CS353 ML Lab 4

Name: K V Sumanth Reddy

Roll No: 181CO225

Q: Write a program in python to implement and demonstrate linear regression for a sample training data set. Compute the accuracy of the classifier.

Dataset Used: Marketing Data (https://www.kaggle.com/fayejavad/marketing-linear-multiple-regression)

Importing Libraries and Dataset

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

```
dataset = pd.read_csv('Marketing_Data.csv')
dataset.head(10)
```

	youtube	facebook	newspaper	sales
0	84.72	19.20	48.96	12.60
1	351.48	33.96	51.84	25.68
2	135.48	20.88	46.32	14.28
3	116.64	1.80	36.00	11.52
4	318.72	24.00	0.36	20.88
5	114.84	1.68	8.88	11.40
6	348.84	4.92	10.20	15.36
7	320.28	52.56	6.00	30.48
8	89.64	59.28	54.84	17.64
9	51.72	32.04	42.12	12.12

```
dataset.describe()
```

	youtube	facebook	newspaper	sales
count	171.000000	171.000000	171.000000	171.000000
mean	178.021053	27.671579	35.240000	16.922807
std	102.449597	17.913532	24.902918	6.314608
min	0.840000	0.000000	0.360000	1.920000
25%	91.080000	11.700000	13.740000	12.540000
50%	179.760000	26.760000	31.080000	15.480000
75%	262.980000	43.680000	50.880000	20.820000
max	355.680000	59.520000	121.080000	32.400000

```
dataset.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 171 entries, 0 to 170
Data columns (total 4 columns):
 #   Column     Non-Null Count  Dtype  
---  ------     --------------  -----  
 0   youtube    171 non-null    float64
 1   facebook   171 non-null    float64
 2   newspaper  171 non-null    float64
 3   sales      171 non-null    float64
dtypes: float64(4)
memory usage: 5.5 KB
```

Data Preprocessing

```
x = dataset.iloc[:,:-1].values
y = dataset.iloc[:, -1].values
```

```
from sklearn.model_selection import train_test_split
x_train, x_test, y_train, y_test = train_test_split(x, y, test_size
```

Training the model and Testing

```
model = LinearRegression()
model.fit(x_train, y_train)

y_pred = model.predict(x_test)
print("------------------------------")
print("Model coefficients:", model.coef_)
```

```
print("Model coefficients:", model.coef_)
print("Model intercept:     %.4f"% model.intercept_)
print("Variance score:      %.4f" % model.score(x_test, y_test))
print("------------------------------")
```

```
------------------------------
Model coefficients: [0.04637277 0.17605644 0.00666605]
Model intercept:     3.5047
Variance score:      0.9142
------------------------------
```

Regression Evaluation Metrics

Mean Absolute Error (MAE) is the mean of the absolute value of the errors:

$$\frac{1}{n}\sum_{i=1}^{n}|y_i - \hat{y}_i|$$

Mean Squared Error (MSE) is the mean of the squared errors:

$$\frac{1}{n}\sum_{i=1}^{n}(y_i - \hat{y}_i)^2$$

Root Mean Squared Error (RMSE) is the square root of the mean of the squared errors:

