22-Multiple_Linear_Regression

October 20, 2024

1 Multiple Linear Regression

[1]:
```
import random
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, root_mean_squared_error,␣
↪r2_score

data = []

for _ in range(500):
    team_name = f"Team {chr(random.randint(65,90))}"
    season = random.randint(2010, 2023)
    wins = random.randint(50, 110)
    losses = 162 - wins
    hits = random.randint(1200,1600)
    doubles = random.randint(200,350)
    triples = random.randint(10,40)
    home_runs = random.randint(100,250)
    strikeouts = random.randint(1000,1500)

    hits_adjusted = hits + (wins-80) * 5
    doubles_adjusted = doubles + (wins-80) * 2
    triples_adjusted = triples + (wins-80) * 3
    home_runs_adjusted = home_runs + (wins-80) * 3
    strikeouts_adjusted = strikeouts - (wins - 80) * 10

    data.append([team_name, season, wins, losses, hits_adjusted,␣
↪doubles_adjusted, triples_adjusted, home_runs_adjusted, strikeouts_adjusted])
```

[2]:
```
columns = ["Team", 'Season', 'Wins',"Losses", 'Hits', 'Doubles', "Tripples",␣
 ↪'HomeRuns', 'Strikesouts']

df = pd.DataFrame(data, columns=columns)
df
```

[2]:

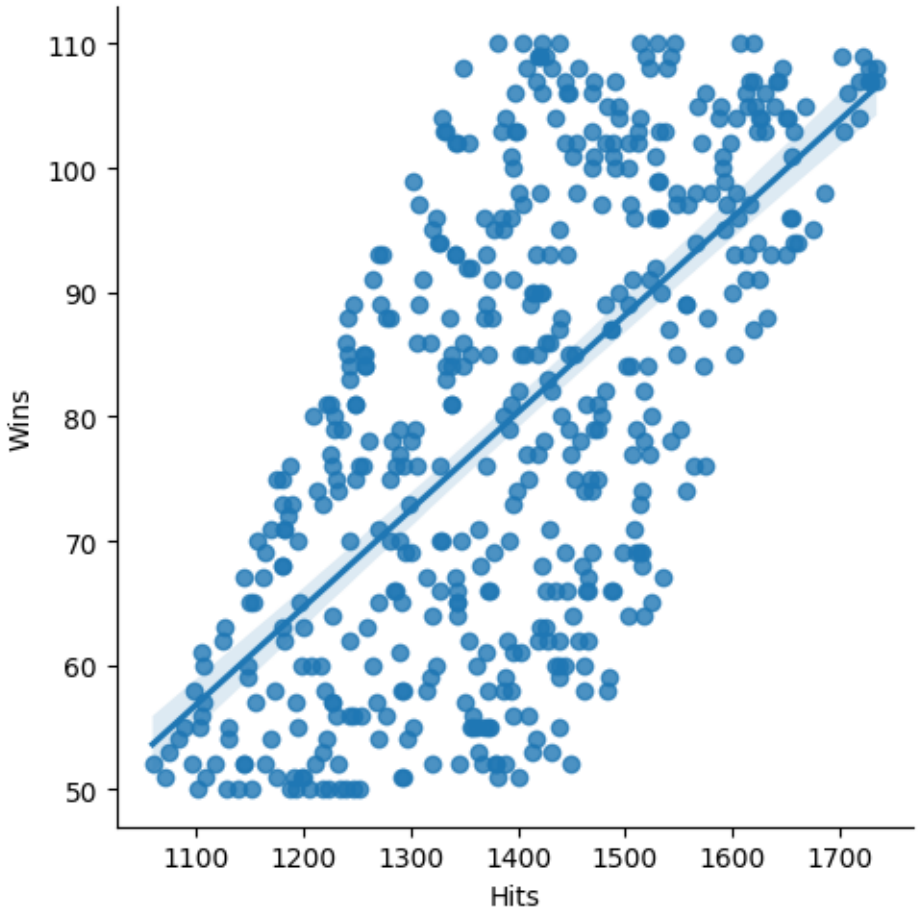
	Team	Season	Wins	Losses	Hits	Doubles	Tripples	HomeRuns	\
0	Team R	2018	68	94	1516	197	-17	172	
1	Team Y	2023	65	97	1344	275	-6	153	
2	Team U	2017	62	100	1457	197	-26	152	
3	Team U	2011	62	100	1182	233	-28	68	
4	Team N	2016	75	87	1248	233	0	194	
..	…	…	…	…	…	…	…		
495	Team D	2010	56	106	1106	152	-40	173	
496	Team O	2022	104	58	1587	310	93	307	
497	Team F	2019	106	56	1612	402	104	285	
498	Team Y	2010	64	98	1320	178	-30	126	
499	Team F	2019	55	107	1090	299	-41	87	

