tion-analysis-and-prediction-in-ml

September 9, 2023

```
[2]: # Beer consumption Analysis and prediction using Linear Regression in Machine␣
      ↪Learning
     import numpy as np
     import pandas as pd
     beer = pd.read_csv("beer.csv")
```

```
[3]: beer.head(5)
```

```
[3]:        Data Temperatura Media (C) Temperatura Minima (C)  \
     0  1/1/2015                  27,3                   23,9
     1  1/2/2015                 27,02                   24,5
     2  1/3/2015                 24,82                   22,4
     3  1/4/2015                 23,98                   21,5
     4  1/5/2015                 23,82                     21

       Temperatura Maxima (C) Precipitacao (mm)  Final de Semana  \
     0                  32,5                 0                0
     1                  33,5                 0                0
     2                  29,9                 0                1
     3                  28,6               1,2                1
     4                  28,3                 0                0

        Consumo de cerveja (litros)
     0                       25.461
     1                       28.972
     2                       30.814
     3                       29.799
     4                       28.900
```

```
[5]: beer.columns
```

```
[5]: Index(['Data', 'Temperatura Media (C)', 'Temperatura Minima (C)',
            'Temperatura Maxima (C)', 'Precipitacao (mm)', 'Final de Semana',
            'Consumo de cerveja (litros)'],
           dtype='object')
```

dimensions of rows and columns

```
[6]: beer.shape
```

```
[6]: (365, 7)
```

EDA

first, using the normal describe command which just displays the columns of the dataset with the data.

```
[7]: beer.describe
```

```
[7]: <bound method NDFrame.describe of            Data Temperatura Media (C)
     Temperatura Minima (C)  \
     0      1/1/2015                  27,3                   23,9
     1      1/2/2015                 27,02                   24,5
     2      1/3/2015                 24,82                   22,4
     3      1/4/2015                 23,98                   21,5
     4      1/5/2015                 23,82                     21
     ..          …                     …                    …
     360  12/27/2015                    24                   21,1
     361  12/28/2015                 22,64                   21,1
     362  12/29/2015                 21,68                   20,3
     363  12/30/2015                 21,38                   19,3
     364  12/31/2015                 24,76                   20,2

         Temperatura Maxima (C) Precipitacao (mm)  Final de Semana  \
     0                     32,5                 0                0
     1                     33,5                 0                0
     2                     29,9                 0                1
     3                     28,6               1,2                1
     4                     28,3                 0                0
     ..                     …                …              …
     360                   28,2              13,6                1
     361                   26,7                 0                0
     362                   24,1              10,3                0
     363                   22,4               6,3                0
     364                     29                 0                0

          Consumo de cerveja (litros)
     0                         25.461
     1                         28.972
     2                         30.814
     3                         29.799
     4                         28.900
     ..                           …
     360                       32.307
     361                       26.095
     362                       22.309
```

```
363                         20.467
364                         22.446

[365 rows x 7 columns]>
```

with describe() command the mathematical description of data inside the dataset is produced namely count, mean od data, its standard deviation, min values, maximumvalues etc.

```
[8]: beer.describe()
```

```
[8]:        Final de Semana  Consumo de cerveja (litros)
     count       365.000000                   365.000000
     mean          0.284932                    25.401367
     std           0.452001                     4.399143
     min           0.000000                    14.343000
     25%           0.000000                    22.008000
     50%           0.000000                    24.867000
     75%           1.000000                    28.631000
     max           1.000000                    37.937000
```

DATA CLEANING

```
[10]: beer.isna()
```

```
[10]:       Data  Temperatura Media (C)  Temperatura Minima (C)  \
      0    False                  False                   False
      1    False                  False                   False
      2    False                  False                   False
      3    False                  False                   False
      4    False                  False                   False
      ..     …                      …                     …
      360  False                  False                   False
      361  False                  False                   False
      362  False                  False                   False
      363  False                  False                   False
      364  False                  False                   False

           Temperatura Maxima (C)  Precipitacao (mm)  Final de Semana  \
      0                     False              False            False
      1                     False              False            False
      2                     False              False            False
      3                     False              False            False
      4                     False              False            False
      ..                      …                  …                …
      360                   False              False            False
      361                   False              False            False
      362                   False              False            False
      363                   False              False            False
```

```
364                   False              False            False

     Consumo de cerveja (litros)
0                          False
1                          False
2                          False
3                          False
4                          False
..                           …
360                        False
361                        False
362                        False
363                        False
364                        False

[365 rows x 7 columns]
```