$$\sqrt{\frac{1}{n}\sum_{i=1}^{n}(y_i - \hat{y}_i)^2}$$

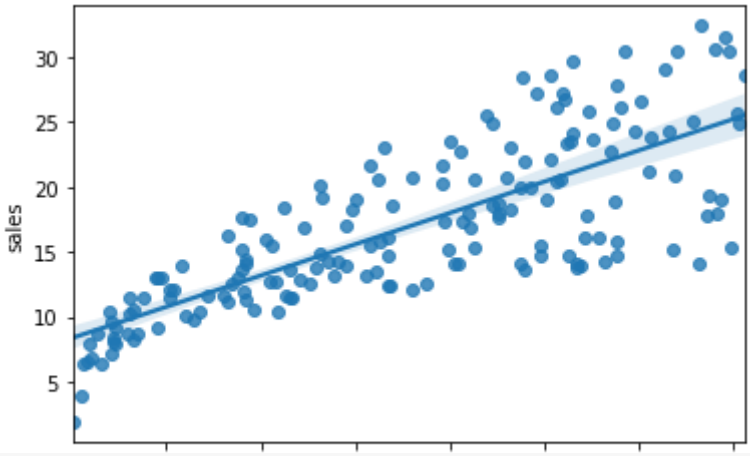
```
print("------------------------------")
print('Mean Absolute Error: %.3f'% metrics.mean_absolute_error(y_te
print('Mean Squared Error: %.3f'% metrics.mean_squared_error(y_test
print('Root Mean Squared Error: %.3f'% np.sqrt(metrics.mean_squared_
print("------------------------------")
```

```
------------------------------
Mean Absolute Error: 1.254
Mean Squared Error: 2.846
Root Mean Squared Error: 1.687
------------------------------
```

Predictions and Visualization

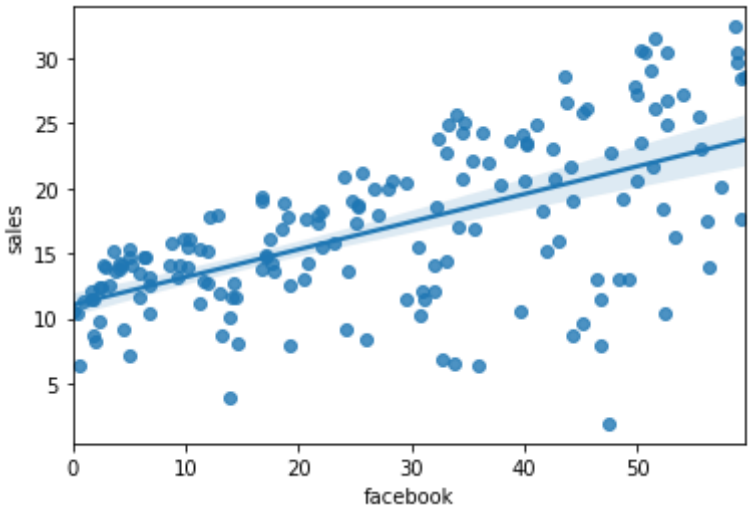
```
sns.regplot(x="youtube", y="sales", data=dataset)
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x7f7e8abf9400>
```



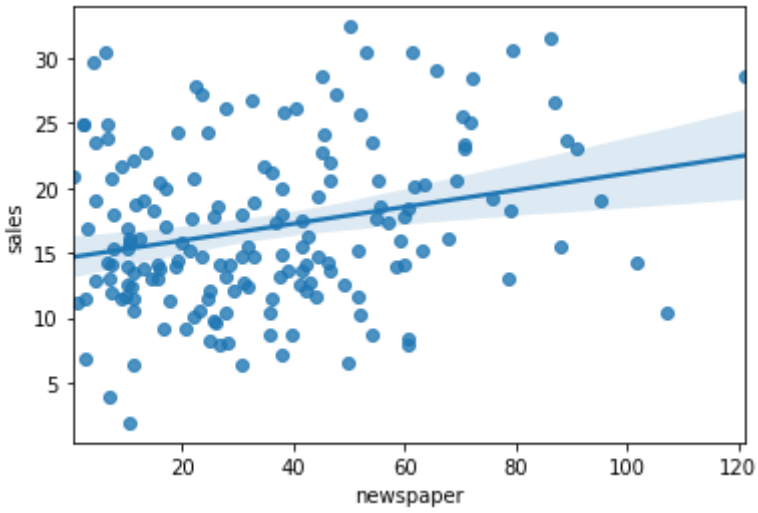

```
sns.regplot(x="facebook", y="sales", data=dataset)
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x7f7e8abf9780>
```




```
sns.regplot(x="newspaper", y="sales", data=dataset)
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x7f7e88639fd0>
```




```
plt.plot([i for i in range(y_pred.size)],y_pred)
plt.xlabel('Index')
plt.ylabel('Sales')
plt.plot([i for i in range(y_test.size)],y_test)
```

```
plt.legend(['Predicted Value', 'Actual Value'])
plt.show()
```