

**EXPT NO: 1 A python program to implement univariate regression DATE:**

**23.8.24      bivariate regression and multivariate regression.**

**AIM:**

To write a python program to implement univariate regression, bivariate regression and multivariate regression.

**PROCEDURE:**

Implementing univariate, bivariate, and multivariate regression using the Iris dataset involve the following steps:

**Step 1: Import Necessary Libraries**

First, import the libraries that are essential for data manipulation, visualization, and model building.

```
import numpy as np 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 LinearRegression
from sklearn.metrics import mean_squared_error, r2_score
```

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## Step 2: Load the Iris Dataset

The Iris dataset can be loaded and display the first few rows of the dataset .

```
# Load the Iris dataset

iris = sns.load_dataset('iris')

# Display the first few rows of the dataset print(iris.head())
```

### OUTPUT :

	sepal_length	sepal_width	petal_length	petal_width	species
0	5.1	3.5	1.4	0.2	setosa
1	4.9	3.0	1.4	0.2	setosa
2	4.7	3.2	1.3	0.2	setosa
3	4.6	3.1	1.5	0.2	setosa
4	5.0	3.6	1.4	0.2	setosa

## Step 3: Data Preprocessing

Ensure the data is clean and ready for modeling. Since the Iris dataset is clean, minimal preprocessing is needed.

```
# Check for missing values print(iris.isnull().sum())

# Display the basic statistical details print(iris.describe())
```

### OUTPUT :

	sepal_length	sepal_width	petal_length	petal_width
count	150.000000	150.000000	150.000000	150.000000
mean	5.843333	3.057333	3.758000	1.199333
std	0.828066	0.435866	1.765298	0.762238
min	4.300000	2.000000	1.000000	0.100000
25%	5.100000	2.800000	1.600000	0.300000
50%	5.800000	3.000000	4.350000	1.300000
75%	6.400000	3.300000	5.100000	1.800000
max	7.900000	4.400000	6.900000	2.500000

## Step 4: Univariate Regression

Univariate regression involves predicting one variable based on a single predictor.

#### 4.1: Select the Features

Choose one feature (e.g., sepal\_length) and one target variable (e.g., sepal\_width).

```
X_uni = iris[['sepal_length']] y_uni  
= iris['sepal_width']
```

#### 4.2: Split the Data

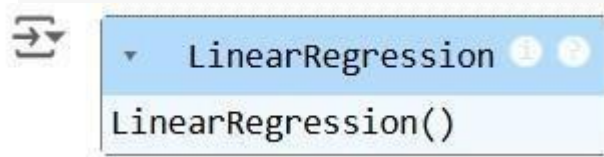
Split the data into training and testing sets.

Fit the linear regression model on the training data.

```
X_uni_train, X_uni_test, y_uni_train, y_uni_test = train_test_split(X_uni,  
y_uni, test_size=0.2, random_state=42)
```

#### 4.3: Train the model

```
uni_model = LinearRegression() uni_model.fit(X_uni_train,  
y_uni_train)
```



#### 4.4: Make Predictions

Use the model to make predictions on the test data.

```
y_uni_pred = uni_model.predict(X_uni_test)
```

#### 4.5: Evaluate the Model

Evaluate the model performance using metrics like Mean Squared Error (MSE) and R-squared.

```
print(f'Univariate MSE: {mean_squared_error(y_uni_test, y_uni_pred)}')  
print(f'Univariate R-squared: {r2_score(y_uni_test, y_uni_pred)}')
```

