Python | Linear Regression using sklearn

Prerequisite: Linear Regression

Linear Regression is a machine learning algorithm based on supervised learning. It performs a regression task. Regression models a target prediction value based on independent variables. It is mostly used for finding out the relationship between variables and forecasting. Different regression models differ based on – the kind of relationship between the dependent and independent variables, they are considering and the number of independent variables being used. This article is going to demonstrate how to use the various Python libraries to implement linear regression on a given dataset. We will demonstrate a binary linear model as this will be easier to visualize. In this demonstration, the model will use Gradient Descent to learn. You can learn about it here.

Step 1: Importing all the required libraries

Python3

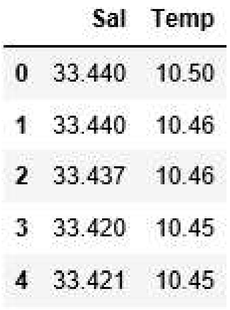
```
import  numpy as np

import  pandas as pd

import  seaborn as sns

import  matplotlib.pyplot as plt

from  sklearn  import  preprocessing, svm

from  sklearn.model_selection  import  train_test_split

from  sklearn.linear_model  import  LinearRegression
```

Step 2: Reading the dataset:

Python3

```
df  =  pd.read_csv(``'bottle.csv'``)

df_binary  =  df[[``'Salnty'``,  'T_degC'``]]

df_binary.columns  =  [``'Sal'``,  'Temp'``]

df_binary.head()
```

Output:



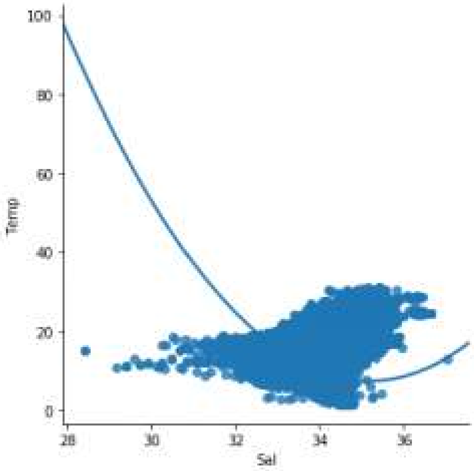
	Sal	Temp
0	33.440	10.50
1	33.440	10.46
2	33.437	10.46
3	33.420	10.45
4	33.421	10.45

Step 3: Exploring the data scatter

Python3

```
sns.lmplot(x  =``"Sal"``, y  =``"Temp"``, data  =  df_binary, order  =  2``, ci  =  None``)

plt.show()
```

Output:



Step 4: Data cleaning

Python3

```
df_binary.fillna(method  =``'ffill'``, inplace  =  True``)
```

Step 5: Training our model

Python3

```
X  =  np.array(df_binary[``'Sal'``]).reshape(``-``1``,  1``)

y  =  np.array(df_binary[``'Temp'``]).reshape(``-``1``,  1``)

df_binary.dropna(inplace  =  True``)

X_train, X_test, y_train, y_test  =  train_test_split(X, y, test_size  =  0.25``)

regr  =  LinearRegression()

regr.fit(X_train, y_train)

print``(regr.score(X_test, y_test))
```

Output:

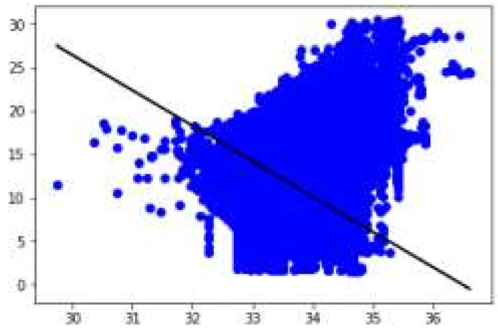
```
0.20780376990868232
```

Step 6: Exploring our results

Python3

```
y_pred  =  regr.predict(X_test)

plt.scatter(X_test, y_test, color  =``'b'``)

plt.plot(X_test, y_pred, color  =``'k'``)

plt.show()
```

Output:



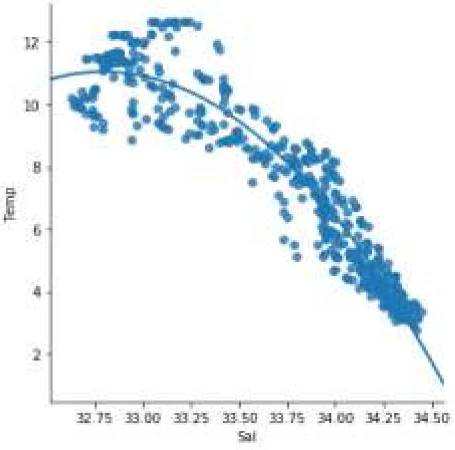
The low accuracy score of our model suggests that our regressive model has not fit very well with the existing data. This suggests that our data is not suitable for linear regression. But sometimes, a dataset may accept a linear regressor if we consider only a part of it. Let us check for that possibility.

Step 7: Working with a smaller dataset

Python3

```
df_binary500  =  df_binary[:][:``500``]

sns.lmplot(x  =``"Sal"``, y  =``"Temp"``, data  =  df_binary500,

                    order  =  2``, ci  =  None``)
```

Output:

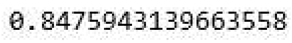


We can already see that the first 500 rows follow a linear model. Continuing with the same steps as before.

Python3

```
df_binary500.fillna(method  =``'fill'``, inplace  =  True``)

X  =  np.array(df_binary500[``'Sal'``]).reshape(``-``1``,  1``)

y  =  np.array(df_binary500[``'Temp'``]).reshape(``-``1``,  1``)

df_binary500.dropna(inplace  =  True``)

X_train, X_test, y_train, y_test  =  train_test_split(X, y, test_size  =  0.25``)

regr  =  LinearRegression()

regr.fit(X_train, y_train)

print``(regr.score(X_test, y_test))
```

Output:

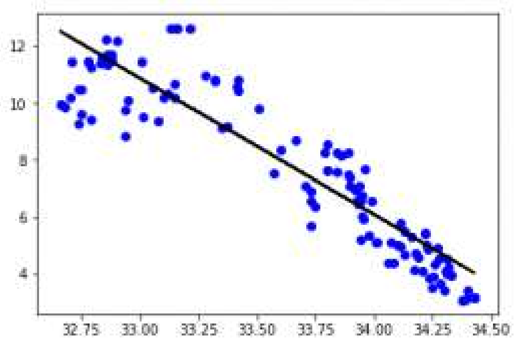


````
0.8475943139663558
````

Python3

````
y_pred  =  regr.predict(X_test)

plt.scatter(X_test, y_test, color  =``'b'``)

plt.plot(X_test, y_pred, color  =``'k'``)

plt.show()
````

Output:



Step 8: Evaluation Metrics For Regression

At last, we check the performance of the Linear Regression model with help of evaluation metrics. For Regression algorithms we widely use mean_absolute_error, and mean_squared_error metrics to check the model performance.

Python3

````
from  sklearn.metrics  import  mean_absolute_error,mean_squared_error

mae  =  mean_absolute_error(y_true``=``y_test,y_pred``=``y_pred)

mse  =  mean_squared_error(y_true``=``y_test,y_pred``=``y_pred)

rmse  =  mean_squared_error(y_true``=``y_test,y_pred``=``y_pred,squared``=``False``)

print``(``"MAE:"``,mae)

print``(``"MSE:"``,mse)
````

```
print``(``"RMSE:"``,rmse)
```

Output:

```
MAE: 0.7927322046360309
MSE: 1.0251137190180517
RMSE: 1.0124789968281078
```