport_name',  
      'arr_flights', 'arr_del15', 'carrier_ct', 'weather_ct', 'nas_ct',  
      'security_ct', 'late_aircraft_ct', 'arr_cancelled', 'arr_diverted',  
      'arr_delay', 'carrier_delay', 'weather_delay', 'nas_delay',  
      'security_delay', 'late_aircraft_delay'],  
      dtype='object')
```

```
year          0  
month         0  
carrier       0  
carrier_name  0  
airport       0  
airport_name  0  
arr_flights   240  
arr_del15     443  
carrier_ct    240  
weather_ct    240  
nas_ct        240  
security_ct   240  
late_aircraft_ct 240  
arr_cancelled 240  
arr_diverted  240  
arr_delay     240  
carrier_delay 240  
weather_delay 240  
nas_delay     240  
security_delay 240  
late_aircraft_delay 240  
dtype: int64
```



Mean Absolute Error: 1592.2201262853362
Mean Squared Error: 25524907.35571326
R-squared: 0.8439698040165798

RESULT:

Thus, the program for predicting flight delays is executed successfully.

12. ENERGY CONSUMPTION FORECASTING

EX.N0 : 12	ENERGY CONSUMPTION FORECASTING
<u>DATE : 23/10/2024</u>	

PROBLEM STATEMENT: Forecast energy consumption based on historical data.

PYTHON CONCEPTS: Functions, numeric types.

VISUALIZATION: Line plots, heatmaps.

MULTIVARIATE ANALYSIS: Time series analysis, regression.

DATASET: Energy Consumption Dataset

ALGORITHM:

Step 1: Start the program.

Step 2: Import necessary libraries.

Step 3: Load the dataset.

Step 4: Encode categorical variable, define feature & testing set.

Step 5: Split the dataset into training & testing set, create trained model.

Step 6: Print equal metric & test the cell.

PROGRAM:

```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
from statsmodels.tsa.arima.model import ARIMA
from sklearn.metrics import mean_squared_error
data = pd.read_csv('C:/Users/APPU/Downloads/energy_consumption_dataset.csv',
parse_dates=['Timestamp'], index_col='Timestamp')
print(data.head()) print(data.info())
```

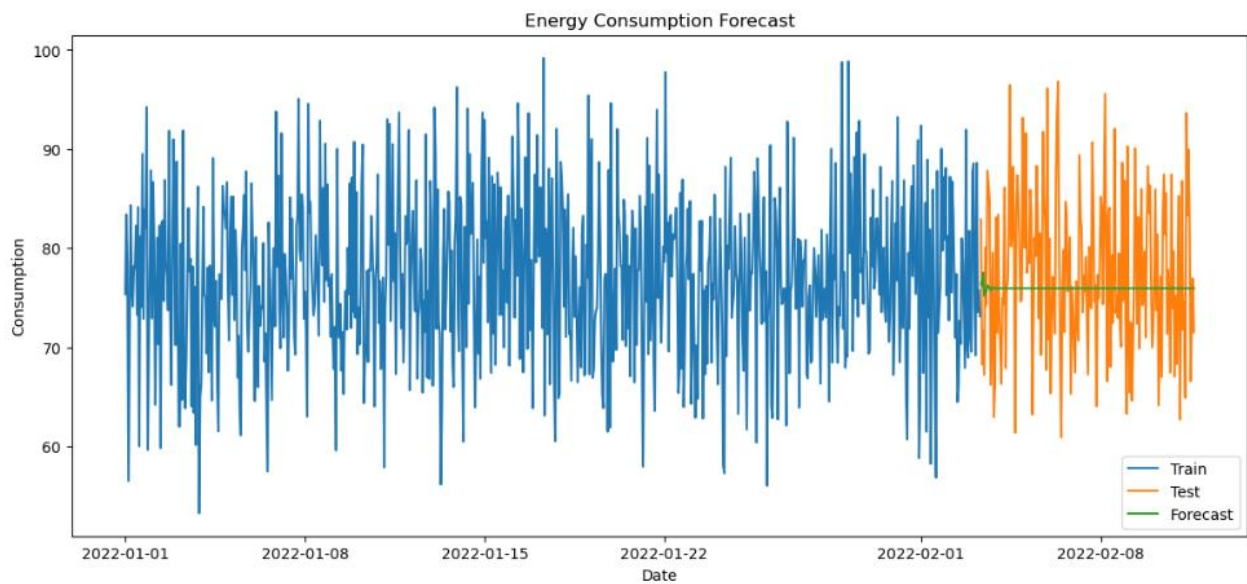
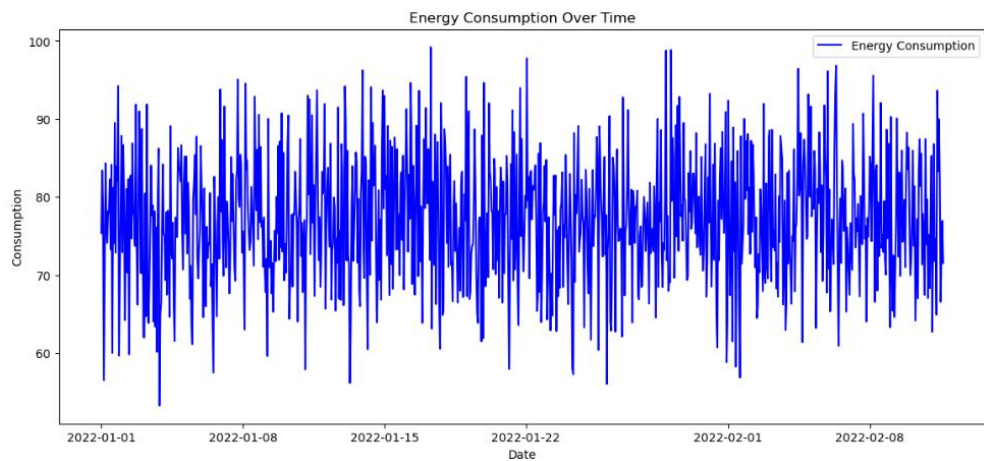
```