**OUTPUT :**



Univariate MSE: 0.13961895650579023

Univariate R-squared: 0.024098626473972984

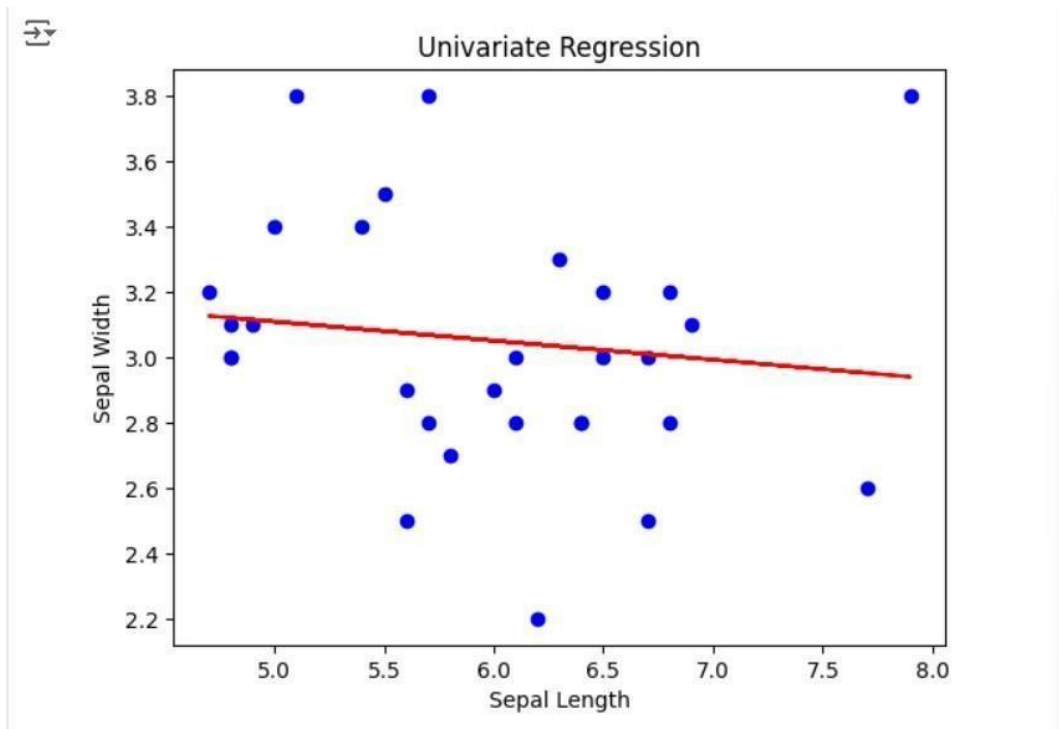
## 4.6: Visualize the Results

Visualize the relationship between the predictor and the target variable.

```
plt.scatter(X_uni_test, y_uni_test, color='blue')  
plt.plot(X_uni_test, y_uni_pred, color='red')  
plt.xlabel('Sepal Length') plt.ylabel('Sepal Width')
```

```
plt.title('Univariate Regression') plt.show()
```

### OUTPUT :



## Step 5 : Bivariate Regression

Bivariate regression involves predicting one variable based on two predictors.

### 5.1: Select the Features

Choose two features (e.g., sepal\_length, petal\_length) and one target variable (e.g., sepal\_width).

```
X_bi = iris[['sepal_length', 'petal_length']]
```

```
y_bi = iris['sepal_width']
```

## 5.2: Split the Data

Split the data into training and testing sets.

```
X_bi_train, X_bi_test, y_bi_train, y_bi_test = train_test_split(X_bi, y_bi,  
test_size=0.2, random_state=42)
```

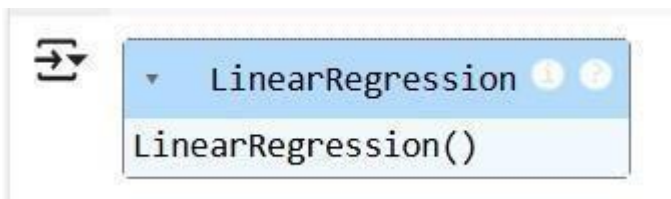
## 5.3: Train the Model

Fit the linear regression model on the training data.

```
bi_model = LinearRegression()
```

```
bi_model.fit(X_bi_train, y_bi_train)
```

## OUTPUT :



## 5.4: Make Predictions

Use the model to make predictions on the test data.

```
y_bi_pred = bi_model.predict(X_bi_test)
```

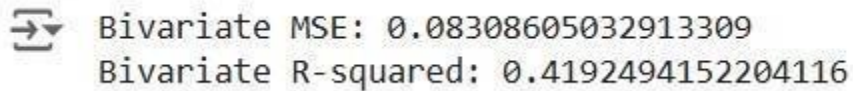
## 5.5: Evaluate the Model

Evaluate the model performance using metrics like MSE and R-squared.

```
print(f'Bivariate MSE: {mean_squared_error(y_bi_test, y_bi_pred)}')

print(f'Bivariate R-squared: {r2_score(y_bi_test, y_bi_pred)}')
```

