MINI PROJECT

FOREST FIRE PREDICTION

CHAITANYA BHARATHI
INSTITUTE OF TECHNOLOGY (A)
Affliated to Osmania University

CERTIFICATE

This is to certify that the project entitled "**FOREST FIRE PREDICTION**", submitted to the Computer Science and Engineering Department, Chaitanya Bharathi Institute of Technology, in partial fulfilment of the requirement for the course Mini Project, is a bonafide record of work done by **KALLAMADI RUTVA (1601-18-733-187)** and **K TINA (1601-18-733-086)** , from August, 2020 to November 2020 under our guidance and supervision.

Mentors,

Mr. R.Srikanth
Department of CSE,
CBIT

Supervisor,

Mr. B Sateesh
Assistant Professor,
Department of CSE,
CBIT

SUMMARY/ABSTRACT:

The inability to accurately predict fire behaviour conditions and understand public information needs can lead to inefficient use of resources to prevent, suppress and control wild fires as well as prevent the use of prescribed fire as an efficient land management tool. Large forest fire impacts are not fully understood and information is needed to address restoration following these types of fire.

INTRODUCTION:

The most common hazard in forests is forests fire. They pose a threat not only to the forest wealth but also to the entire regime to fauna and flora seriously disturbing the bio-diversity and the ecology and environment of a region. During summer, when there is no rain for months, the forests become littered with dry senescent leaves and twinges, which could burst into flames ignited by the slightest spark. ? Forest fire causes imbalances in nature and endangers biodiversity by reducing faunal and floral wealth. Traditional methods of fire prevention are not proving effective and it is now essential to raise public awareness on the matter, particularly among those people who live close to or in forested areas

CAUSES OF FOREST FIRE: Causes of forest fires can be divided into two broad categories: environmental (which are beyond control) and human related (which are controllable). Many forest fires start from natural causes such as lightning which set trees on fire. However, rain extinguishes such fires without causing much damage. High atmospheric temperatures and dryness (low humidity) offer favourable circumstances for a fire to start.

CAUSES OF FOREST FIRE:

- Natural and human caused . There are three elements that are required for a forest fire to burn which are heat oxygen and fuel and these are so-called the fire triangle .
- Generally the fire spreads in the direction of he most abundant supply of these elements.
- But many other factors such as the area , FFMC , DC , ISI , temperature , wind speed and direction , rain conditions are the required inputs for the prediction of forest fires so that proper prevention measures can be taken .
- Natural and human caused .

TYPES OF FOREST FIRE:

- Surface fires : They occur in forest on the surface up to 1.3 meters high.
- Ground fires: They occur on ground below the leaves .
- Crown fires: They are the most dangerous fires that spread fast they occur on top of he trees . They are most destructive.

HUMAN CAUSED FOREST FIRE:

- Smoking near vegetation
- Petroleum products used in logging and hunting equipment .
- Campfires that are not well monitored .
- Electric faults from the nearby electrical plants
- During hunting the use of bullets which can cause fire hazards .

NATURALLY CAUSED FOREST FIRE

Mainly caused in rough terrains which is difficult for personnel reach on time .

- Volcanic activities
- Spontaneous combustion of dry leaves and vegetation can be responsible for fire outbreaks .
- Lightening

THE NEEDS OF THE FIRE MANAGEMENT:

The incidence of forest fires in the country is on the increase and more is burned each year .The major cause of this failure is the piecemeal approach to the problem. Both the national focus and the technical resources required for sustaining a systematic forest fire management elements like strategies fire centres.

PREVENTION:

- Can be prevented by using machine learning by estimating the conditions .
- By helping people evacuate the region before the accident occurs .
- by taking the necessary precautions .

ELEMENTS REQUIRED IN PREVENTION :

- X-Coordinate
- Y-Coordinate
- Month
- Day
- DMC
- DC
- ISI
- TEMPERATURE
- WIND
- RAIN
- RH(relative humidity)

PREDICTION OF AREA BURNT :

- Area burnt in the forest is predicted in HA(10000 sq m)
- The attributes of FWI system(ISI , DMC ,DC ,Rain ,Wind...etc) play a vital role in predicting how vulnerable a region is to wildfire.
- Furthermore , an ML model helps in calculating and predicting the intensity, direction of flow and damages that a forest fire might cause.
- Area :- The coordinates and the location so that estimation is easier.
- DC :-The Drought Code (DC) is a numeric rating of the average moisture content of deep, compact organic layers. This code is a useful indicator of seasonal drought effects on forest fuels and the amount of smoldering in deep duff layers and large logs.
- RH :- Relative Humidity is the moisture content in air and is an important factor to calculate air burnt.

- The Initial Spread Index (ISI) is a numeric rating of the expected rate of fire spread. It combines the effects of wind and the FFMC on rate of spread without the influence of variable quantities of fuel.
- Temperature :- The temperature in that region as the rate of the fire spread can be estimated .
- Wind :- The direction of the wind and the speed .
- Rain Probability :- The probability of rain .

DATA COLLECTION :

- We referred PDFs, and some other sources on the internet. We need a real time data for preparing the model. Forest fire data has been collected from Github .
- The dataset is available in the form of csv with 518entries of data of 11 attributes (x , y , month , day , RH , DC , ISI , temp , wind , rain ,area)
- In order to read and use this data, as well as implement the Linear Regression, the language python was used and was done in the IBM CLOUD environment.

OBJECTIVES OF RESEARCH:

To determine the impact of forest fire on forest cover types classification and change detection of study area using mutli-temporal.

- To develop forest cover classification scheme from satellite image interpretation and forest distribution scope(altitude)
- To evaluate forest cover change from different temporal scales.
- To determine how the forest fire influences the forest cover types
- To facilitate forest inventory by integrating satellite data analysis and ground survey

INDUSTRY PROFILE:

The economic backbone of many BC communities, forestry is a vital part of BC's economy. The sector continues to recover from 2009, one of the worst years for the industry in recent history, with expanded export markets in Asia, pulp product specialization, and continued expansion into green energy. The BC forestry industry is a world leader in sustainable forest management with more land certified to internationally recognized sustainability standards than any other jurisdiction in the world. Accounting for nearly a quarter of all direct manufacturing employment in BC, the forestry industry supports 145,800jobs, with annual revenue of $15.7 billion. The industry consists of more than 7,000 businesses in BC – most of which are small businesses employing less than 20 employees – and is a major customer for BC's transportation industries. An estimated 14 million metric tonnes of forest cargoshipped through bc ports annually to more than 25 countries. In this issue, CPABC Industry Update examines the economic impact of the forestry industry on BC's economy, sustainability certification and

forest management practices, data revolutions in forest monitoring, and Aboriginal title to land, and also includes a Q&A with members working in the forestry industry. Next issue, you'll notice some changes to Industry Update – we'll be including more articles addressing issues facing members in industry, in addition to our focus on a specific industry. These changes are being made based on feedback from the member satisfaction survey conducted this past spring. We hope you enjoy this edition of Industry Update, and look forward to your feedback on this and future issues.