data = data.fillna(method='ffill')
plt.figure(figsize=(14, 6))
plt.plot(data['EnergyConsumption'], color='blue', label='Energy Consumption')
plt.title('Energy Consumption Over Time')
plt.xlabel('Date') plt.ylabel('Consumption')
plt.legend() plt.show()
numeric_data = data.select_dtypes(include=[np.number])
plt.figure(figsize=(10, 8))
sns.heatmap(numeric_data.corr(), annot=True, cmap='coolwarm')
plt.title('Correlation Matrix') plt.show()
from statsmodels.tsa.seasonal import seasonal_decompose
result = seasonal_decompose(data['EnergyConsumption'], model='additive', period=24) # Adjust
period based on your data's frequency
result.plot() plt.show()
train_size = int(len(data) * 0.8)
train, test = data['EnergyConsumption'][:train_size], data['EnergyConsumption'][train_size:]
model = ARIMA(train, order=(5, 1, 0)) # Adjust (p,d,q) based on your data's behavior
fitted_model = model.fit()
forecast = fitted_model.forecast(steps=len(test))
forecast_index = test.index
mse = mean_squared_error(test, forecast)
rmse = np.sqrt(mse)
print(f'RMSE: {rmse}')
plt.figure(figsize=(14, 6))
plt.plot(train, label='Train')
plt.plot(test, label='Test')
plt.plot(forecast_index, forecast, label='Forecast')
plt.title('Energy Consumption Forecast')
plt.xlabel('Date')
plt.ylabel('Consumption')
plt.legend()
plt.show()

```

OUTPUT:

Timestamp	Temperature	Humidity	SquareFootage	Occupancy \	Timestamp	HVACUsage	LightingUsage	RenewableEnergy	DayOfWeek
2022-01-01 00:00:00	25.139433	43.431581	1565.693999	5	2022-01-01 00:00:00	On	Off	2.774699	Monday
2022-01-01 01:00:00	27.731651	54.225919	1411.064918	1	2022-01-01 01:00:00	On	On	21.831384	Saturday
2022-01-01 02:00:00	28.704277	58.907658	1755.715009	2	2022-01-01 02:00:00	Off	Off	6.764672	Sunday
2022-01-01 03:00:00	20.080469	50.371637	1452.316318	1	2022-01-01 03:00:00	Off	On	8.623447	Wednesday
2022-01-01 04:00:00	23.097359	51.401421	1094.130359	9	2022-01-01 04:00:00	On	Off	3.071969	Friday



RESULT:

Thus, the program for energy consumption forecasting is executed successfully.