regression-pr-03

January 4, 2024

[1]:
```
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
```

[4]:
```
df=pd.read_csv('../08-Linear-Regression-Models/Advertising.csv')
```

[5]:
```
df.head()
```

[5]:
```
      TV  radio  newspaper  sales
0  230.1   37.8       69.2   22.1
1   44.5   39.3       45.1   10.4
2   17.2   45.9       69.3    9.3
3  151.5   41.3       58.5   18.5
4  180.8   10.8       58.4   12.9
```

[10]:
```
X=df.drop('sales',axis=1)
y=df['sales']
```

[107]:
```
from sklearn.preprocessing import PolynomialFeatures
```

[138]:
```
polynomical_convertor = PolynomialFeatures(degree=2,include_bias=False)
```

[139]:
```
polynomical_convertor.fit(X)
```

[139]:
```
PolynomialFeatures(include_bias=False)
```

[140]:
```
poly_features=polynomical_convertor.transform(X)
```

[141]:
```
X.shape
```

[141]:
```
(200, 3)
```

[142]:
```
poly_features.shape
```

[142]:
```
(200, 9)
```

```
[143]: X.iloc[0]
```

```
[143]: TV           230.1
       radio         37.8
       newspaper     69.2
       Name: 0, dtype: float64
```

```
[144]: poly_features[0]
```

```
[144]: array([2.301000e+02, 3.780000e+01, 6.920000e+01, 5.294601e+04,
              8.697780e+03, 1.592292e+04, 1.428840e+03, 2.615760e+03,
              4.788640e+03])
```

```
[145]: polynomical_convertor.fit_transform(X)
```

```
[145]: array([[ 230.1 ,   37.8 ,   69.2 , …, 1428.84, 2615.76, 4788.64],
              [  44.5 ,   39.3 ,   45.1 , …, 1544.49, 1772.43, 2034.01],
              [  17.2 ,   45.9 ,   69.3 , …, 2106.81, 3180.87, 4802.49],
              …,
              [ 177.  ,    9.3 ,    6.4 , …,   86.49,   59.52,   40.96],
              [ 283.6 ,   42.  ,   66.2 , …, 1764.  , 2780.4 , 4382.44],
              [ 232.1 ,    8.6 ,    8.7 , …,   73.96,   74.82,   75.69]])
```

```
[146]: X_train, X_test, y_train, y_test = train_test_split(poly_features, y,␣
        ↪test_size=0.3, random_state=101)
```

```
[147]: from sklearn.linear_model import LinearRegression
```

```
[148]: model=LinearRegression()
```

```
[149]: model.fit(X_train,y_train)
```

```
[149]: LinearRegression()
```

```
[150]: test_pred=model.predict(X_test)
```

```
[151]: from sklearn.metrics import mean_absolute_error,mean_squared_error
```

```
[152]: MAE=mean_absolute_error(y_test,test_pred)
```

```
[153]: MSE=mean_squared_error(y_test,test_pred)
```

```
[154]: RMSE=np.sqrt(MSE)
```

```
[155]: MAE
```

```
[155]: 0.4896798044803838
```

[156]:

```
MSE
```

[156]:

```
0.4417505510403753
```

[157]:

```
RMSE
```

[157]:

```
0.6646431757269274
```

[158]:

```
model.coef_
```

[158]:

```
array([ 5.17095811e-02,  1.30848864e-02,  1.20000085e-02, -1.10892474e-04,
        1.14212673e-03, -5.24100082e-05,  3.34919737e-05,  1.46380310e-04,
       -3.04715806e-05])
```

[159]:

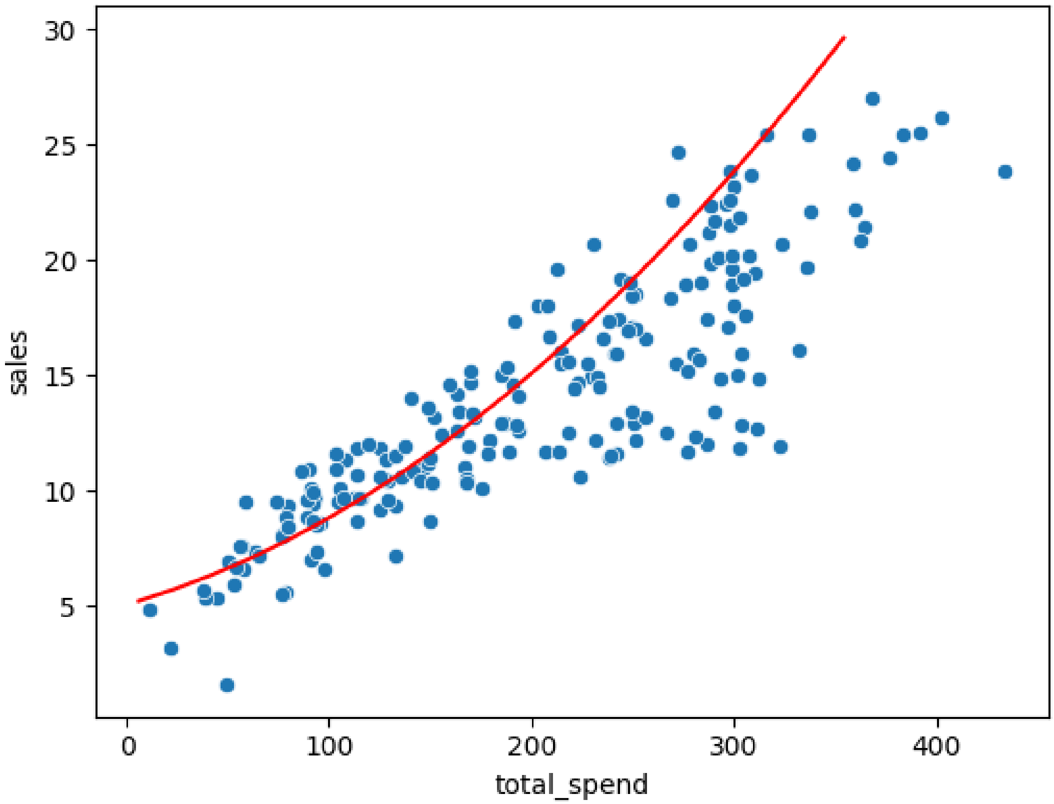
```
# create diffr order polynomial
# split poly freatures
# fit on train
# store/save rmse for both train and test
# plot the results(error vs poly order)


df_res=pd.DataFrame()
df_res['total_spend']=df['TV']+df['radio']+df['newspaper']
df_res['sales']=df['sales']
pot_spend=pd.DataFrame(np.linspace(0,120,60).reshape(20,3))
pot_spend.sum()
potSpend=polynomical_convertor.transform(pot_spend)
polynomical_convertor.fit_transform(pot_spend)
potPred=model.predict(potSpend)
sns.scatterplot(x='total_spend',y='sales',data=df_res)
plt.plot(np.array(pot_spend.sum(axis=1)),np.array(potPred),color='red')
```

```
/home/mustafa/Desktop/ML/first/lib/python3.10/site-packages/sklearn/base.py:465:
UserWarning: X does not have valid feature names, but PolynomialFeatures was
fitted with feature names
  warnings.warn(
```