Current resources need to be redirected to support research that improves the understanding of fire causes and effects and identifies existing management practices that predispose ecosystems to harmful fires. Forest departments need to invest more in the promotion of management systems that mimic natural fire regimes or take advantage of well-established fire use or natural fire; develop tactics to prevent recurring harmful fires; establish reliable fire monitoring programs and strengthen the involvement of key stakeholders, especially local communities, in fire management.

REVIEW OF LITERATURE:

The World Conservation Union (IUCN), The Nature Conservancy (TNC) and The Worldwide Fund for Nature (WWF) have come together to work proactively with multi-lateral agencies, governments, private sector and local communities to develop integrated fire management approaches that address underlying causes and develop long-term sustainable solutions. The core elements of such an approach must include:

- Supporting research to improve the understanding of forest fires and their ecology, ecological and social costs and benefits, causes and management options.
- Building awareness amongst policy-makers, the public and the media of the underlying causes of catastrophic forest fires.
- Mandating and equipping managers to implement integrated fire management programs.
- Involving local communities and land managers in management planning and implementation, assisting them to participate effectively.
- Developing and enforcing compatible and mutually reinforcing land-use laws that provide a legal basis for the ecologically appropriate use of fire.
- Discouraging land management practices that predispose forests to harmful fires.
- Promoting management strategies to mimic natural fire regimes, including techniques such as prescribed burns and managed wildfires.

- Avoiding manipulating natural or well-established fire regimes.

SOFTWARE SPECIFICATIONS:

- Machine Learning
- Jupyter Notebook
- IBM Cloud
- Python for programming
- CSV file for Dataset

Data analysis:

- From the original data examples with missing values were removed .
- Total number of observations in dataset: **518**
- Total number of attributes in dataset : **13**
- Metadata and attribute information:

	X	Y	month	day	DMC	DC	ISI	temp	RH	wind	area
0	7	5	8	0	26.2	94.3	5.1	8.2	51	6.7	0.00
1	7	4	11	5	35.4	669.1	6.7	18.0	33	0.9	0.00
2	7	4	11	2	43.7	686.9	6.7	14.6	33	1.3	0.00
3	8	6	8	0	33.3	77.5	9.0	8.3	97	4.0	0.00
4	8	6	8	3	51.3	102.2	9.6	11.4	99	1.8	0.00
5	8	6	2	3	85.3	488.0	14.7	22.2	29	5.4	0.00
6	8	6	2	1	88.9	495.6	8.5	24.1	27	3.1	0.00
7	8	6	2	1	145.4	608.2	10.7	8.0	86	2.2	0.00
8	8	6	12	5	129.5	692.6	7.0	13.1	63	5.4	0.00
9	7	5	12	2	88.0	698.6	7.1	22.8	40	4.0	0.00
10	7	5	12	2	88.0	698.6	7.1	17.8	51	7.2	0.00
11	7	5	12	2	73.2	713.0	22.6	19.3	38	4.0	0.00
12	6	5	2	0	70.8	665.3	0.8	17.0	72	6.7	0.00
13	6	5	12	1	126.5	686.5	7.0	21.3	42	2.2	0.00
14	6	5	12	6	133.3	699.6	9.2	26.4	21	4.5	0.00
15	6	5	12	0	141.2	713.9	13.9	22.9	44	5.4	0.00
16	5	5	8	2	35.8	80.8	7.8	15.1	27	5.4	0.00
17	8	5	11	1	32.8	664.2	3.0	16.7	47	4.9	0.00
18	6	4	8	6	27.9	70.8	6.3	15.9	35	4.0	0.00
19	6	4	1	2	27.4	97.1	5.1	9.3	44	4.5	0.00
20	6	4	12	5	129.5	692.6	7.0	18.3	40	2.7	0.00
21	5	4	12	1	78.5	724.3	9.2	19.1	38	2.7	0.00
22	7	4	7	3	96.3	200.0	56.1	21.0	44	4.5	0.00
23	7	4	2	2	110.9	537.4	6.2	19.5	43	5.8	0.00