[11]:

```
# observing if any nan or missing values present or not
beer.isna().any()
```

[11]:

```
Data                               False
Temperatura Media (C)              False
Temperatura Minima (C)             False
Temperatura Maxima (C)             False
Precipitacao (mm)                  False
Final de Semana                    False
Consumo de cerveja (litros)    False
dtype: bool
```

[18]:

```
# dropping any rows present with nan values
beer.dropna(how='all', inplace=True)
```

[19]:

```
# replacing commas with period(dot)
beer.replace({',':'.'},regex = True, inplace=True)
```

[20]:

```
# converting the type of data to date time
beer['Data'] = pd.to_datetime(beer['Data'])
```

[47]:

```
#timestamp = date.map(lambda x : dateutil.parser.parse(x))
#beer = beer.apply(pd.to_numeric)

beer = beer.astype({'Temperatura Media (C)':'float','Temperatura Minima (C)':
 ↪'float','Temperatura Maxima (C)':'float','Consumo de cerveja (litros)':
 ↪'float'})
```

[48]:

```
# converting weekdays to weekends
beer.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 365 entries, 0 to 364
Data columns (total 8 columns):
 #   Column                       Non-Null Count  Dtype
---  ------                       --------------  -----
 0   Data                         365 non-null    datetime64[ns]
 1   Temperatura Media (C)        365 non-null    float64
 2   Temperatura Minima (C)       365 non-null    float64
 3   Temperatura Maxima (C)       365 non-null    float64
 4   Precipitacao (mm)            365 non-null    object
 5   Final de Semana              365 non-null    int64
 6   Consumo de cerveja (litros)  365 non-null    float64
 7   Day                          365 non-null    object
dtypes: datetime64[ns](1), float64(4), int64(1), object(2)
memory usage: 22.9+ KB
```

[61]:

```
days = ['Monday', 'Tuesday','Wednesday','Thursday','Friday','Saturday','Sunday']

beer['Day'] = beer['Day'].replace({'Monday':1,'Tuesday':2, 'Wednesday':
 ↪3,'Thursday':4,'Friday':5,'Saturday':6,'Sunday':0})

beer.drop(['Data'], axis=1)
```

[61]:

```
     Temperatura Media (C)  Temperatura Minima (C)  Temperatura Maxima (C)  \
0                    27.30                    23.9                    32.5
1                    27.02                    24.5                    33.5
2                    24.82                    22.4                    29.9
3                    23.98                    21.5                    28.6
4                    23.82                    21.0                    28.3
..                     …                      …                       …
360                  24.00                    21.1                    28.2
361                  22.64                    21.1                    26.7
362                  21.68                    20.3                    24.1
363                  21.38                    19.3                    22.4
364                  24.76                    20.2                    29.0

    Precipitacao (mm)  Final de Semana  Consumo de cerveja (litros)  Day
0                   0                0                       25.461    4
1                   0                0                       28.972    5
2                   0                1                       30.814    6
3                 1.2                1                       29.799    0
4                   0                0                       28.900    1
..                …              …                           …   …
360              13.6                1                       32.307    0
361                 0                0                       26.095    1
362              10.3                0                       22.309    2
363               6.3                0                       20.467    3
```

```
364                 0                 0                       22.446    4

[365 rows x 7 columns]
```