OUTPUT :

A Jupyter Notebook output cell with a magnifying glass icon. It displays two lines of text: "Bivariate MSE: 0.08308605032913309" and "Bivariate R-squared: 0.4192494152204116".

```
Bivariate MSE: 0.08308605032913309
Bivariate R-squared: 0.4192494152204116
```

## 5.6: Visualize the Results

Since visualizing in 3D is challenging, we can plot the relationships between the target and each predictor separately.

```
# Sepal Length vs Sepal Width

plt.subplot(1, 2, 1)

plt.scatter(X_bi_test['sepal_length'], y_bi_test, color='blue')

plt.plot(X_bi_test['sepal_length'], y_bi_pred, color='red')

plt.xlabel('Sepal Length')

plt.ylabel('Sepal Width')

# Petal Length vs Sepal Width

plt.subplot(1, 2, 2)

plt.scatter(X_bi_test['petal_length'], y_bi_test, color='blue')
```

```
plt.plot(X_bi_test['petal_length'], y_bi_pred, color='red')

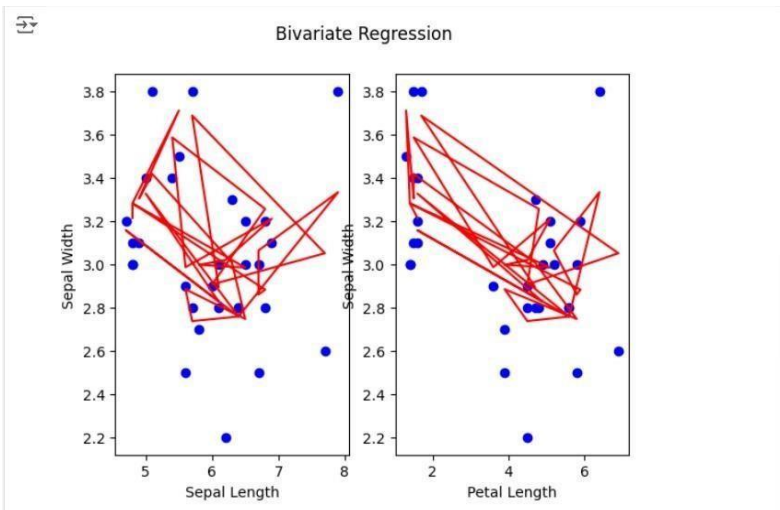
plt.xlabel('Petal Length')

plt.ylabel('Sepal Width')

plt.suptitle('Bivariate Regression')

plt.show()
```

## OUTPUT :



### Step 6: Multivariate Regression

Multivariate regression involves predicting one variable based on multiple predictors.

#### 6.1: Select the Features

Choose multiple features (e.g., sepal\_length, petal\_length, petal\_width) and one target variable (e.g., sepal\_width).

```
X_multi = iris[['sepal_length', 'petal_length', 'petal_width']] y_multi
= iris['sepal_width']
```

#### 6.2: Split the Data

Split the data into training and testing sets.

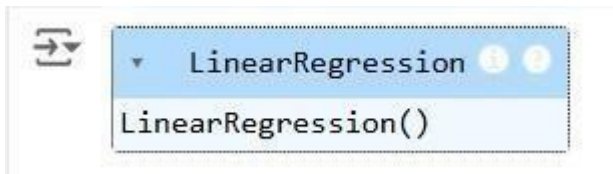
```
X_multi_train, X_multi_test, y_multi_train, y_multi_test =  
  
train_test_split(X_multi,  
  
y_multi, test_size=0.2, random_state=42)
```

### 6.3: Train the Model

Fit the linear regression model on the training data.

```
multi_model = LinearRegression() multi_model.fit(X_multi_train,  
y_multi_train)
```

#### OUTPUT :



### 6.4: Make Predictions

Use the model to make predictions on the test data.