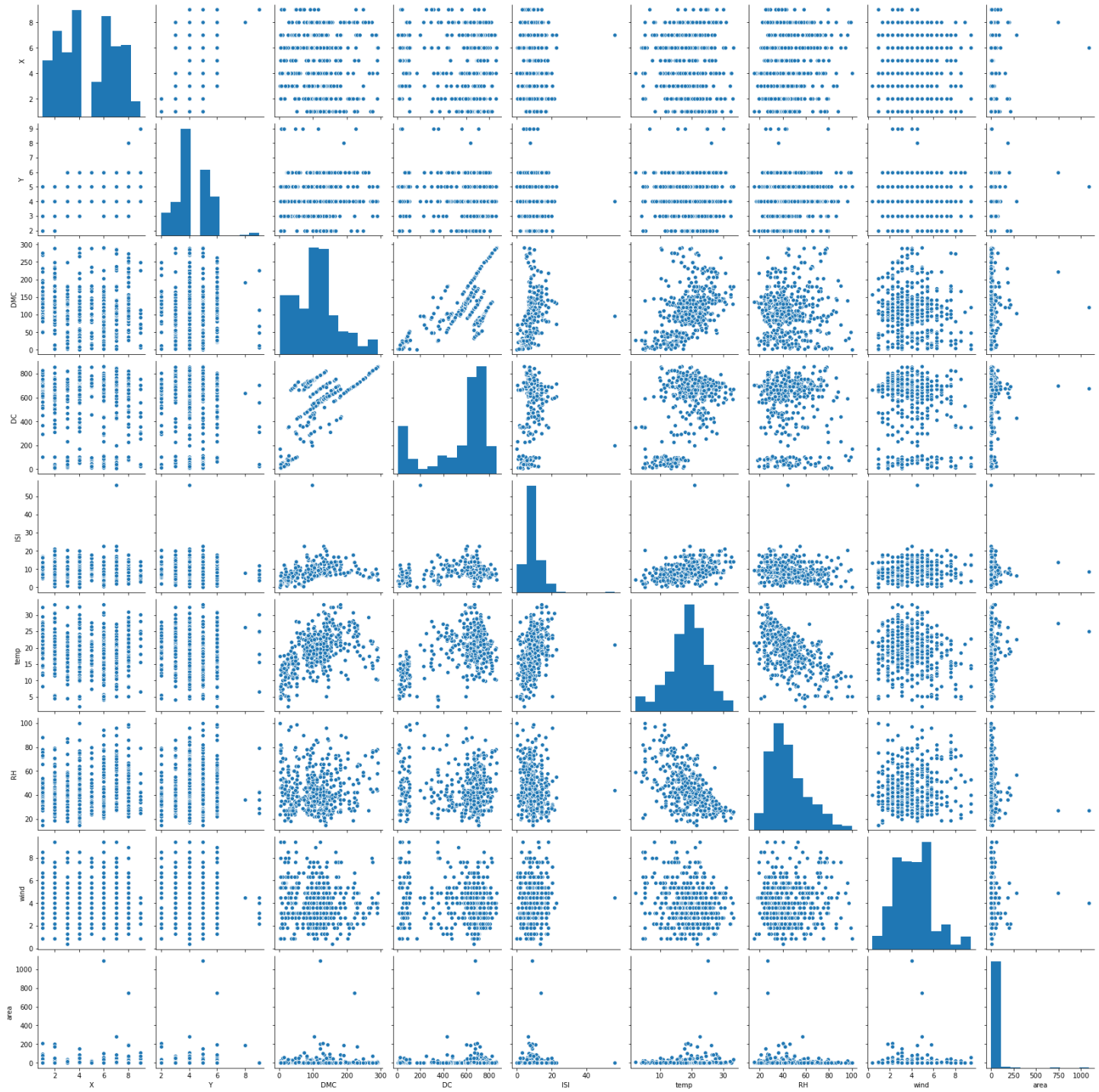
Exploratory Data Analysis

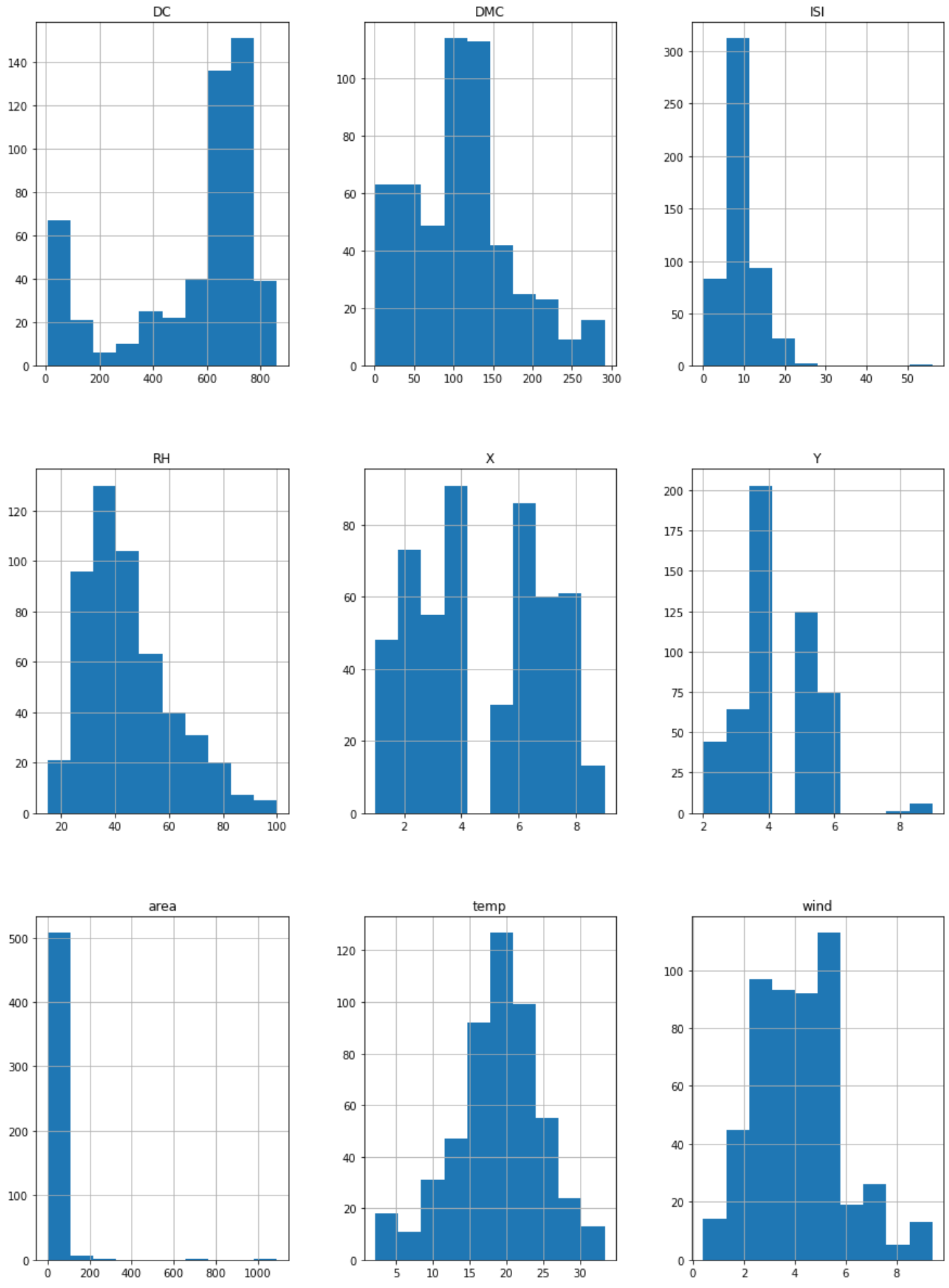
In this notebook we perform an exploratory data analysis over the forest fire Dataset. In this analysis we seek to understand the distribution of the dataset attributes, as well as the relationship between them.

