ML 16 - EDA With Algerian Forest Fires By Virat Tiwari

December 8, 2023

1 EDA With Algerian Forest Fires By Virat Tiwari

Dataset Information :-

This datset includes 244 instances that regroup a data of two regions of Algerian and Bejaia region located in th north east of algerian and the sidi bel abbers region located in the northwest of algeria .

122 instances for each region . The period from june 2012 to september 2012. The dataset includes 11 attributes and 1 output attribute (class) , The 244 instances have been classified into the fire (138 classes) and not fire (106 classes) classes.

ATTRIBUTE INFORMATION :-

1) Date

2) Temp

3) RH : Relative Humadity

4) Ws : wind speed

5) Rain

6) Fine fuel moisture code (FFMC) from the FWI index

7) Duff Moisture Code (DMC)

8) Drought code (DC)

9) Intial speed index

10) Build up index (BUI)

11) Fire weather index

12) Classes : Fire and Not Fire

[1]:
```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
import warnings
warnings.filterwarnings("ignore")
```

[2]:
```
dataset=pd.read_csv("Algerian_forest_fires_dataset_UPDATE.csv",header=1)
dataset.head()
```

[2]:

	day	month	year	Temperature	RH	Ws	Rain	FFMC	DMC	DC	ISI	BUI	FWI	Classes
0	01	06	2012	29	57	18	0	65.7	3.4	7.6	1.3	3.4	0.5	not fire
1	02	06	2012	29	61	13	1.3	64.4	4.1	7.6	1	3.9	0.4	not fire
2	03	06	2012	26	82	22	13.1	47.1	2.5	7.1	0.3	2.7	0.1	not fire
3	04	06	2012	25	89	13	2.5	28.6	1.3	6.9	0	1.7	0	not fire
4	05	06	2012	27	77	16	0	64.8	3	14.2	1.2	3.9	0.5	not fire

[3]:
```
dataset.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 246 entries, 0 to 245
Data columns (total 14 columns):
 #   Column       Non-Null Count  Dtype
---  ------       --------------  -----
 0   day          246 non-null    object
 1   month        245 non-null    object
 2   year         245 non-null    object
 3   Temperature  245 non-null    object
 4    RH          245 non-null    object
 5    Ws          245 non-null    object
 6   Rain         245 non-null    object
 7   FFMC         245 non-null    object
 8   DMC          245 non-null    object
 9   DC           245 non-null    object
 10  ISI          245 non-null    object
 11  BUI          245 non-null    object
 12  FWI          245 non-null    object
 13  Classes      244 non-null    object
dtypes: object(14)
memory usage: 27.0+ KB
```

DATA CLEANING

[5]:
```
# Check Missing Values
# This is how we get the rows in which null values are present

dataset[dataset.isnull().any(axis=1)]
```

[5]:
```
                                day month  year Temperature   RH   Ws Rain   \
122  Sidi-Bel Abbes Region Dataset   NaN   NaN         NaN  NaN  NaN   NaN
167                               14    07  2012          37   37   18   0.2

     FFMC   DMC      DC   ISI   BUI      FWI Classes
122   NaN   NaN     NaN   NaN   NaN      NaN       NaN
167  88.9  12.9  14.6 9  12.5  10.4  fire          NaN
```

[10]:
```
dataset.loc[:122,"Region"]=0
dataset.loc[122:,"Region"]=1
df=dataset
```