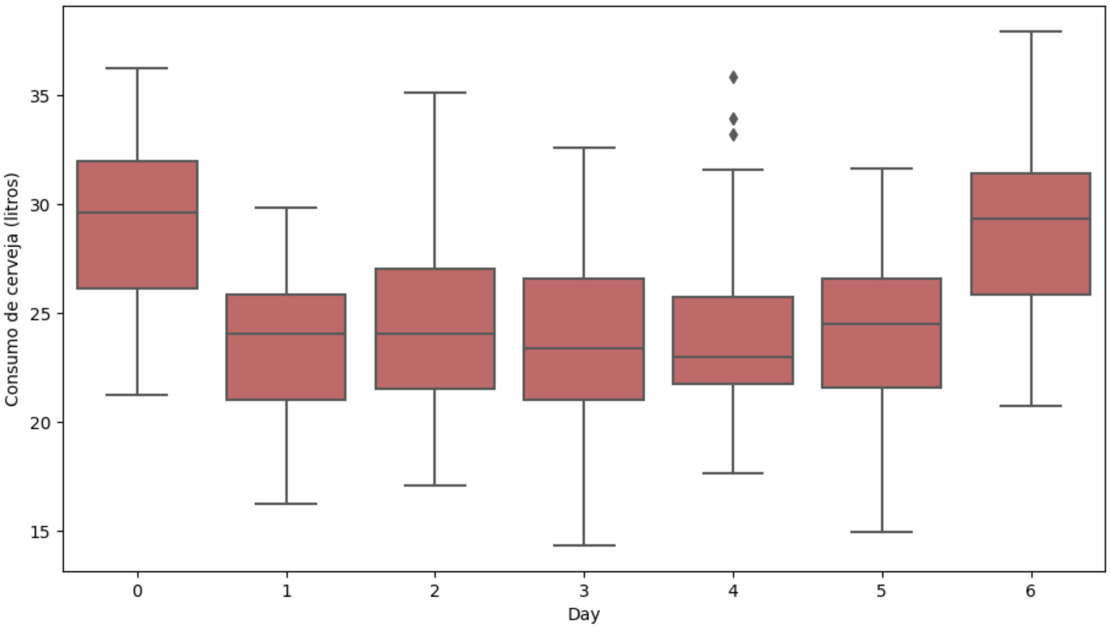
[64]:
```
#beer['Day']=beer['Data'].apply(lambda a: days[a.weekday()])
beer.head(5)
```

[64]:
```
                  Data  Temperatura Media (C)  Temperatura Minima (C)  \
0  1420070400000000000                  27.30                    23.9
1  1420156800000000000                  27.02                    24.5
2  1420243200000000000                  24.82                    22.4
3  1420329600000000000                  23.98                    21.5
4  1420416000000000000                  23.82                    21.0

   Temperatura Maxima (C) Precipitacao (mm)  Final de Semana  \
0                    32.5                 0                0
1                    33.5                 0                0
2                    29.9                 0                1
3                    28.6               1.2                1
4                    28.3                 0                0

   Consumo de cerveja (litros)  Day
0                       25.461    4
1                       28.972    5
2                       30.814    6
3                       29.799    0
4                       28.900    1
```

[65]:
```
beer.columns
```

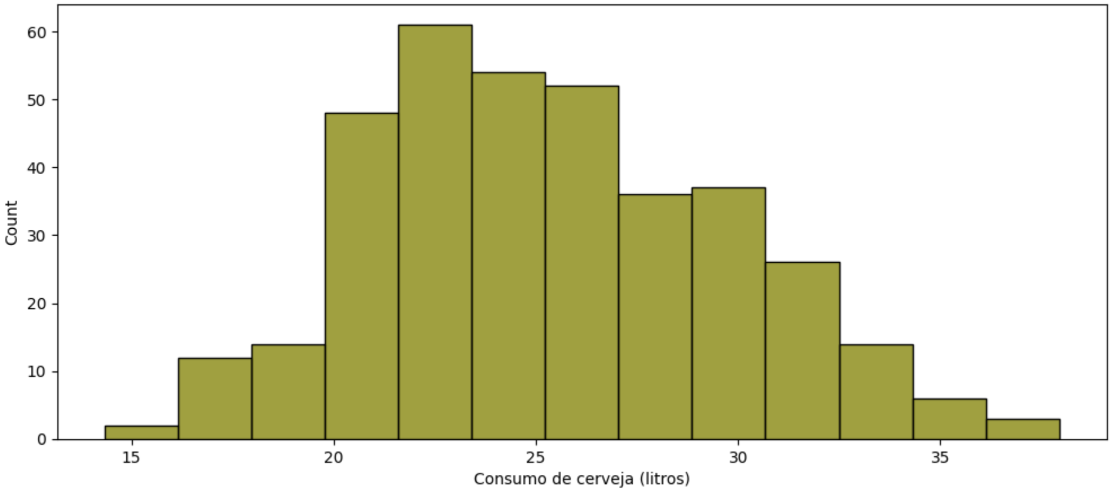
[65]:
```
Index(['Data', 'Temperatura Media (C)', 'Temperatura Minima (C)',
       'Temperatura Maxima (C)', 'Precipitacao (mm)', 'Final de Semana',
       'Consumo de cerveja (litros)', 'Day'],
      dtype='object')
```