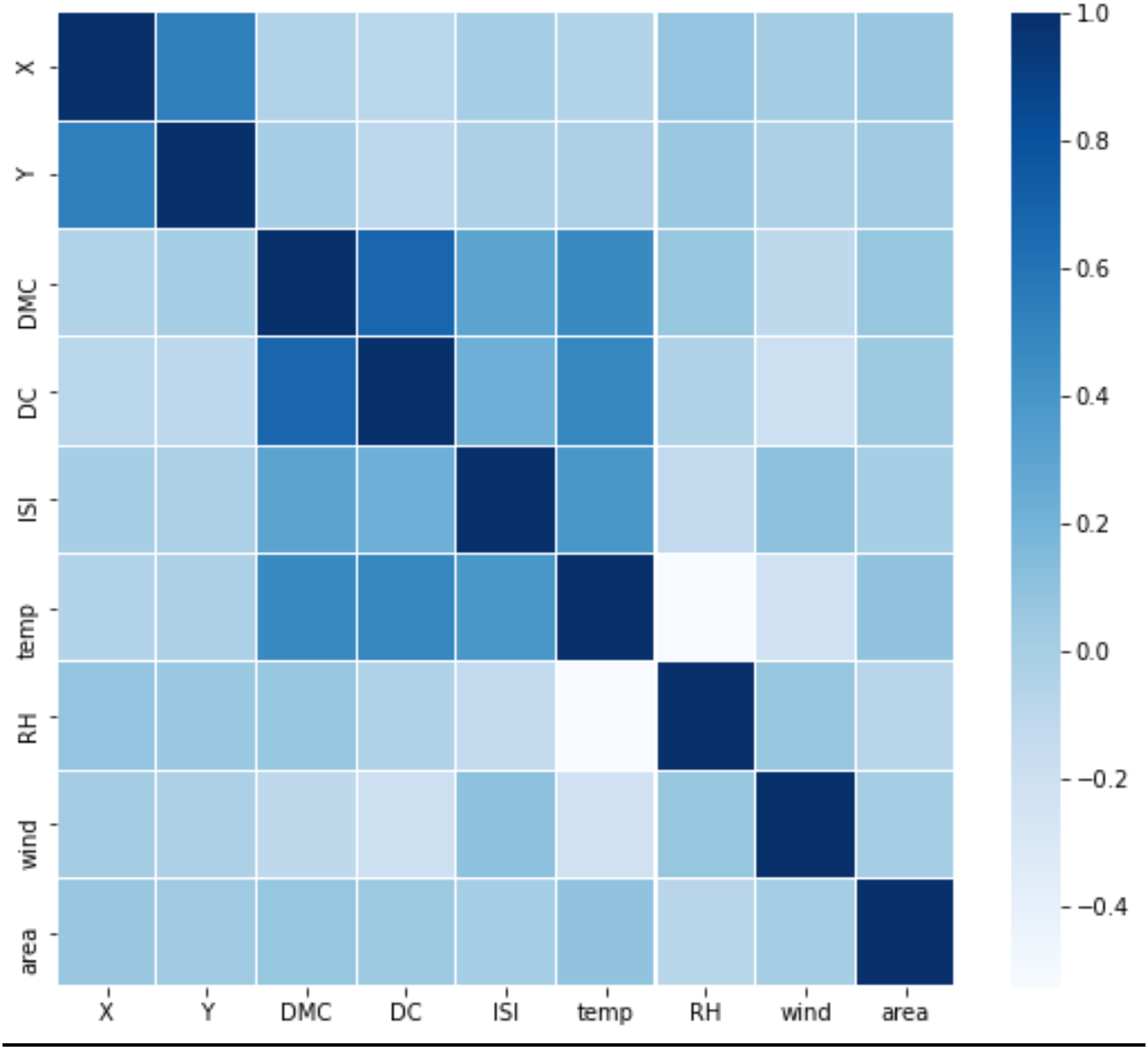
The analysis is divided in sections:

- We present the forest fire Dataset and their attributes:
- We perform the analysis of each attribute individually.
- We seek for correlations between the attributes and how the segmentation affects the results.

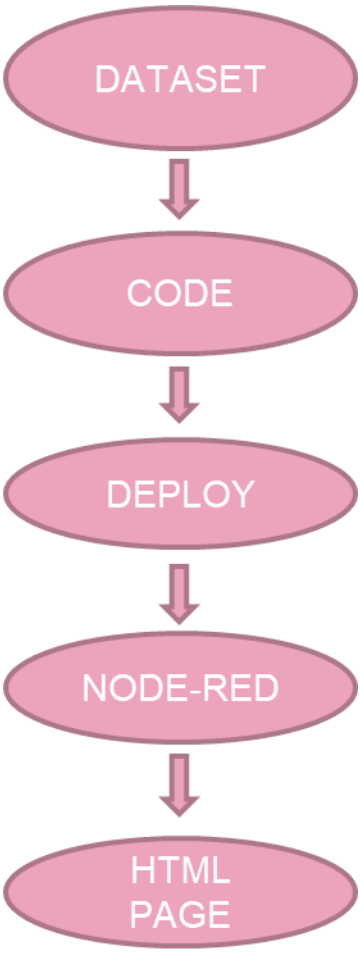
DIFFERENT TYPES OF GRAPHS PLOTTED:



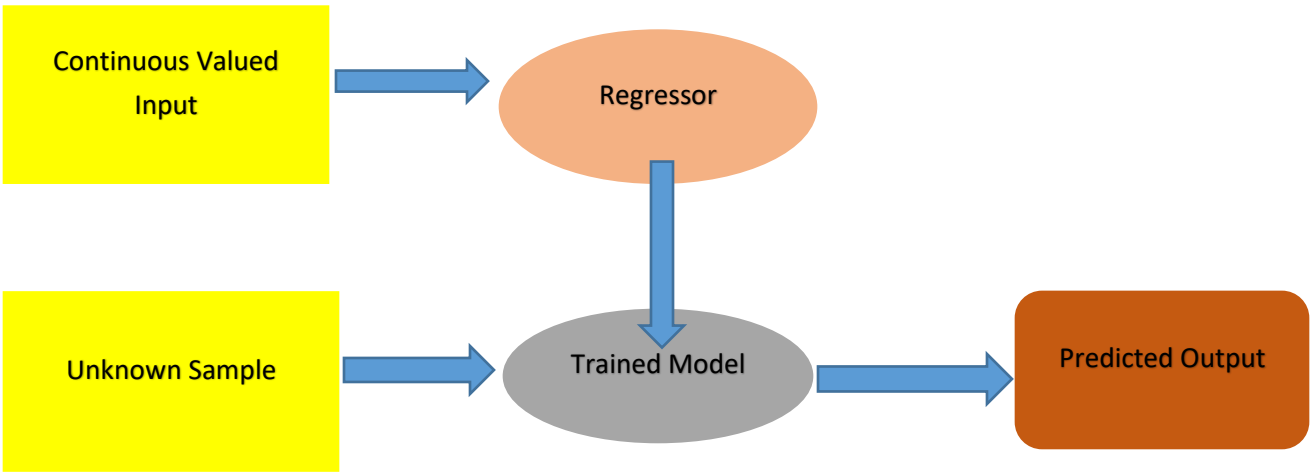

DC
DMC
ISI
RH
X
Y
area
temp
wind


X
Y
DMC
DC
ISI
temp
RH
wind
area
1.0
0.8
0.6
0.4
0.2
0.0
−0.2
−0.4

DESIGN OF THE PROBLEM:



FLOWCHART OF LINEAR REGRESSION:



RESULTS:

Therefore, with an Accuracy of 71.4% in Linear Regression model we have done the project.

DISCUSSION:

Limitations:

It can be used only on jupyter notebook now. But, in future we will develop more like creating a web page and App.

Future Scope:

The future of forest fires the project analysed the factors that influence the likelihood of forest fires in a bid to understand how this risk is likely to evolve in the coming decades. It looked into ways of adapting to these changing conditions in terms of managing the hazard and protecting or restoring landscapes, and it also assessed the implications for society.

CONCLUSION:

- Forest fire is multi –sector issues.
- Forest fire is a national problem , however , limited data inhibit its management and most of the information is based on opinion.
- for fire concern .
- A national campaign on forest fire management is needed.
- Forest fire is multi –sector issues
- Forest fire is a national problem,however,limited data inhibit its management,and most of the information is based on opinion.
- for fire concern
- A national campaign on forest fire management is needed

Control strategies:

- Public education
- Uses of laws,bylaws and regulations
- Participatory forest management i.e CBFiM
- Use of successful tradition al forest management systems
- Establishment of NFMC under TFS
- Anti-fire posters (“Usichome moto”)

FUTURE WORK:

They can be used in Forest Departments to Predict forest fire and we can further make an app or web page for it and also predict the exact latitude and longitude till where the fire spread will happen to create a cut of region as now we are only predicting the percentage how much it will be burnt.

FINDINGS AND SUGGESTIONS:

Be informed: The danger of fire in your region in your region or in the sector where you intend to go, and the preventive measures in effect. These measures may consist in:

- A ban on open fires in the forest or nearby
- The municipal by-laws governing outdoor fires
- The instructions in effect in controlled zones (ZECs), parks and reserves
- The restrictions on access to the forest, as well as on travel, work and burning in the forest

Take precautions: Here is what you can do for your protection

Always have and within reach (at the cottage, in your backpack when hiking in the forest).

- Store building materials, firewood and propane tanks more than 10 m away from any building on your land; clear away all vegetation within a radius of 3 m of the propane storage tank in order to reduce the risk of a fire spreading.
- Intervene promptly if a fire starts.
- Choose a cleared location, out of the wind, for a fire outside; have a shovel, a bucket of water or a rake nearby, constantly monitor your fire and, to extinguish it, spray it with abundant water and cover it with ash, sand or earth.
- Burn anything (waste, dead leaves) at the end of the day, when there is no wind, far from vegetation and in compliance with municipal by-laws.
- If you smoke outside, put out your cigarette butt on a rock or bury it in the ground.

Protect yourself from smoke:

The smoke caused by a forest fire moves according to the speed of the wind.

The following people are more likely to be bothered by the smoke:

- Young children
- The elderly
- People with respiratory problems such as asthma and bronchitis
- People with heart problems
- Listen carefully to public notices and warnings about the presence of smoke or the air quality
- Avoid outdoor activities when the air quality index is poor.
- Close the windows and doors of your home, along with the air exchange system, when there is smoke outside.
- Breathe into a damp cloth when in the presence of thick smoke, and be sure to keep the cloth in front of your mouth and nose in order to avoid inhaling smoke.

REFERENCES:

https://www.sciencedirect.com/topics/earth-and-planetary-sciences/forest-fire

http://vikaspedia.in/energy/environment/know-your-environment/forest-fires

https://github.com/topics/forest-fire

https://www.urgencequebec.gouv.qc.ca/En/situation-urgence/Pages/Incendie-de-foret.aspx

http://www.indiaenvironmentportal.org.in/files/file/Forest-Fire-Prevention-Management.pdf

CODE :

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In [1]:
```
import numpy as np
import pandas as pd
from sklearn.preprocessing import LabelEncoder
from sklearn.feature_selection import RFE
```

In [2]:
```
from sklearn .feature_selection import RFE
import matplotlib.pyplot as plt
```

In [3]:
```
from sklearn.metrics import explained_variance_score
from sklearn.metrics import mean_absolute_error
```

In [4]:
```
dataset = pd.read_csv("forestfires.csv")
```

In [5]:
```
print(dataset)
```

```
     X  Y month  day    DMC     DC   ISI  temp  RH  wind   area
0    7  5   mar  fri   26.2   94.3   5.1   8.2  51   6.7   0.00
1    7  4   oct  tue   35.4  669.1   6.7  18.0  33   0.9   0.00
2    7  4   oct  sat   43.7  686.9   6.7  14.6  33   1.3   0.00
3    8  6   mar  fri   33.3   77.5   9.0   8.3  97   4.0   0.00
4    8  6   mar  sun   51.3  102.2   9.6  11.4  99   1.8   0.00
..  .. ..   ...  ...    ...    ...   ...   ...  ..   ...    ...
512  4  3   aug  sun   56.7  665.6   1.9  27.8  32   2.7   6.44
513  2  4   aug  sun   56.7  665.6   1.9  21.9  71   5.8  54.29
514  7  4   aug  sun   56.7  665.6   1.9  21.2  70   6.7  11.16
515  1  4   aug  sat  146.0  614.7  11.3  25.6  42   4.0   0.00
516  6  3   nov  tue    3.0  106.7   1.1  11.8  31   4.5   0.00

[517 rows x 11 columns]
```


In [6]:
```
x2 =  dataset.iloc[:,0:10].values
y2 =  dataset.iloc[:,:10].values
```

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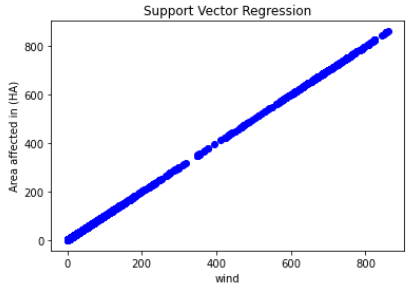
In [7]:
```
print(x2.size,y2.size)
```

```
5170 5170
```

In [8]:
```
arr = ['X','Y','month','day','DMC','DC','ISI','temp','RH','wind']
for i in range(10):
    if(i==2 or i==3):
        continue
    else:
        x1=x2[:,i]
        y1=y2[:,i]
        plt.scatter(x1,y1,color='blue')
        plt.xlabel(arr[i])
        plt.ylabel('Area affected in (HA)')
        plt.title('Support Vector Regression')
plt.show()
```



In [9]:
```
dataset.hist()
```

Activate Windows
Go to Settings to activate Windows.

Out[9]:
```
array([[<matplotlib.axes._subplots.AxesSubplot object at 0x000001EA04E66E20>,
        <matplotlib.axes._subplots.AxesSubplot object at 0x000001EA04EE3490>,
```

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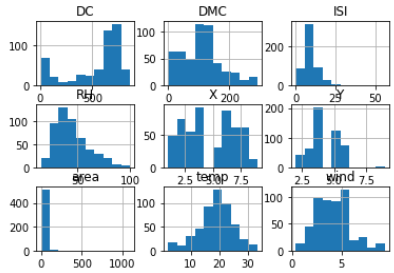
In [9]:
```
dataset.hist()
```

Out[9]:
```
array([[<matplotlib.axes._subplots.AxesSubplot object at 0x000001EA04E66E20>,
        <matplotlib.axes._subplots.AxesSubplot object at 0x000001EA04EE3490>,
        <matplotlib.axes._subplots.AxesSubplot object at 0x000001EA04F0F8E0>],
       [<matplotlib.axes._subplots.AxesSubplot object at 0x000001EA04F3CD30>,
        <matplotlib.axes._subplots.AxesSubplot object at 0x000001EA04F761C0>,
        <matplotlib.axes._subplots.AxesSubplot object at 0x000001EA04FA1580>],
       [<matplotlib.axes._subplots.AxesSubplot object at 0x000001EA04FA1670>,
        <matplotlib.axes._subplots.AxesSubplot object at 0x000001EA04FCDB50>,
        <matplotlib.axes._subplots.AxesSubplot object at 0x000001EA050343A0>]],
      dtype=object)
```



In [10]:
```
dataset1=pd.read_csv("forestfires.csv")
x1 = dataset1.iloc[:,2]
y1=dataset1.iloc[:,10].values
x2=dataset1.iloc[:,3]
plt.bar(x1,y1)
plt.xlabel('MONTHS')
plt.ylabel('AREA AFFECTED IN (HA)')
```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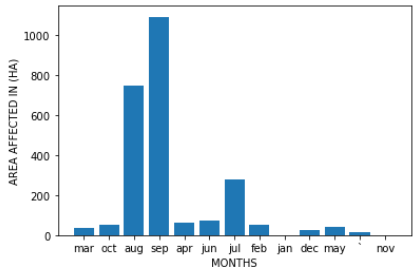
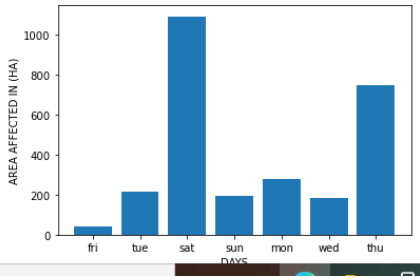
Out[10]:
```
Text(0, 0.5, 'AREA AFFECTED IN (HA)')
```



In [11]:
```
plt.bar(x2,y1)
plt.xlabel('DAYS')
plt.ylabel('AREA AFFECTED IN (HA)')
```

Out[11]:
```
Text(0, 0.5, 'AREA AFFECTED IN (HA)')
```



In [12]:
```
le = LabelEncoder()

dataset['month'] = le.fit_transform(dataset['month'])
dataset['day'] = le.fit_transform(dataset['day'])
dataset.isnull().any()
```

Out[12]:
```
X        False
Y        False
month    False
day      False
DMC      False
DC       False
ISI      False
temp     False
RH       False
wind     False
area     False
dtype: bool
```

In [13]:
```
import seaborn as sns
sns.heatmap(dataset.corr(),annot = True)
```

Out[13]:
```
<matplotlib.axes._subplots.AxesSubplot at 0x1ea05f44430>
```

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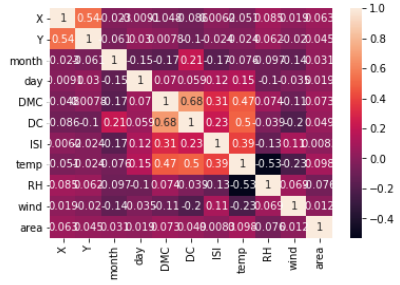

In [14]:
```
dataset
```

Out[14]:

	X	Y	month	day	DMC	DC	ISI	temp	RH	wind	area
0	7	5	8	0	26.2	94.3	5.1	8.2	51	6.7	0.00
1	7	4	11	5	35.4	669.1	6.7	18.0	33	0.9	0.00
2	7	4	11	2	43.7	686.9	6.7	14.6	33	1.3	0.00
3	8	6	8	0	33.3	77.5	9.0	8.3	97	4.0	0.00
4	8	6	8	3	51.3	102.2	9.6	11.4	99	1.8	0.00
...	...	...	...	...	...	...	...	...	...	...	...
512	4	3	2	3	56.7	665.6	1.9	27.8	32	2.7	6.44
513	2	4	2	3	56.7	665.6	1.9	21.9	71	5.8	54.29
514	7	4	2	3	56.7	665.6	1.9	21.2	70	6.7	11.16
515	1	4	2	2	146.0	614.7	11.3	25.6	42	4.0	0.00
516	6	3	10	5	3.0	106.7	1.1	11.8	31	4.5	0.00

517 rows × 11 columns

In [15]:
```
x = dataset.iloc[:,0:9].values
y = dataset.iloc[:,9:10].values
```

In [16]:
```
print(x)
```

```
[[ 7.   5.   8.  ...  5.1  8.2 51. ]
 [ 7.   4.  11.  ...  6.7 18.  33. ]
 [ 7.   4.  11.  ...  6.7 14.6 33. ]
 ...
 [ 7.   4.   2.  ...  1.9 21.2 70. ]
 [ 1.   4.   2.  ... 11.3 25.6 42. ]
 [ 6.   3.  10.  ...  1.1 11.8 31. ]]
```

In [17]:
```
print(y)
```

```
[[6.7]
 [0.9]
 [1.3]
 [4. ]
 [1.8]
 [5.4]
 [3.1]
 [2.2]
 [5.4]
 [4. ]
 [7.2]
 [4. ]
 [6.7]
 [2.2]
 [4.5]
 [5.4]
 [5.4]
 [4.9]
 [4. ]
 [4.5]
```


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```
 [5.4]
 [5.8]
 [1.3]
 [2.7]
 [3.6]
 [3.6]
 [7.6]
 [1.8]
 [3.6]
 [2.7]
 [4.5]
 [4.5]
 [5.4]
 [4. ]
 [2.7]
 [3.1]
 [6.7]
 [5.4]
 [2.7]
 [4.9]
 [4. ]
 [3.6]
 [3.1]
 [1.8]
 [5.8]
 [1.3]
 [2.2]
 [4.9]
 [4.9]
 [3.6]
 [2.2]
 [4.9]
 [2.7]
 [5.4]
 [0.9]
 [5.8]
 [6.3]
 [4.9]
```

```
[5.4]
[4.5]
[5.4]
[5.4]
[5.4]
[4. ]
[4.5]
[3.1]
[6.3]
[3.1]
[3.1]
[3.1]
[5.4]
[5.8]
[4.5]
[3.6]
[2.7]
[7.6]
[6.3]
[6.3]
[4.9]
[4. ]
[3.1]
[2.2]
[5.4]
[5.4]
[3.1]
[5.4]
[5.4]
[2.2]
[3.1]
[3.6]
[0.9]
[2.7]
[3.1]
[4.9]
[3.1]
[2.7]
[5.8]
```


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In [18]:
```
from sklearn.model_selection import train_test_split
x_train, x_test,y_train, y_test = train_test_split(x,y,test_size=0.25,random_state = 0)
```

In [68]:
```
from sklearn.linear_model import LinearRegression
from sklearn.metrics import mean_squared_error
from sklearn.model_selection import train_test_split
x_train, x_test, y_train, y_test = train_test_split(x,y,test_size=0.3,random_state = 42)
reg_all = LinearRegression()
reg_all.fit(x_train, y_train)
y_pred = reg_all.predict(x_test)
```

In [69]:
```
print("R^2: {}".format(reg_all.score(x_test, y_test)))
rmse = np.sqrt(y_test,y_pred)
print("Root Mean Squared Error: {}".format(rmse))
```

```
R^2: 0.07135461694724488
Root Mean Squared Error: [[2.21359436]
 [2.21359436]
 [1.34164079]
 [2.21359436]
 [2.21359436]
 [1.76068169]
 [2.        ]
 [1.64316767]
 [1.76068169]
 [1.4832397 ]
 [1.8973666 ]
 [1.64316767]
 [1.34164079]
 [1.8973666 ]
 [2.68328157]
 [1.34164079]
 [1.64316767]
 [1.8973666 ]
 [2.21359436]
 [2.32379001]
 [2.40831892]
```


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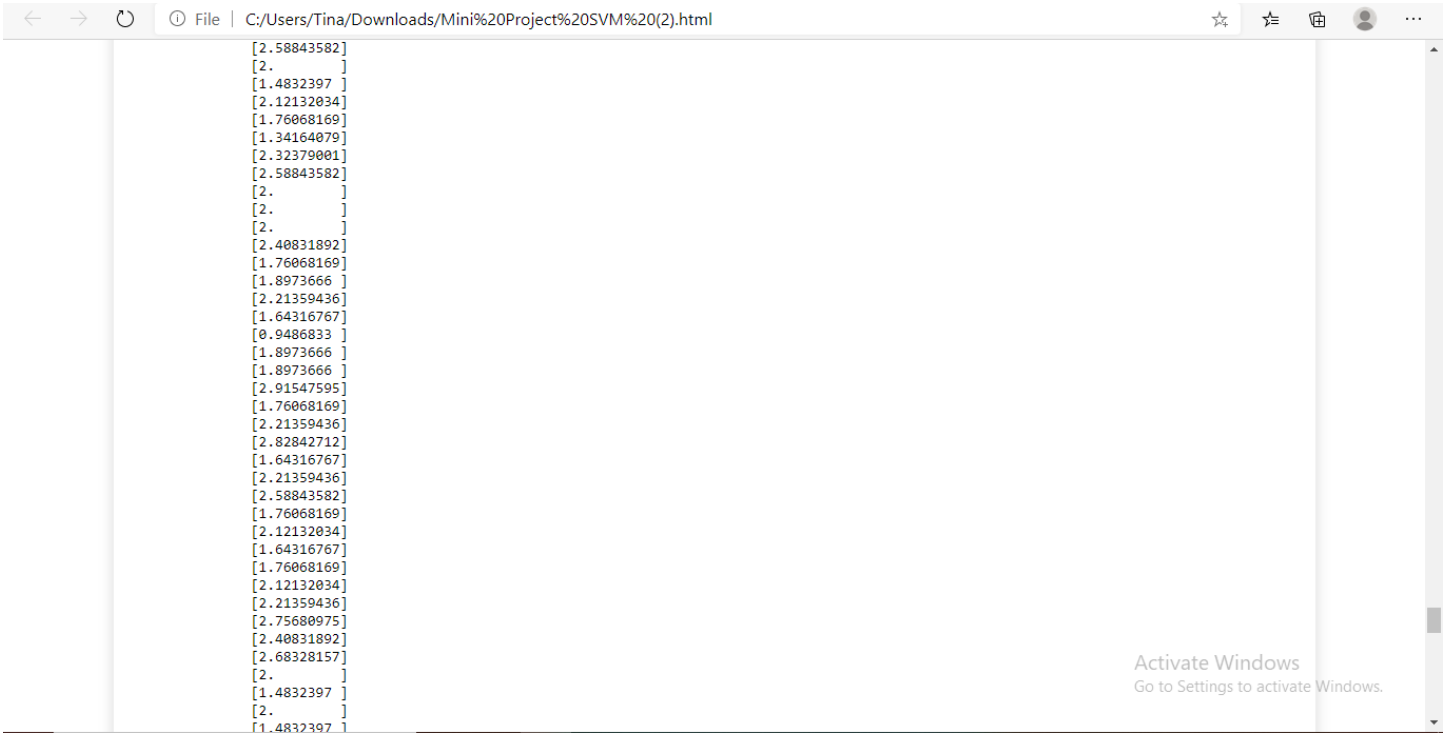
[2.21359436]
[2.91547595]
[2.50998008]
[2.32379001]
[1.76068169]
[1.76068169]
[1.34164079]
[1.34164079]
[1.64316767]
[2.75680975]
[2.12132034]
[1.34164079]
[2.]
[2.50998008]
[2.12132034]
[1.14017543]
[2.21359436]
[2.12132034]
[1.64316767]
[1.8973666]
[2.50998008]
[1.14017543]
[1.4832397]
[1.4832397]
[2.21359436]
[1.76068169]
[3.06594194]
[2.21359436]
[2.]
[2.40831892]
[2.]
[1.8973666]
[1.64316767]
[2.21359436]
[2.75680975]
[1.14017543]
[1.64316767]
[1.4832397]
Activate Windows
Go to Settings to activate Windows.


File | C:/Users/Tina/Downloads/Mini%20Project%20SVM%20(2).html
[2.58843582]
[2.]
[1.4832397]
[2.12132034]
[1.76068169]
[1.34164079]
[2.32379001]
[2.58843582]
[2.]
[2.]
[2.]
[2.40831892]
[1.76068169]
[1.8973666]
[2.21359436]
[1.64316767]
[0.9486833]
[1.8973666]
[1.8973666]
[2.91547595]
[1.76068169]
[2.21359436]
[2.82842712]
[1.64316767]
[2.21359436]
[2.58843582]
[1.76068169]
[2.12132034]
[1.64316767]
[1.76068169]
[2.12132034]
[2.21359436]
[2.75680975]
[2.40831892]
[2.68328157]
[2.]
[1.4832397]
[2.]
Activate Windows
Go to Settings to activate Windows.

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```
[1.4832397 ]
[2.        ]
[1.76068169]
[2.        ]
[2.32379001]
[1.76068169]
[2.58843582]
[1.8973666 ]
[2.12132034]
[1.34164079]
[1.4832397 ]
[2.21359436]
[2.91547595]
[1.4832397 ]
[2.        ]
[1.64316767]
[2.32379001]
[2.75680975]
[2.32379001]
[2.50998008]
[2.12132034]
[2.        ]
[2.82842712]
[1.4832397 ]
[2.32379001]
[2.75680975]
[1.64316767]
[2.        ]
[1.14017543]
[1.76068169]
[1.64316767]
[2.21359436]
[2.40831892]
[2.21359436]
[2.12132034]
[2.12132034]
[2.75680975]
[1.8973666 ]
[1.64316767]]
```


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In [70]:
```
reg_all.score(x_test,y_test)
```

Out[70]:
```
0.07135461694724488
```

In [71]:
```
from sklearn.ensemble import RandomForestRegressor
```

In [72]:
```
rf= RandomForestRegressor()
```

In [73]:
```
rf.fit(x_train,y_train)
```

```
<ipython-input-73-895403b03771>:1: DataConversionWarning: A column-vector y was passed when a 1d array was expected. Please cha
nge the shape of y to (n_samples,), for example using ravel().
  rf.fit(x_train,y_train)
```

Out[73]:
```
RandomForestRegressor()
```

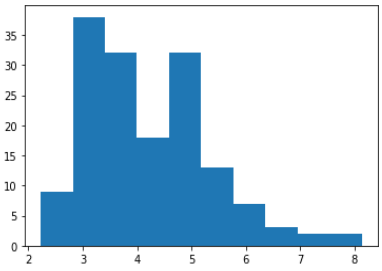
In [74]:
```
y_pred = rf.predict(x_test)
y_pred
```

Out[74]:
```
array([3.343, 4.739, 2.765, 3.987, 3.989, 4.021, 4.668, 2.889, 2.923,
       5.046, 3.376, 2.969, 2.227, 3.496, 3.087, 4.818, 6.388, 3.809,
       5.843, 5.088, 5.548, 4.341, 7.285, 5.377, 4.124, 3.385, 3.917,
       4.466, 2.852, 4.773, 4.784, 3.448, 2.361, 3.231, 5.446, 4.723,
       5.404, 3.513, 4.09 , 3.258, 3.232, 5.213, 4.035, 3.35 , 3.374,
       6.052, 5.174, 5.347, 5.159, 5.017, 3.787, 3.525, 4.637, 3.122,
       4.029, 6.538, 3.955, 2.296, 3.581, 4.307, 3.802, 4.071, 5.324,
       3.887, 3.096, 4.852, 3.378, 2.924, 5.32 , 5.791, 4.511, 2.805,
       7.205, 4.721, 3.578, 4.601, 3.965, 4.02 , 3.515, 3.434, 5.239,
       2.998, 3.147, 5.115, 4.265, 6.161, 5.023, 3.756, 8.089, 4.677,
       5.298, 4.859, 2.833, 5.176, 3.91 , 3.211, 4.677, 3.509, 3.164,
       4.993, 6.167, 6.421, 5.868, 3.228, 3.086, 2.458, 3.329, 3.748,
       3.222, 3.607, 3.122, 5.619, 6.025, 3.163, 3.205, 4.919, 4.215,
       2.895, 3.374, 4.212, 4.689, 2.896, 4.136, 3.528, 3.647, 3.91 ,
       3.316, 2.243, 3.506, 8.128, 5.593, 3.749, 2.572, 4.373, 5.141,
       3.711, 4.762, 3.444, 3.292, 5.15 , 4.855, 2.326, 5.045, 3.168,
       3.065, 3.196, 3.696, 4.472, 4.647, 5.351, 3.763, 4.071, 4.805,
```

```
3.711, 4.762, 3.444, 3.292, 5.15 , 4.855, 2.326, 5.045, 3.168,
3.065, 3.196, 3.696, 4.472, 4.647, 5.351, 3.763, 4.071, 4.805,
4.834, 3.562, 3.406])
```

In [75]:
```
plt.hist(y_pred)
```

Out[75]:
```
(array([ 9., 38., 32., 18., 32., 13.,  7.,  3.,  2.,  2.]),
 array([2.227 , 2.8171, 3.4072, 3.9973, 4.5874, 5.1775, 5.7676, 6.3577,
        6.9478, 7.5379, 8.128 ]),
 <a list of 10 Patch objects>)
```



In [76]:
```
rf.score(x_test,y_test)
```

Out[76]:
```
0.24861374209086173
```