[11]:
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 246 entries, 0 to 245
Data columns (total 15 columns):
 #   Column       Non-Null Count  Dtype
---  ------       --------------  -----
 0   day          246 non-null    object
 1   month        245 non-null    object
 2   year         245 non-null    object
 3   Temperature  245 non-null    object
 4    RH          245 non-null    object
 5    Ws          245 non-null    object
 6   Rain         245 non-null    object
 7   FFMC         245 non-null    object
 8   DMC          245 non-null    object
 9   DC           245 non-null    object
 10  ISI          245 non-null    object
 11  BUI          245 non-null    object
 12  FWI          245 non-null    object
 13  Classes      244 non-null    object
 14  Region       246 non-null    float64
dtypes: float64(1), object(14)
memory usage: 29.0+ KB
```

[12]:
```
df.head()
```

[12]:
```
   day month  year Temperature  RH  Ws Rain   FFMC  DMC    DC  ISI  BUI  FWI  \
0  01    06  2012          29  57  18     0  65.7  3.4   7.6  1.3  3.4  0.5
1  02    06  2012          29  61  13   1.3  64.4  4.1   7.6    1  3.9  0.4
2  03    06  2012          26  82  22  13.1  47.1  2.5   7.1  0.3  2.7  0.1
3  04    06  2012          25  89  13   2.5  28.6  1.3   6.9    0  1.7    0
4  05    06  2012          27  77  16     0  64.8    3  14.2  1.2  3.9  0.5

     Classes    Region
```

```
0  not fire        0.0
1  not fire        0.0
2  not fire        0.0
3  not fire        0.0
4  not fire        0.0
```

[13]:
```
df.tail()
```

[13]:
```
     day month  year Temperature  RH  Ws Rain   FFMC  DMC    DC  ISI   BUI  \
241  26    09  2012          30  65  14     0  85.4   16  44.5  4.5  16.9
242  27    09  2012          28  87  15   4.4  41.1  6.5     8  0.1   6.2
243  28    09  2012          27  87  29   0.5  45.9  3.5   7.9  0.4   3.4
244  29    09  2012          24  54  18   0.1  79.7  4.3  15.2  1.7   5.1
245  30    09  2012          24  64  15   0.2  67.3  3.8  16.5  1.2   4.8

     FWI      Classes    Region
241  6.5        fire        1.0
242    0    not fire        1.0
243  0.2    not fire        1.0
244  0.7    not fire        1.0
245  0.5  not fire          1.0
```

[15]:
```
df[["Region"]]=df[["Region"]].astype(int)
```

[16]:
```
df.head()
```

[16]:
```
   day month  year Temperature  RH  Ws Rain   FFMC  DMC    DC  ISI  BUI  FWI  \
0  01    06  2012          29  57  18     0  65.7  3.4   7.6  1.3  3.4  0.5
1  02    06  2012          29  61  13   1.3  64.4  4.1   7.6    1  3.9  0.4
2  03    06  2012          26  82  22  13.1  47.1  2.5   7.1  0.3  2.7  0.1
3  04    06  2012          25  89  13   2.5  28.6  1.3   6.9    0  1.7    0
4  05    06  2012          27  77  16     0  64.8    3  14.2  1.2  3.9  0.5

      Classes    Region
0  not fire           0
1  not fire           0
2  not fire           0
3  not fire           0
4  not fire           0
```

[17]:
```
df.isnull().sum()
```

[17]:
```
day            0
month          1
year           1
Temperature    1
 RH            1
```

```
 Ws            1
Rain           1
FFMC           1
DMC            1
DC             1
ISI            1
BUI            1
FWI            1
Classes        2
Region         0
dtype: int64
```

[19]:
```
# Here we drop or remove missing values

df=df.dropna().reset_index(drop=True)
```

[21]:
```
df.isnull().sum()
```

[21]:
```
day            0
month          0
year           0
Temperature    0
 RH            0
 Ws            0
Rain           0
FFMC           0
DMC            0
DC             0
ISI            0
BUI            0
FWI            0
Classes        0
Region         0
dtype: int64
```

[22]:
```
# This is another extra datapoint that is not useful so we have to drop or␣
 ↪remove this  as wel

df.iloc[[122]]
```

[22]:
```
     day  month  year  Temperature   RH   Ws  Rain   FFMC  DMC  DC  ISI  BUI  \
122  day  month  year  Temperature   RH   Ws  Rain   FFMC  DMC  DC  ISI  BUI

     FWI  Classes    Region
122  FWI  Classes         1
```

[23]:
```
df=df.drop(122).reset_index(drop=True)
```

[25]:
```
df.loc[[122]]
```

[25]:
```
     day month  year Temperature  RH  Ws Rain   FFMC  DMC   DC  ISI  BUI  FWI  \
122  01    06  2012          32  71  12   0.7  57.1  2.5  8.2  0.6  2.8  0.2

       Classes    Region
122  not fire          1
```

[26]:
```
df.columns
```

[26]:
```
Index(['day', 'month', 'year', 'Temperature', ' RH', ' Ws', 'Rain ', 'FFMC',
       'DMC', 'DC', 'ISI', 'BUI', 'FWI', 'Classes  ', 'Region'],
      dtype='object')
```

[27]:
```
# Fix Spaces in Columns
# . strip ( ) function removes the blank space from the columns

df.columns=df.columns.str.strip()
df.columns
```

[27]:
```
Index(['day', 'month', 'year', 'Temperature', 'RH', 'Ws', 'Rain', 'FFMC',
       'DMC', 'DC', 'ISI', 'BUI', 'FWI', 'Classes', 'Region'],
      dtype='object')
```

[28]:
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 243 entries, 0 to 242
Data columns (total 15 columns):
 #   Column       Non-Null Count  Dtype
---  ------       --------------  -----
 0   day          243 non-null    object
 1   month        243 non-null    object
 2   year         243 non-null    object
 3   Temperature  243 non-null    object
 4   RH           243 non-null    object
 5   Ws           243 non-null    object
 6   Rain         243 non-null    object
 7   FFMC         243 non-null    object
 8   DMC          243 non-null    object
 9   DC           243 non-null    object
 10  ISI          243 non-null    object
 11  BUI          243 non-null    object
 12  FWI          243 non-null    object
 13  Classes      243 non-null    object
 14  Region       243 non-null    int64
dtypes: int64(1), object(14)
```

```
memory usage: 28.6+ KB
```

CHANGE THE REQUIRED COLUMNS AS INTEGER DATA TYPES

[29]:
```
df.columns
```

[29]:
```
Index(['day', 'month', 'year', 'Temperature', 'RH', 'Ws', 'Rain', 'FFMC',
       'DMC', 'DC', 'ISI', 'BUI', 'FWI', 'Classes', 'Region'],
      dtype='object')
```

[32]:
```
# This is how we covert Object Datatype into the Integer Datatype

df[["month","day","year","Temperature","RH","Ws"]]=df[["month","day","year","Temperature","RH"
 ↪astype(int)
```

[33]:
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 243 entries, 0 to 242
Data columns (total 15 columns):
 #   Column       Non-Null Count  Dtype
---  ------       --------------  -----
 0   day          243 non-null    int64
 1   month        243 non-null    int64
 2   year         243 non-null    int64
 3   Temperature  243 non-null    int64
 4   RH           243 non-null    int64
 5   Ws           243 non-null    int64
 6   Rain         243 non-null    object
 7   FFMC         243 non-null    object
 8   DMC          243 non-null    object
 9   DC           243 non-null    object
 10  ISI          243 non-null    object
 11  BUI          243 non-null    object
 12  FWI          243 non-null    object
 13  Classes      243 non-null    object
 14  Region       243 non-null    int64
dtypes: int64(7), object(8)
memory usage: 28.6+ KB
```

CHANGE THE REQUIRED COLUMNS AS FLOAT DATA TYPES

[36]:
```
df.columns
```

[36]:
```
Index(['day', 'month', 'year', 'Temperature', 'RH', 'Ws', 'Rain', 'FFMC',
       'DMC', 'DC', 'ISI', 'BUI', 'FWI', 'Classes', 'Region'],
      dtype='object')
```

[34]:
```
df[["Rain","FFMC","DMC","DC","ISI","BUI","FWI"]]=df[["Rain","FFMC","DMC","DC","ISI","BUI","FWI
 ↪astype(float)
```

[35]:
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 243 entries, 0 to 242
Data columns (total 15 columns):
 #   Column       Non-Null Count  Dtype  
---  ------       --------------  -----  
 0   day          243 non-null    int64  
 1   month        243 non-null    int64  
 2   year         243 non-null    int64  
 3   Temperature  243 non-null    int64  
 4   RH           243 non-null    int64  
 5   Ws           243 non-null    int64  
 6   Rain         243 non-null    float64
 7   FFMC         243 non-null    float64
 8   DMC          243 non-null    float64
 9   DC           243 non-null    float64
 10  ISI          243 non-null    float64
 11  BUI          243 non-null    float64
 12  FWI          243 non-null    float64
 13  Classes      243 non-null    object 
 14  Region       243 non-null    int64  
dtypes: float64(7), int64(7), object(1)
memory usage: 28.6+ KB
```

[41]:
```
df.describe()
```

[41]:

	day	month	year	Temperature	RH	Ws	\
count	243.000000	243.000000	243.0	243.000000	243.000000	243.000000	
mean	15.761317	7.502058	2012.0	32.152263	62.041152	15.493827	
std	8.842552	1.114793	0.0	3.628039	14.828160	2.811385	
min	1.000000	6.000000	2012.0	22.000000	21.000000	6.000000	
25%	8.000000	7.000000	2012.0	30.000000	52.500000	14.000000	
50%	16.000000	8.000000	2012.0	32.000000	63.000000	15.000000	
75%	23.000000	8.000000	2012.0	35.000000	73.500000	17.000000	
max	31.000000	9.000000	2012.0	42.000000	90.000000	29.000000	

	Rain	FFMC	DMC	DC	ISI	BUI	\
count	243.000000	243.000000	243.000000	243.000000	243.000000	243.000000	
mean	0.762963	77.842387	14.680658	49.430864	4.742387	16.690535	
std	2.003207	14.349641	12.393040	47.665606	4.154234	14.228421	
min	0.000000	28.600000	0.700000	6.900000	0.000000	1.100000	
25%	0.000000	71.850000	5.800000	12.350000	1.400000	6.000000	
50%	0.000000	83.300000	11.300000	33.100000	3.500000	12.400000	

```
75%       0.500000   88.300000   20.800000   69.100000    7.250000   22.650000
max      16.800000   96.000000   65.900000  220.400000   19.000000   68.000000

              FWI      Region
count  243.000000  243.000000
mean     7.035391    0.497942
std      7.440568    0.501028
min      0.000000    0.000000
25%      0.700000    0.000000
50%      4.200000    0.000000
75%     11.450000    1.000000
max     31.100000    1.000000
```

[42]:
```
df.head()
```

[42]:
```
   day  month  year  Temperature  RH  Ws  Rain  FFMC  DMC   DC  ISI  BUI  \
0    1      6  2012           29  57  18   0.0  65.7  3.4  7.6  1.3  3.4
1    2      6  2012           29  61  13   1.3  64.4  4.1  7.6  1.0  3.9
2    3      6  2012           26  82  22  13.1  47.1  2.5  7.1  0.3  2.7
3    4      6  2012           25  89  13   2.5  28.6  1.3  6.9  0.0  1.7
4    5      6  2012           27  77  16   0.0  64.8  3.0 14.2  1.2  3.9

   FWI      Classes  Region
0  0.5  not fire          0
1  0.4  not fire          0
2  0.1  not fire          0
3  0.0  not fire          0
4  0.5  not fire          0
```

[44]:
```
# Here we save the updated csv file

df.to_csv("Algerian_forest_fires_dataset_Cleaned.csv",index=False)
```

EXPLORATORY DATA ANALYSIS

[47]:
```
# here we drop or remove some of the features from the dataset that we do not␣
 ↪use

df_copy=df.drop(["day","month","year"],axis=1)
```

[48]:
```
df_copy.head()
```

[48]:
```
   Temperature  RH  Ws  Rain  FFMC  DMC   DC  ISI  BUI  FWI      Classes  \
0           29  57  18   0.0  65.7  3.4  7.6  1.3  3.4  0.5  not fire
1           29  61  13   1.3  64.4  4.1  7.6  1.0  3.9  0.4  not fire
2           26  82  22  13.1  47.1  2.5  7.1  0.3  2.7  0.1  not fire
3           25  89  13   2.5  28.6  1.3  6.9  0.0  1.7  0.0  not fire
```

```
4           27  77  16   0.0  64.8  3.0  14.2  1.2  3.9  0.5  not fire

   Region
0       0
1       0
2       0
3       0
4       0
```

[49]:
```
# Here we see the classes of categories

df_copy["Classes"].value_counts()
```

[49]:
```
fire            131
not fire        101
fire              4
fire              2
not fire          2
not fire          1
not fire          1
not fire          1
Name: Classes, dtype: int64
```

NOW WE CONVERT THE CATEGORIES INTO TWO PARTS :

1) FIRE
2) NOT FIRE

[50]:
```
# Coversion of fire into 1 and not fire into 0
# np.where ( ) function is used for conversion and str.contains ( ) function is␣
 ↪used for converting fire or not fire into 1 and 0

df_copy["Classes"]=np.where(df_copy["Classes"].str.contains("not fire"),0,1)
```

[51]:
```
df_copy.head()
```

[51]:
```
   Temperature  RH  Ws  Rain  FFMC  DMC   DC  ISI  BUI  FWI  Classes  Region
0           29  57  18   0.0  65.7  3.4  7.6  1.3  3.4  0.5        0       0
1           29  61  13   1.3  64.4  4.1  7.6  1.0  3.9  0.4        0       0
2           26  82  22  13.1  47.1  2.5  7.1  0.3  2.7  0.1        0       0
3           25  89  13   2.5  28.6  1.3  6.9  0.0  1.7  0.0        0       0
4           27  77  16   0.0  64.8  3.0 14.2  1.2  3.9  0.5        0       0
```

[52]:
```
df_copy.tail()
```

[52]:
```
     Temperature  RH  Ws  Rain  FFMC  DMC   DC  ISI  BUI  FWI  Classes  \
238           30  65  14   0.0  85.4 16.0 44.5  4.5 16.9  6.5        1
239           28  87  15   4.4  41.1  6.5  8.0  0.1  6.2  0.0        0
```

```
240           27  87  29   0.5  45.9   3.5   7.9  0.4   3.4  0.2        0
241           24  54  18   0.1  79.7   4.3  15.2  1.7   5.1  0.7        0
242           24  64  15   0.2  67.3   3.8  16.5  1.2   4.8  0.5        0

     Region
238       1
239       1
240       1
241       1
242       1
```

[53]:
```
df_copy["Classes"].value_counts()
```

[53]:
```
1    137
0    106
Name: Classes, dtype: int64
```

Observation : This is imabalance dataset becouse “fire” contain 137 datapoints and “Not fire” contain 10 datapoints

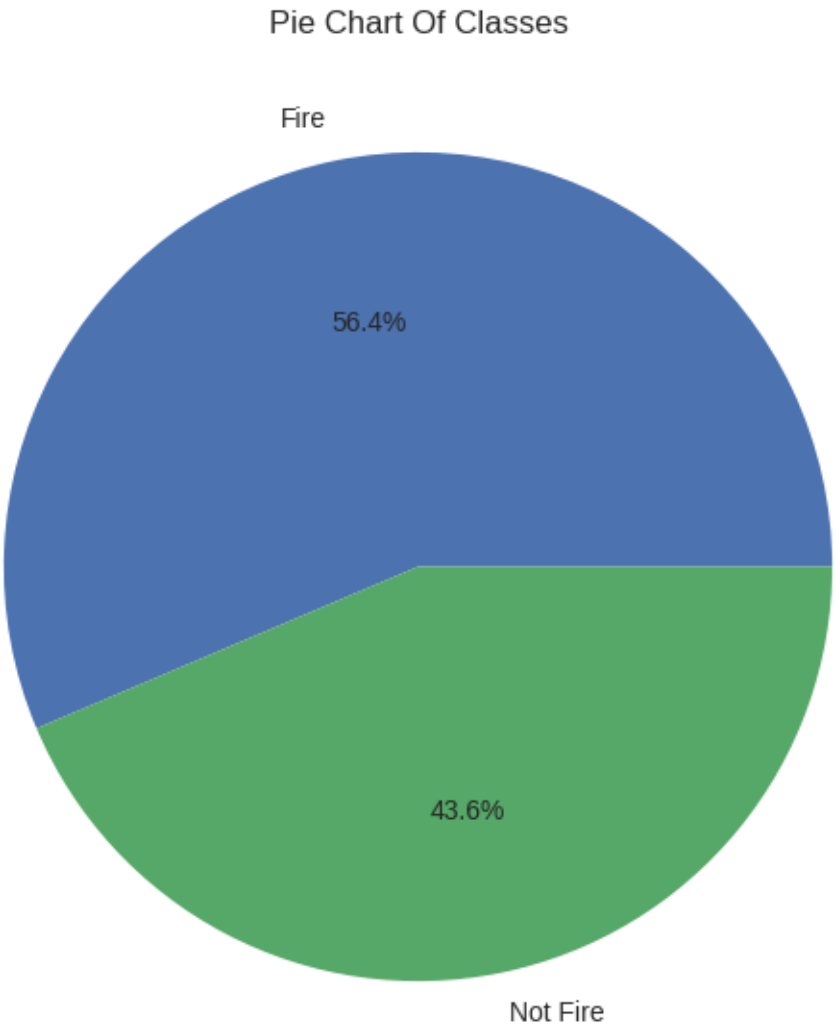
VISUALIZATION OF DATASET : -

[54]:
```
plt.style.use("seaborn")
df_copy.hist(bins=50,figsize=(20,15))
plt.show()
```

[55]:
```
#Percentage of PIE CHART

percentage=df_copy["Classes"].value_counts(normalize=True)*100
```

[56]:
```
classlabels=["Fire","Not Fire"]
plt.figure(figsize=(12,7))
plt.pie(percentage,labels=classlabels,autopct="%1.1f%%")
plt.title("Pie Chart Of Classes")
plt.show()
```



CORRELATION IN DATASETS : -

[57]:
```
df_copy.corr()
```

[57]:

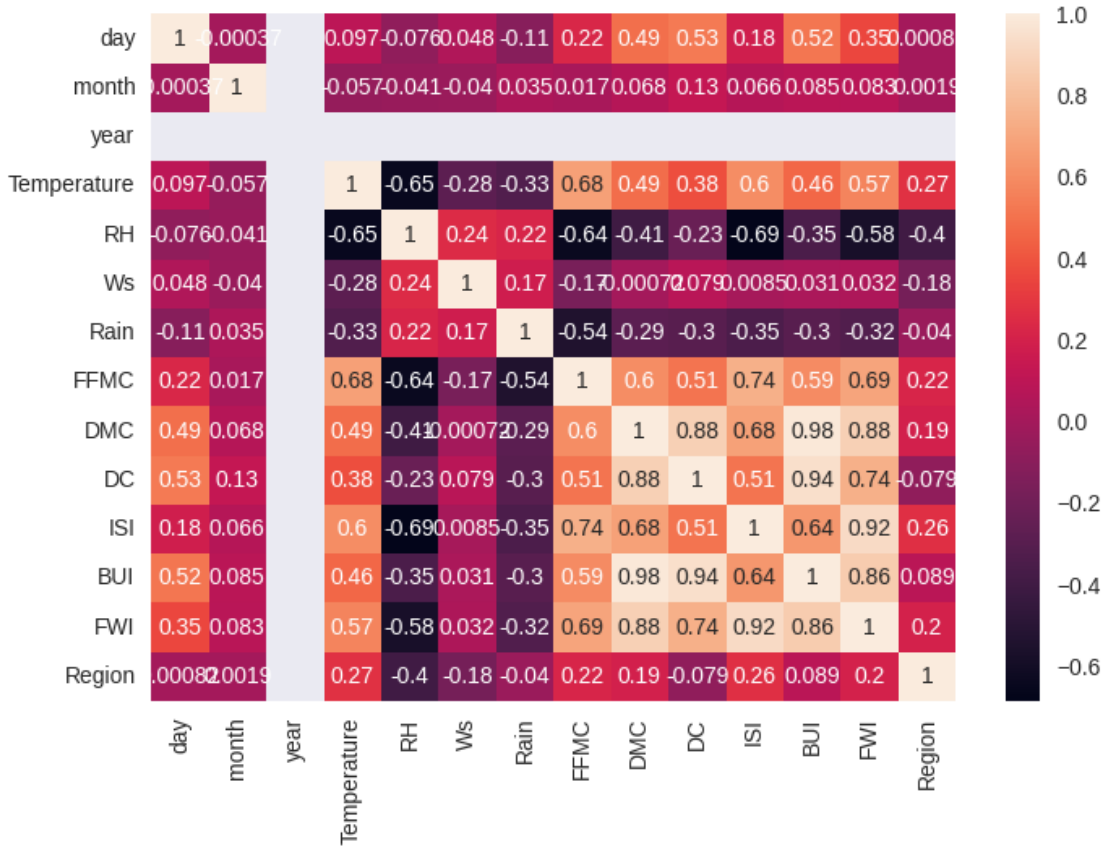
	Temperature	RH	Ws	Rain	FFMC	DMC	\
Temperature	1.000000	-0.651400	-0.284510	-0.326492	0.676568	0.485687	
RH	-0.651400	1.000000	0.244048	0.222356	-0.644873	-0.408519	
Ws	-0.284510	0.244048	1.000000	0.171506	-0.166548	-0.000721	
Rain	-0.326492	0.222356	0.171506	1.000000	-0.543906	-0.288773	
FFMC	0.676568	-0.644873	-0.166548	-0.543906	1.000000	0.603608	
DMC	0.485687	-0.408519	-0.000721	-0.288773	0.603608	1.000000	
DC	0.376284	-0.226941	0.079135	-0.298023	0.507397	0.875925	
ISI	0.603871	-0.686667	0.008532	-0.347484	0.740007	0.680454	
BUI	0.459789	-0.353841	0.031438	-0.299852	0.592011	0.982248	

```
FWI             0.566670 -0.580957  0.032368 -0.324422  0.691132  0.875864
Classes         0.516015 -0.432161 -0.069964 -0.379097  0.769492  0.585658
Region          0.269555 -0.402682 -0.181160 -0.040013  0.222241  0.192089
```

```
                   DC       ISI       BUI       FWI   Classes    Region
Temperature  0.376284  0.603871  0.459789  0.566670  0.516015  0.269555
RH          -0.226941 -0.686667 -0.353841 -0.580957 -0.432161 -0.402682
Ws           0.079135  0.008532  0.031438  0.032368 -0.069964 -0.181160
Rain        -0.298023 -0.347484 -0.299852 -0.324422 -0.379097 -0.040013
FFMC         0.507397  0.740007  0.592011  0.691132  0.769492  0.222241
DMC          0.875925  0.680454  0.982248  0.875864  0.585658  0.192089
DC           1.000000  0.508643  0.941988  0.739521  0.511123 -0.078734
ISI          0.508643  1.000000  0.644093  0.922895  0.735197  0.263197
BUI          0.941988  0.644093  1.000000  0.857973  0.586639  0.089408
FWI          0.739521  0.922895  0.857973  1.000000  0.719216  0.197102
Classes      0.511123  0.735197  0.586639  0.719216  1.000000  0.162347
Region      -0.078734  0.263197  0.089408  0.197102  0.162347  1.000000
```

[60]:
```
sns.heatmap(df.corr(),annot=True)
```

[60]:
```
<AxesSubplot: >
```



Thank You so Much !!

YOURS VIRAT TIWARI :)