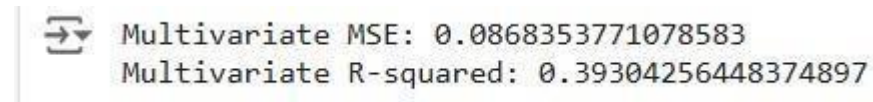
```
y_multi_pred = multi_model.predict(X_multi_test)
```

### 6.5: Evaluate the Model

Evaluate the model performance using metrics like MSE and R-squared.

```
print(f'Multivariate MSE: {mean_squared_error(y_multi_test, y_multi_pred)}')  
print(f'Multivariate R-squared: {r2_score(y_multi_test, y_multi_pred)}')
```

#### OUTPUT :



## Step 7: Visualize the multivariate regression

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```
plt.figure(figsize=(15,4))

plt.subplot(1, 2, 1)

plt.scatter(X_multi_test['sepal_length'], y_multi_test, color='blue')
```

```
plt.plot(X_multi_test['sepal_length'], y_multi_pred, color='red')
```

```
plt.xlabel('sepal_length')
```

```
plt.ylabel('sepal_width')
```

```
plt.title('Multivariate Regression-1')
```

```
plt.show()
```

```
plt.figure(figsize=(15,4))
```

```
plt.subplot(1, 2, 1)
```

```
plt.scatter(X_multi_test['petal_length'], y_multi_test, color='blue')
```

```
plt.plot(X_multi_test['petal_length'], y_multi_pred, color='red')

plt.xlabel('petal_length')

plt.ylabel('sepal_width')

plt.title('Multivariate Regression-2')

plt.show()

plt.figure(figsize=(15,4))

plt.subplot(1, 2, 2 )

plt.scatter(X_multi_test['petal_length'], y_multi_test, color='blue')

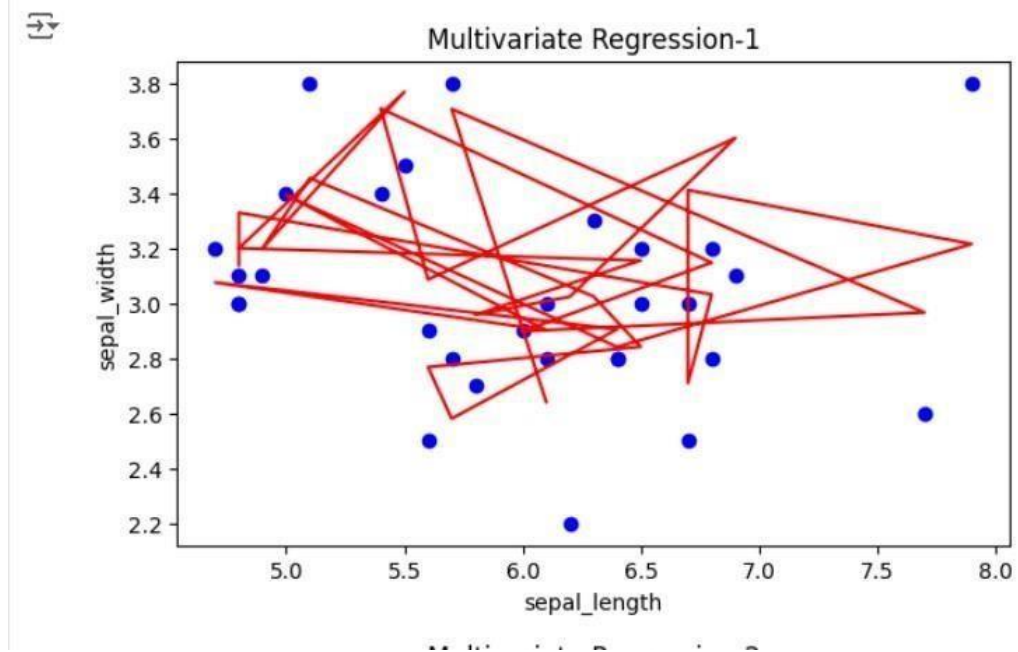
plt.plot(X_multi_test['petal_length'], y_multi_pred, color='red')