[66]:
```
import seaborn as sns
import matplotlib.pyplot as plt

plt.figure(figsize=(11,6))
ax = sns.boxplot(data=beer, x='Day',y='Consumo de cerveja (litros)',␣
 ↪color="indianred")
```



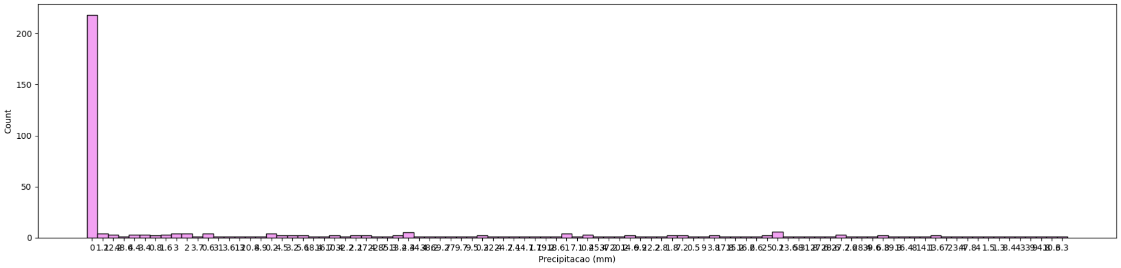
```
[112]: plt.figure(figsize=(12,5))
       sns.histplot(beer , x="Consumo de cerveja (litros)" , color='olive')
```

```
[112]: <Axes: xlabel='Consumo de cerveja (litros)', ylabel='Count'>
```



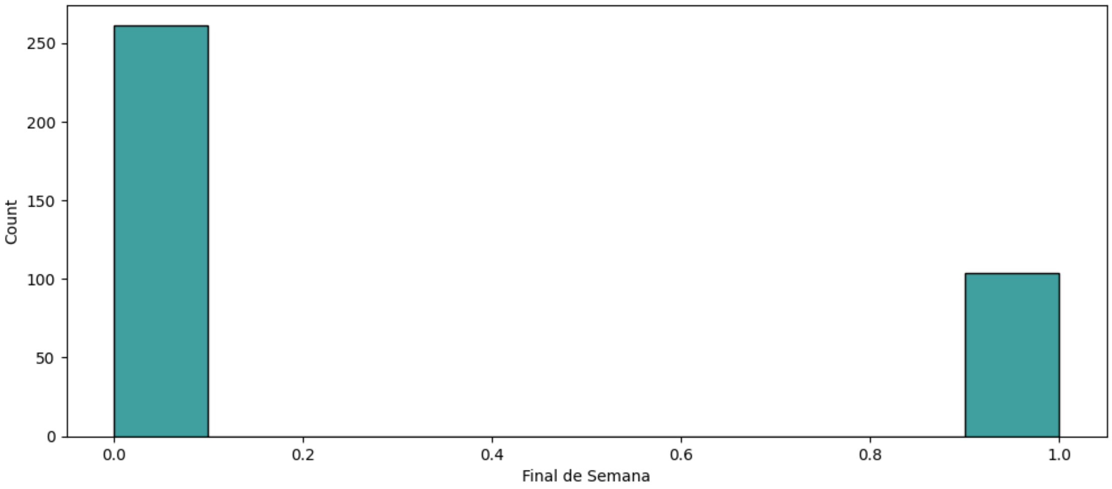
```
[127]: plt.figure(figsize=(23,5))
       sns.histplot(beer , x="Precipitacao (mm)" , color='violet')
```

```
[127]: <Axes: xlabel='Precipitacao (mm)', ylabel='Count'>
```



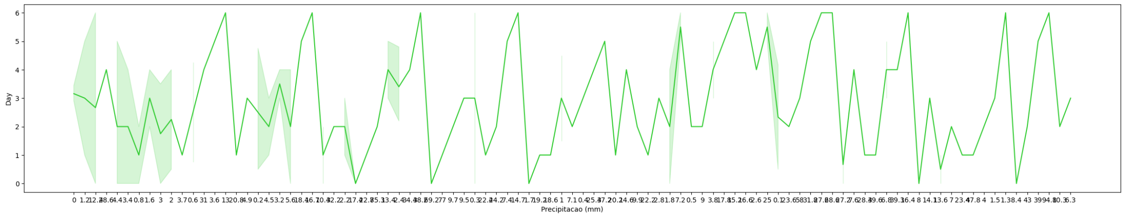
```
[117]: plt.figure(figsize=(12,5))
       sns.histplot(beer , x="Final de Semana" , color='teal')
```

```
[117]: <Axes: xlabel='Final de Semana', ylabel='Count'>
```



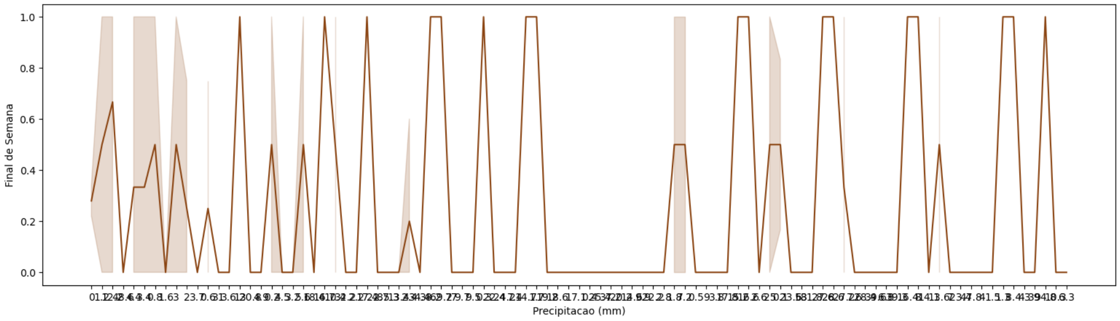
```
[126]: plt.figure(figsize=(29,5))
       sns.lineplot(x='Precipitacao (mm)', y='Day', data=beer, color='limegreen')
```

```
[126]: <Axes: xlabel='Precipitacao (mm)', ylabel='Day'>
```



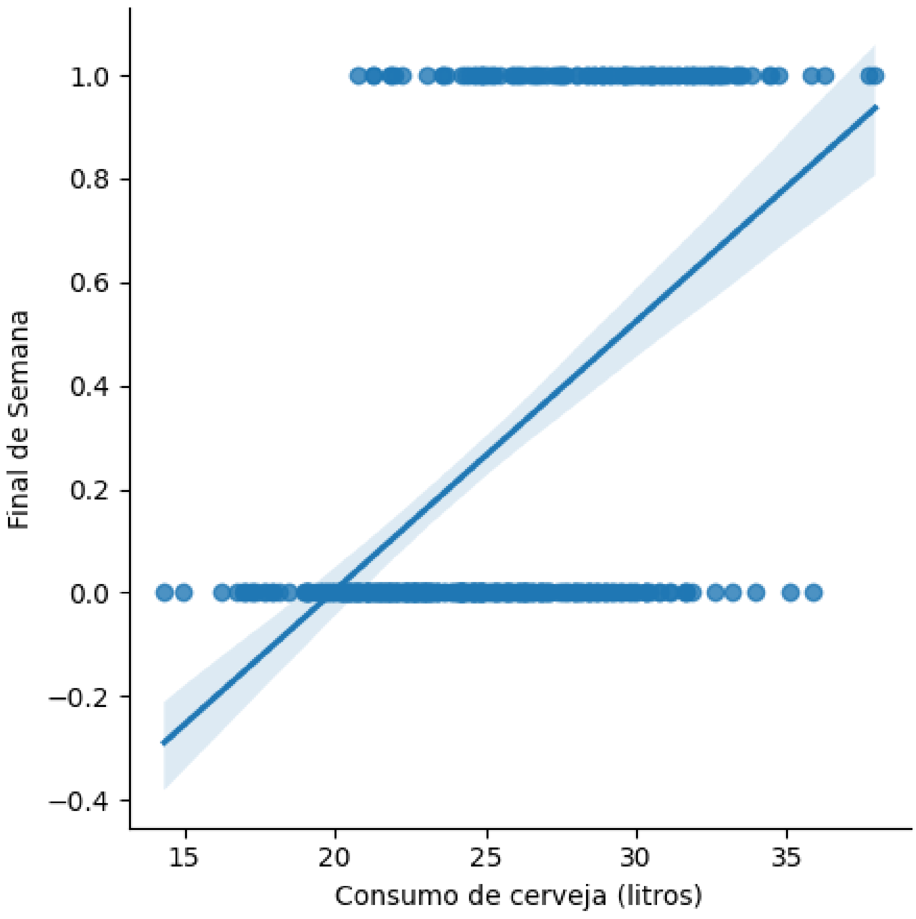
[129]:
```
plt.figure(figsize=(19,5))
sns.lineplot(x='Precipitacao (mm)', y='Final de Semana', data=beer,␣
 ↪color='saddlebrown')
```

[129]:
```
<Axes: xlabel='Precipitacao (mm)', ylabel='Final de Semana'>
```



[133]:
```
plt.figure(figsize=(10,5))
sns.lmplot(x= 'Consumo de cerveja (litros)', y='Final de Semana', data=beer)
```

[133]:
```
<seaborn.axisgrid.FacetGrid at 0x79a78284a9e0>

<Figure size 1000x500 with 0 Axes>
```



[85]:
```
from sklearn.model_selection import train_test_split

# dropping the target values
x = beer.drop("Data", axis=1)

y= beer['Consumo de cerveja (litros)']

xtrain, xtest, ytrain, ytest = train_test_split(x,y, test_size=0.2,␣
 ↪random_state=42)
```

[86]:
```
from sklearn.linear_model import LinearRegression
from sklearn.metrics import confusion_matrix
from sklearn import metrics

L=LinearRegression()
beer['Data'] = pd.to_numeric(pd.to_datetime(beer['Data']))
L.fit(xtrain,ytrain)
```

```
[86]: LinearRegression()
```

```
[87]: y_pred = L.predict(xtest)
      print(L.score(xtest , ytest))
```

```
1.0
```

```
[102]: from sklearn.model_selection import train_test_split
       x = beer.drop("Consumo de cerveja (litros)", axis=1)
       y= beer['Consumo de cerveja (litros)']

       xtrain, xtest, ytrain, ytest = train_test_split(x,y, test_size=0.2,␣
        ↪random_state=32)
       from sklearn.linear_model import LinearRegression
       from sklearn.metrics import confusion_matrix
       from sklearn import metrics

       L=LinearRegression()
       beer['Data'] = pd.to_numeric(pd.to_datetime(beer['Data']))
       L.fit(xtrain,ytrain)
       y_pred = L.predict(xtest)
       print(L.score(xtest , ytest))
```

```
0.44753330684957426
```

```
[70]: y_pred
```

```
[70]: array([26.36476346, 27.38357735, 29.51945925, 24.24788941, 28.41127772,
             20.49956302, 25.06477236, 21.15087143, 20.76139266, 22.75227083,
             28.39966701, 27.80594359, 22.59541924, 26.80878518, 22.9637712 ,
             24.86539129, 30.0535599 , 23.1264367 , 26.60473775, 24.73355932,
             30.1660252 , 22.39744558, 26.00566154, 20.38451303, 21.48328967,
             25.64000457, 24.74727957, 29.82904921, 25.92465065, 26.8759044 ,
             25.33346274, 26.53546932, 30.11199202, 28.36456217, 24.78968375,
             23.91899357, 28.33134898, 25.17047699, 27.31096035, 27.70890767,
             28.18383108, 28.46700732, 24.95220103, 22.04914598, 26.11424429,
             25.78056654, 26.43378333, 25.5369827 , 27.02452207, 25.53011284,
             24.13615029, 27.63571748, 27.54326356, 28.81473754, 21.21265299,
             27.30339868, 26.79924668, 27.38626656, 21.47241743, 25.90397454,
             23.69932148, 29.55983883, 25.91833692, 24.55715151, 29.53676997,
             26.01200698, 25.32848714, 22.0456233 , 21.87785279, 25.30048265,
             26.29560742, 24.79553862, 26.67603486])
```

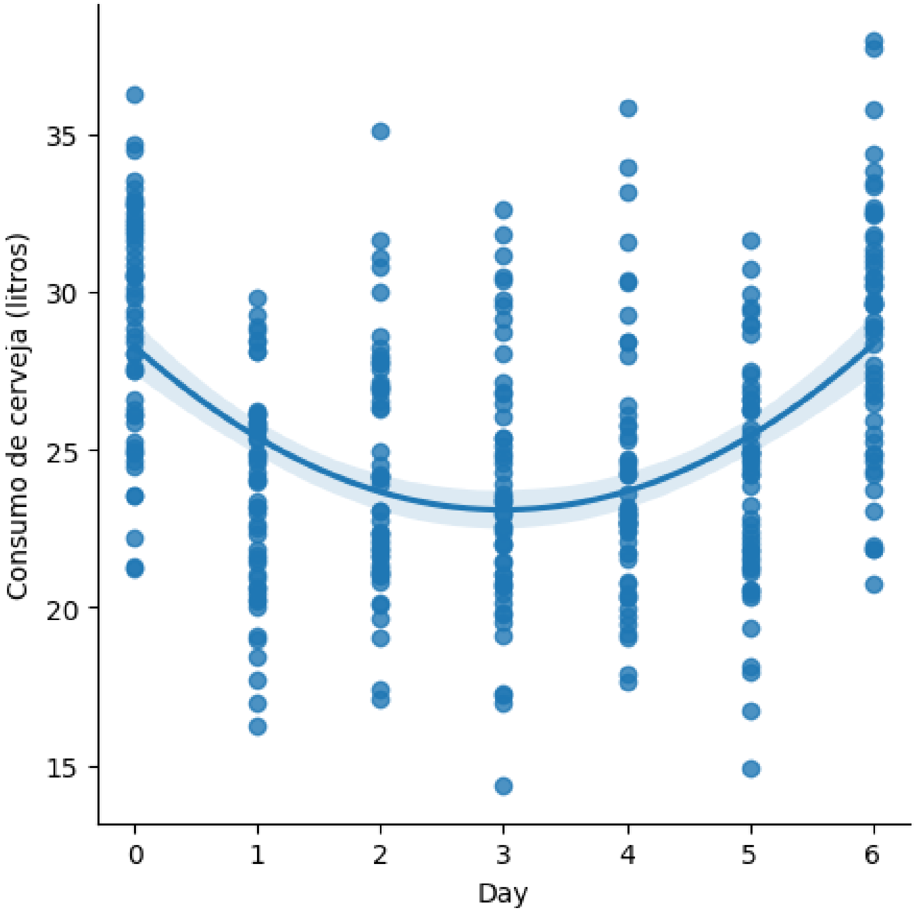
```
[72]: ytest
```

```
[72]: 193    25.640
      33     31.655
```

```
15      29.938
309     20.575
57      26.241
         …
203     19.029
82      21.617
94      32.713
192     33.298
325     31.933
Name: Consumo de cerveja (litros), Length: 73, dtype: float64
```

[77]:

```
sns.lmplot(x ="Day", y ="Consumo de cerveja (litros)", data = beer, order = 2)
plt.show()
```



[101]:

```
regr = LinearRegression()
regr.fit(xtrain, ytrain)
print(regr.score(xtest, ytest))
y_pred = regr.predict(xtest)
```

```
0.531384628597559
```

[103]:

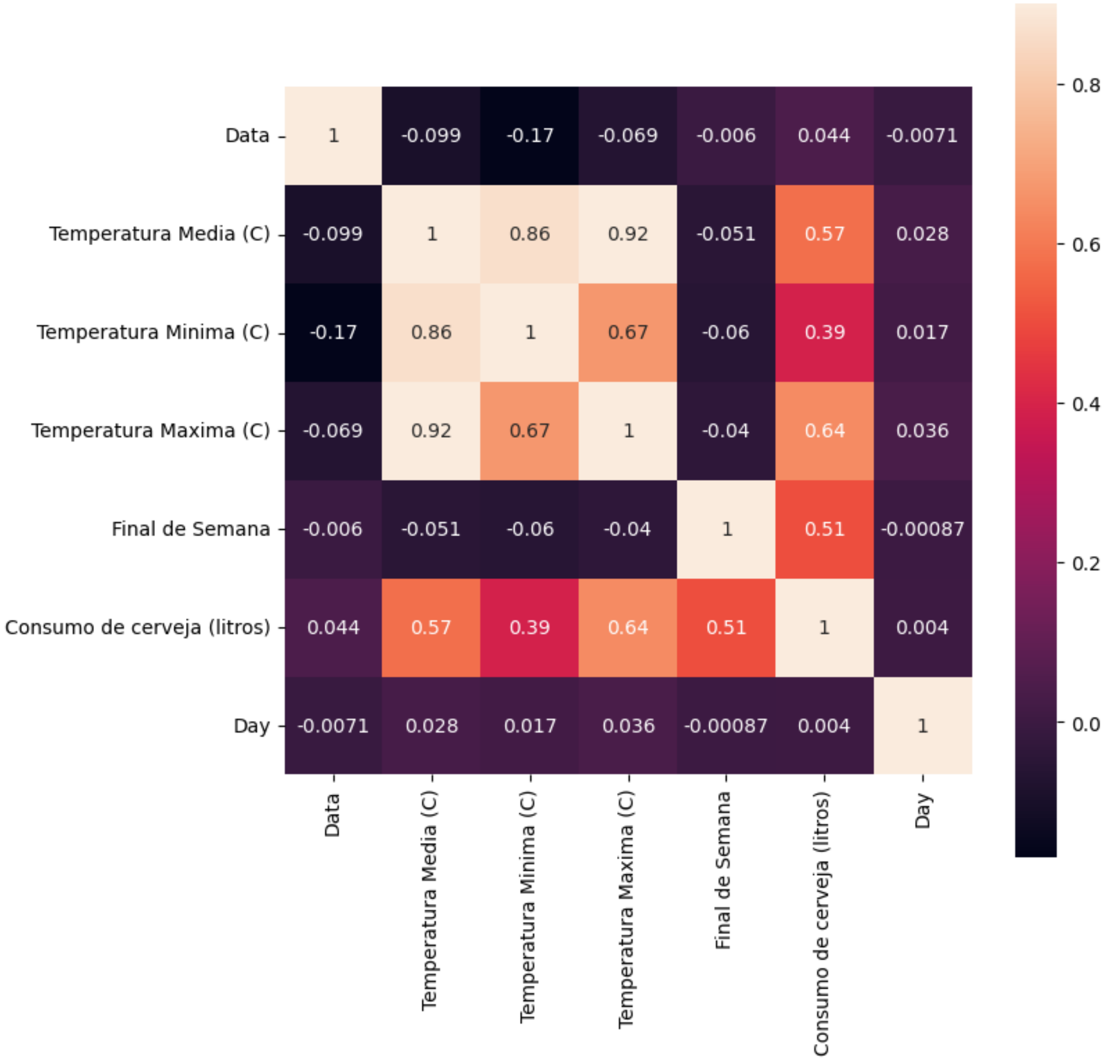
```
from sklearn.metrics import mean_absolute_error,mean_squared_error

mae = mean_absolute_error(y_true=ytest, y_pred=y_pred)

#squared True returns MSE value, False returns RMSE value.
mse = mean_squared_error(y_true= ytest,y_pred=y_pred) #default=True
rmse = mean_squared_error(y_true= ytest,y_pred=y_pred,squared=False)

print("MAE:",mae)
print("MSE:",mse)
print("RMSE:",rmse)
```

```
MAE: 2.6345518760119706
MSE: 10.359020220783298
RMSE: 3.2185431829918483
```

[110]:

```
from sklearn.metrics import confusion_matrix #confusion matrix only displays info of numeric data
correlation_metrics = beer.corr()
fig = plt.figure(figsize = (8,8))
sns.heatmap(correlation_metrics , vmax = 0.9 , square = True, annot=True)
plt.show()
```

```
<ipython-input-110-4dbc9bc8b4a6>:2: FutureWarning: The default value of
numeric_only in DataFrame.corr is deprecated. In a future version, it will
default to False. Select only valid columns or specify the value of numeric_only
to silence this warning.
  correlation_metrics = beer.corr()
```


Data
1
-0.099
-0.17
-0.069
-0.006
0.044
-0.0071
Temperatura Media (C)
-0.099
1
0.86
0.92
-0.051
0.57
0.028
Temperatura Minima (C)
-0.17
0.86
1
0.67
-0.06
0.39
0.017
Temperatura Maxima (C)
-0.069
0.92
0.67
1
-0.04
0.64
0.036
Final de Semana
-0.006
-0.051
-0.06
-0.04
1
0.51
-0.00087
Consumo de cerveja (litros)
0.044
0.57
0.39
0.64
0.51
1
0.004
Day
-0.0071
0.028
0.017
0.036
-0.00087
0.004
1
Data
Temperatura Media (C)
Temperatura Minima (C)
Temperatura Maxima (C)
Final de Semana
Consumo de cerveja (litros)
Day
0.8
0.6
0.4
0.2
0.0