	Strikesouts
0	1582
1	1495
2	1454
3	1271
4	1058
..	…
495	1341
496	1130
497	1224
498	1204
499	1573

[500 rows x 9 columns]

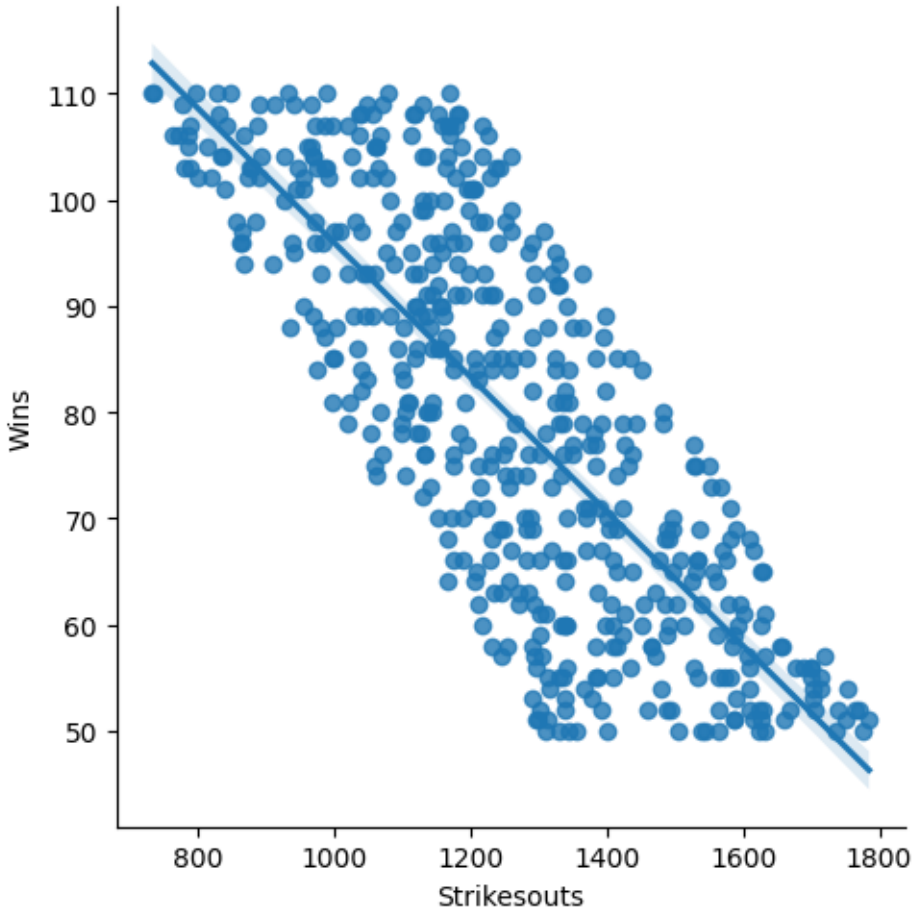
[3]:
```
sns.lmplot(x="Hits", y="Wins", data=df)
```

[3]:
```
<seaborn.axisgrid.FacetGrid at 0x143f5ca4bd0>
```



[4]:
```
sns.lmplot(x="Strikesouts", y="Wins", data=df)
```

[4]: <seaborn.axisgrid.FacetGrid at 0x143c0b5b450>



[5]:
```
df2 = df.drop(columns=['Team', 'Season', 'Losses'], axis=1)
df2
```

[5]:

	Wins	Hits	Doubles	Tripples	HomeRuns	Strikesouts
0	68	1516	197	-17	172	1582
1	65	1344	275	-6	153	1495
2	62	1457	197	-26	152	1454
3	62	1182	233	-28	68	1271
4	75	1248	233	0	194	1058
..	…	…	…	…	…	…
495	56	1106	152	-40	173	1341
496	104	1587	310	93	307	1130
497	106	1612	402	104	285	1224
498	64	1320	178	-30	126	1204
499	55	1090	299	-41	87	1573

[500 rows x 6 columns]

[6]:
```
df2.columns
```

[6]:
```
Index(['Wins', 'Hits', 'Doubles', 'Tripples', 'HomeRuns', 'Strikesouts'],
dtype='object')
```

[7]:
```
X = df[['Hits', 'Doubles', 'Tripples', 'HomeRuns', 'Strikesouts']]
y = df['Wins']

X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2,␣
 ↪random_state=24)

lr = LinearRegression()
lr.fit(X_train, y_train)
```

[7]:
```
LinearRegression()
```

[8]:
```
lr.score(X_test, y_test)
```

[8]:
```
0.9766876951321011
```

[9]:
```
lr.score(X_train, y_train)
```

[9]:
```
0.9779524643162276
```

[10]:
```
y_pred = lr.predict(X_test)
y_pred
```

[10]:
```
array([ 79.43521812,  84.98752505,  50.06532199,  86.3822643 ,
        70.2017775 , 105.95777075, 112.95922339,  63.40753436,
        69.69225294,  61.45407411, 109.65817756,  91.24687093,
        53.51602938,  93.85145009,  52.19256777, 103.42618223,
        93.19739631,  49.75559028,  69.68435674,  66.0810152 ,
        55.59211481,  55.51175199,  83.75514524,  87.95757516,
        80.68253472,  89.01173975,  66.41065628,  51.2704802 ,
       114.21228759, 100.30212302,  88.33733575,  78.18776603,
        84.57104209,  55.42473415,  68.36036516,  77.72199593,
        63.81868048,  78.23857521,  95.88171008,  46.68880483,
       106.20061061,  99.65684269, 102.86836133,  76.59226093,
        97.43890582,  76.61837152,  67.35962044,  96.54023581,
        98.99463936,  56.07128436,  73.84535217,  66.34627102,
       100.5049504 ,  74.42990629,  66.88490465, 103.15534167,
        97.23129157,  64.7906051 ,  69.02154043,  67.47991565,
        62.22324859,  57.34789107, 103.81785868,  97.64835468,
        77.99833509,  98.76947005, 106.69044356,  56.70169242,
       111.37678841,  69.6311106 ,  99.53710032,  61.06668516,
       104.96695125,  90.96773068,  96.64482364,  49.51410132,
        67.4316584 ,  56.55871945, 101.21202627, 103.06747698,
        88.72028133, 100.99416768,  90.87960032,  95.11780101,
```

```
       105.01142639,  77.77341573,  57.13396359,  75.36364628,
        62.00493217,  66.91415242,  72.84128309,  97.89586341,
       109.90864271, 112.59300656,  76.58139883,  89.71476103,
        97.45697597,  80.89370933, 110.05559584,  56.32579865])
```

[11]:
```
mean_absolute_error(y_test, y_pred)
```

[11]:
```
2.394583294287179
```

[12]:
```
root_mean_squared_error(y_test, y_pred)
```

[12]:
```
2.7715279457881903
```

[13]:
```
r2_score(y_test, y_pred)
```

[13]:
```
0.9766876951321011
```

[14]:
```
lr.coef_
```

[14]:
```
array([ 0.00362517,  0.00364042,  0.29551377,  0.01535465, -0.00312123])
```

[15]:
```
lr.intercept_
```

[15]:
```
67.51826690267674
```