plt.xlabel('petal_length')
```

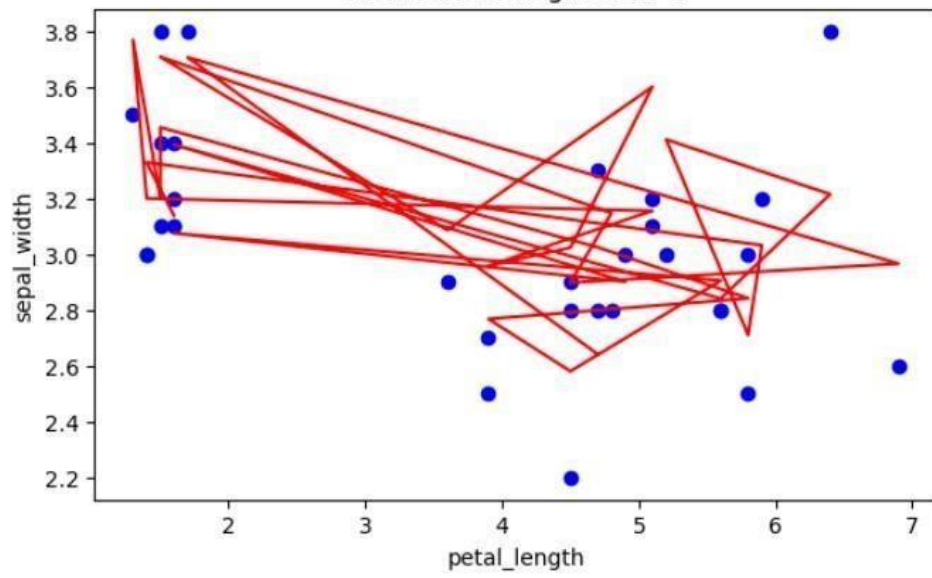
```
plt.ylabel('sepal_width')
```

```
plt.title('Multivariate Regression-3') plt.show()
```

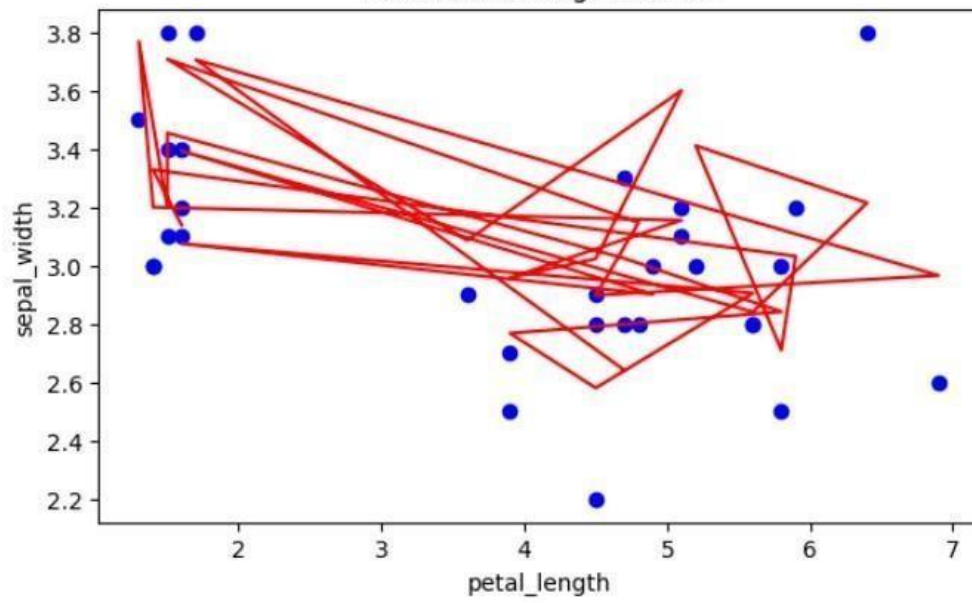
**OUTPUT :**



Multivariate Regression-2



Multivariate Regression-3



## Step 8: Interpret the Results

After implementing and evaluating the models, interpret the coefficients to understand the influence of each predictor on the target variable.

```
print('Univariate Coefficients:', uni_model.coef_)

print('Bivariate Coefficients:', bi_model.coef_)

print('Multivariate Coefficients:', multi_model.coef_)
```

### OUTPUT:

```
⇒ Univariate Coefficients: [-0.05829418]
   Bivariate Coefficients: [ 0.56420418 -0.33942806]
   Multivariate Coefficients: [ 0.62934965 -0.63196673  0.6440201 ]
```

**RESULT:**

This step-by-step process will help us to implement univariate, bivariate, and multivariate regression models using the Iris dataset and analyze their performance.

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