[159]:

```
[<matplotlib.lines.Line2D at 0x7f12bb2b2d70>]
```



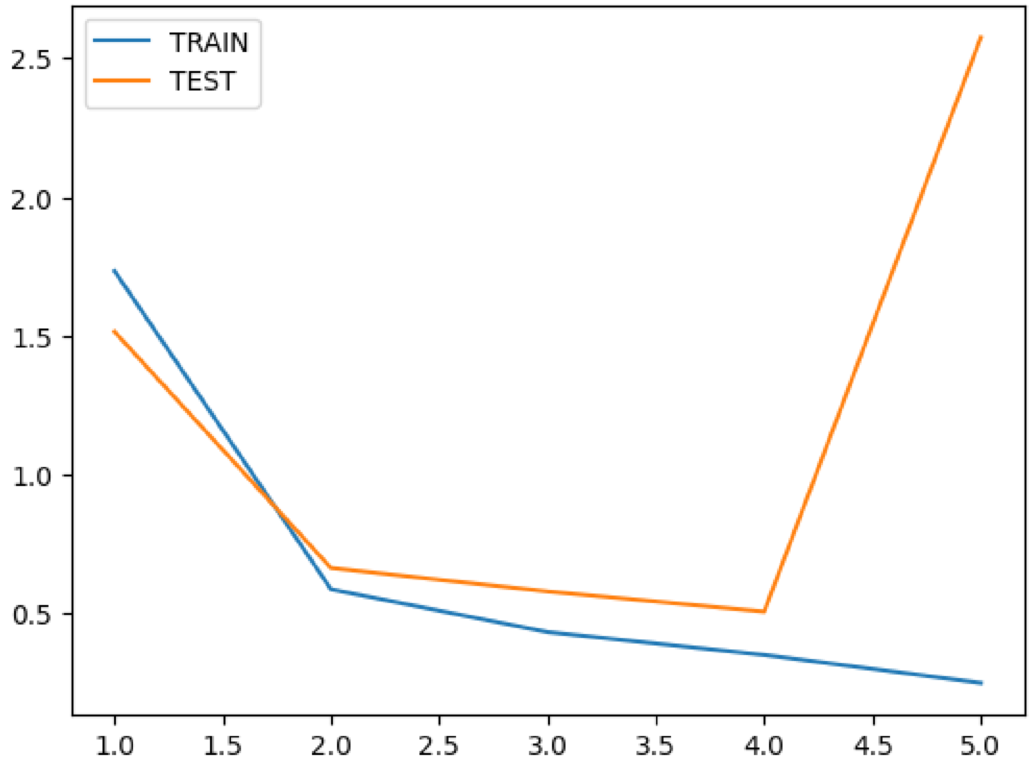
[160]:
```
train_rmse_errors=[]
test_rmse_errors=[]
for d in range(1,10):
    poly_convertor=PolynomialFeatures(degree=d,include_bias=False)
    poly_features=poly_convertor.fit_transform(X)
    X_train, X_test, y_train, y_test = train_test_split(poly_features, y,␣
 ↪test_size=0.3, random_state=101)
    model=LinearRegression()
    model.fit(X_train,y_train)
    train_pred=model.predict(X_train)
    test_pred=model.predict(X_test)

    train_rmse=np.sqrt(mean_squared_error(y_train,train_pred))
    test_rmse=np.sqrt(mean_squared_error(y_test,test_pred))
    train_rmse_errors.append(train_rmse)
    test_rmse_errors.append(test_rmse)
```

[161]:
```
plt.plot(range(1,6),train_rmse_errors[0:5],label='TRAIN')
plt.plot(range(1,6),test_rmse_errors[0:5],label='TEST')
plt.legend()
```

[161]:

```
<matplotlib.legend.Legend at 0x7f12f904f5b0>
```



[172]:

```
final_poly_convertor=PolynomialFeatures(degree=2,include_bias=False)
final_model=LinearRegression()
```

[173]:

```
full_converted_X=final_poly_convertor.fit_transform(X)
final_model.fit(full_converted_X,y)
```

[173]:

```
LinearRegression()
```

[174]:

```
from joblib import  dump,load
```

[175]:

```
dump(final_model,'final_poly_model.joblib')
```

[175]:

```
['final_poly_model.joblib']
```

[176]:

```
dump(final_poly_convertor,'final_convertor.joblib')
```

[176]:

```
['final_convertor.joblib']
```

[177]:

```
loaded_converter=load('final_convertor.joblib')
```

[178]:

```
loaded_model=load('final_poly_model.joblib')
```

[251]:

```
campaign=[[360,1203,23]]
```

[252]:

```
transformed_data=loaded_converter.fit_transform(campaign)
```

[253]:

```
predictions=loaded_model.predict(transformed_data)
```

[254]:

```
predictions
```

[254]:

```
array([677.63837852])
```

[ ]: