```
import matplotlib.pyplot as plt
import numpy as np
import pandas as pd



from sklearn import metrics
from sklearn.metrics import classification_report,confusion_matrix


import warnings
warnings.filterwarnings(action="ignore")
%matplotlib inline
pd.set_option("display.max_rows", 1000)
pd.set_option("display.max_columns", 1000)


fires = pd.read_csv("/content/modis_2022_India.csv")    #reading the dataset
fires.head(15)    #show the first 15 instances of dataset
```

	brightness	number22	acq_time	confidence	bright_t31	frp	type
0	313.5	1.0	826.0	61.0	297.6	6.9	0
1	344.5	2.0	1649.0	26.0	290.0	10.2	0
2	316.7	3.0	813.0	62.0	297.3	15.0	0
3	312.0	4.0	545.0	70.0	303.1	10.8	0
4	308.5	5.0	1718.0	70.0	289.6	10.1	0
5	304.9	6.0	534.0	80.0	296.8	29.3	0
6	314.6	7.0	1707.0	51.0	290.5	5.5	0
7	307.9	8.0	521.0	42.0	296.4	8.0	0
8	304.3	9.0	603.0	65.0	299.3	36.7	0
9	351.0	10.0	819.0	64.0	297.7	10.0	0
10	301.6	11.0	903.0	45.0	296.9	23.0	0
11	314.9	12.0	807.0	70.0	299.5	25.3	0
12	318.2	13.0	539.0	47.0	299.4	7.1	0
13	311.6	14.0	755.0	25.0	302.5	19.3	0
14	307.6	15.0	528.0	70.0	291.8	12.7	0

Next steps: Generate code with `fires` View recommended plots

```
#generate descriptive statistics of each attribute
fires.describe().T
```

	count	mean	std	min	25%	50%	75%	max
brightness	363.0	322.590358	12.892102	300.3	313.60	321.3	330.900	386.4
number22	362.0	182.538674	105.800575	1.0	91.25	181.5	274.750	365.0
acq_time	362.0	870.610497	452.874941	421.0	528.00	755.5	845.250	2110.0
confidence	362.0	53.878453	20.237417	0.0	43.00	58.0	68.000	98.0
bright_t31	362.0	296.263812	7.019746	272.8	291.80	296.7	300.875	317.4
frp	362.0	16.284254	15.462712	3.3	7.30	11.3	19.300	158.0
type	363.0	0.011019	0.148249	0.0	0.00	0.0	0.000	2.0

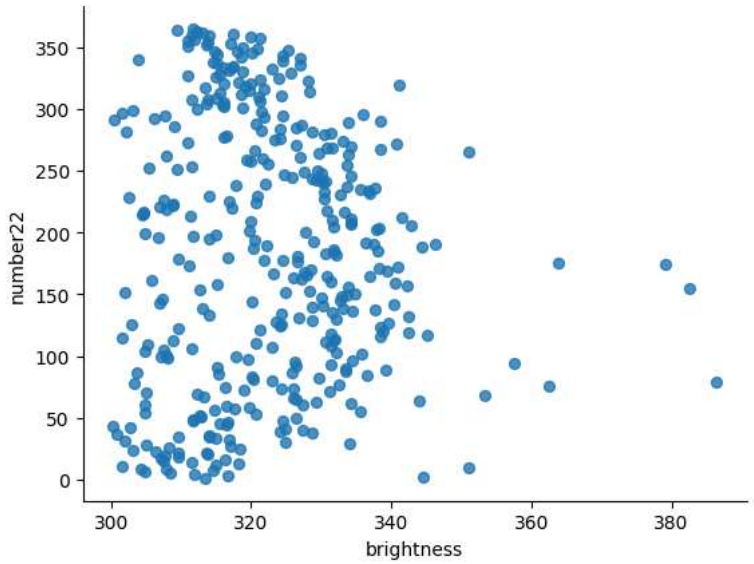
```
#given area of land burnt, but we have to predict if there is fire or not so changing values of area to 0 and 1 only
#here 0 represet there is not fire and 1 represent fire, changing all values of area which are greater than 0 to 1
fires['type'].values[fires['type'].values > 0] = 1

#renaming the area attribute to output for clear understanding
fires = fires.rename(columns={'type': 'output'})
fires.head(5)
```

	brightness	number22	acq_time	confidence	bright_t31	frp	output
0	313.5	1.0	826.0	61.0	297.6	6.9	0
1	344.5	2.0	1649.0	26.0	290.0	10.2	0
2	316.7	3.0	813.0	62.0	297.3	15.0	0
3	312.0	4.0	545.0	70.0	303.1	10.8	0
4	308.5	5.0	1718.0	70.0	289.6	10.1	0

Next steps: Generate code with `fires` View recommended plots

brightness vs number22

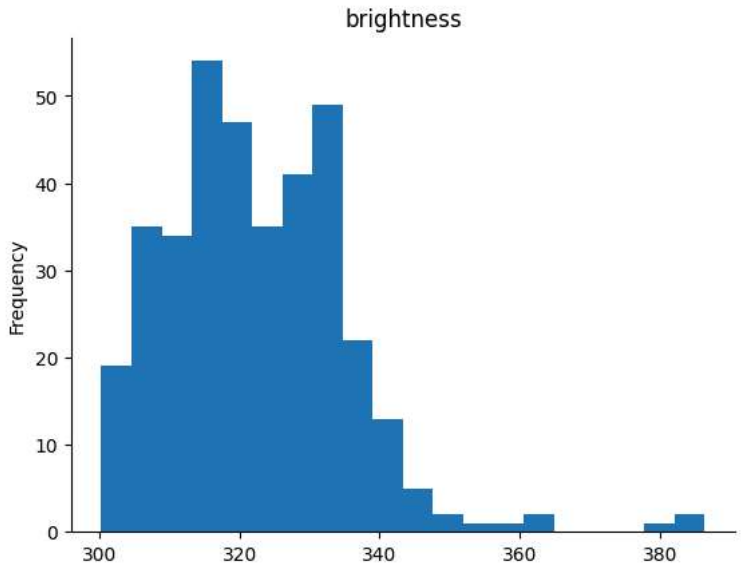
```
# @title brightness vs number22

from matplotlib import pyplot as plt
fires.plot(kind='scatter', x='brightness', y='number22', s=32, alpha=.8)
plt.gca().spines[['top', 'right',]].set_visible(False)
```



Start coding or generate with AI.

brightness

Show code



```
#Compute pairwise correlation of columns
fires.corr()
```

	brightness	number22	acq_time	confidence	bright_t31	frp	output
brightness	1.000000	-0.008818	0.141465	-0.020934	-0.040939	0.043530	0.004681
number22	-0.008818	1.000000	-0.071771	-0.122989	-0.141450	-0.154428	0.034188
acq_time	0.141465	-0.071771	1.000000	0.155767	-0.366920	-0.190422	-0.047896
confidence	-0.020934	-0.122989	0.155767	1.000000	0.287941	0.047150	0.007825
bright_t31	-0.040939	-0.141450	-0.366920	0.287941	1.000000	-0.042485	-0.070854
frp	0.043530	-0.154428	-0.190422	0.047150	-0.042485	1.000000	-0.025507
output	0.004681	0.034188	-0.047896	0.007825	-0.070854	-0.025507	1.000000

```
#sorting to see which attribute is correlated more to attribut "output"
fires.corr()['output'].sort_values()
#we can see that attribute "month" is the mostly correlated  to attribute "output"
```

```
bright_t31   -0.070854
acq_time     -0.047896
frp          -0.025507
brightness    0.004681
confidence    0.007825
number22      0.034188
output        1.000000
Name: output, dtype: float64
```

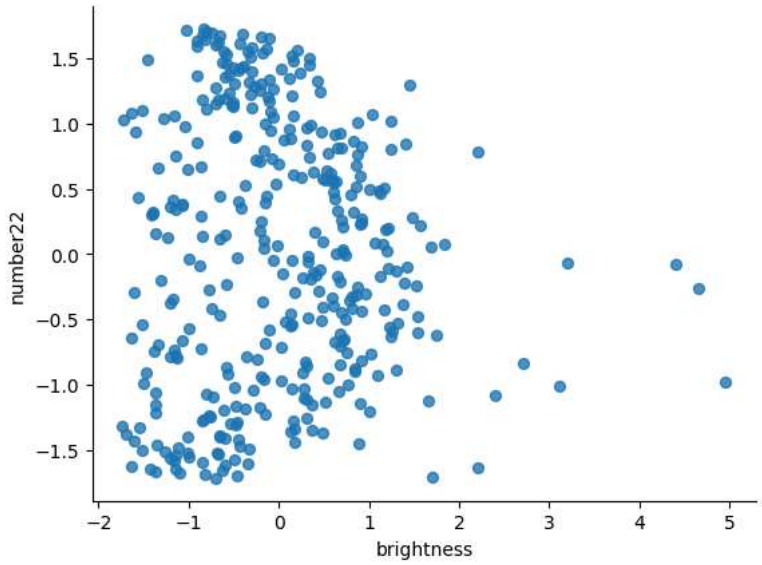
```
from sklearn.preprocessing import StandardScaler
#standardization of data
#removing the mean and scaling it to unit variance
#score=(x-mean)/std
scaler = StandardScaler()
#fitting forest fire dataset to scaler by removing the attribute output
scaler.fit(fires.drop('output',axis=1))

scaled_features = scaler.transform(fires.drop('output',axis=1))
df_feat = pd.DataFrame(scaled_features,columns=fires.columns[:-1])
df_feat.head()
```

	brightness	number22	acq_time	confidence	bright_t31	frp
0	-0.706084	-1.718232	-0.098641	0.352387	0.190610	-0.607736
1	1.701808	-1.708767	1.721153	-1.379476	-0.893548	-0.394024
2	-0.457527	-1.699302	-0.127387	0.401869	0.147815	-0.083170
3	-0.822595	-1.689838	-0.719981	0.797723	0.975199	-0.355167
4	-1.094454	-1.680373	1.873723	0.797723	-0.950609	-0.400500

Next steps: Generate code with `df_feat` View recommended plots

brightness vs number22

Show code




```
from sklearn.model_selection import train_test_split
X = df_feat
y = fires['output']
X_train, X_test, y_train, y_test = train_test_split(X,y,test_size=0.35,random_state=200)
```

Logistic Regression

```
# Check for missing values in X_train
missing_values = X_train.isnull().sum()

# Print the number of missing values in each column
print(missing_values)
```

```
brightness    0
number22      1
acq_time      1
confidence    1
bright_t31    1
frp           1
dtype: int64
```

```
X_train = X_train.dropna()
y_train = y_train[X_train.index]
```

```
from sklearn.impute import SimpleImputer

imputer = SimpleImputer(strategy="mean")
X_train = imputer.fit_transform(X_train)
```

```
!pip install scikit-learn
import sklearn.linear_model as lm
import sklearn.metrics as metrics

logistic_model = lm.LogisticRegression()
logistic_model.fit(X_train, y_train)

predictions = logistic_model.predict(X_test)

# Print the evaluation metrics
print("Precision:", metrics.precision_score(y_test, predictions))
print("Recall:", metrics.recall_score(y_test, predictions))
print("Accuracy:", metrics.accuracy_score(y_test, predictions))
```

```
Requirement already satisfied: scikit-learn in /usr/local/lib/python3.10/dist-packages (1.2.2)
Requirement already satisfied: numpy>=1.17.3 in /usr/local/lib/python3.10/dist-packages (from scikit-learn) (1.25.2)
Requirement already satisfied: scipy>=1.3.2 in /usr/local/lib/python3.10/dist-packages (from scikit-learn) (1.11.4)
Requirement already satisfied: joblib>=1.1.1 in /usr/local/lib/python3.10/dist-packages (from scikit-learn) (1.4.0)
Requirement already satisfied: threadpoolctl>=2.0.0 in /usr/local/lib/python3.10/dist-packages (from scikit-learn) (3.4.0)
Precision: 0.0
Recall: 0.0
Accuracy: 1.0
```

Prediction

```
#prediction using logistic regression
class_label={1:'There is Fire',0:'There is no fire'}
x_new=[[12, 4, 9 ,11 ,92, 133]]


y_predict=logistic_model.predict(x_new)
print(class_label[y_predict[0]])
```

```
There is no fire
```

KNN

```
#importing k nearest neighbour
from sklearn.neighbors import KNeighborsClassifier
k_nearest_neighbor_model = KNeighborsClassifier(n_neighbors=1)
k_nearest_neighbor_model.fit(X_train,y_train)
pred = k_nearest_neighbor_model.predict(X_test)


error_rate = []
for i in range(1,100):
    k_nearest_neighbor_model = KNeighborsClassifier(n_neighbors=i)
    k_nearest_neighbor_model.fit(X_train,y_train)
    pred_i = k_nearest_neighbor_model.predict(X_test)
    error_rate.append(np.mean(pred_i != y_test))


plt.figure(figsize=(10,6))
plt.plot(range(1,100),error_rate,color='blue', linestyle='dashed', marker='o',
         markerfacecolor='red', markersize=10)
plt.title('Error Rate vs. K Value')
plt.xlabel('K')
plt.ylabel('Error Rate')


knn = KNeighborsClassifier(n_neighbors=7)
knn.fit(X_train,y_train)
pred = knn.predict(X_test)
print('WITH K=7')
print('\n')
print(confusion_matrix(y_test,pred))
print('\n')
print(classification_report(y_test,pred))
```

```
WITH K=7


[[128]]


              precision    recall  f1-score   support

           0       1.00      1.00      1.00       128

    accuracy                           1.00       128
   macro avg       1.00      1.00      1.00       128
weighted avg       1.00      1.00      1.00       128
```

```
knn = KNeighborsClassifier(n_neighbors=17)
knn.fit(X_train,y_train)
pred = knn.predict(X_test)
print('WITH K=17')
print('\n')
print(confusion_matrix(y_test,pred))
print('\n')
print(classification_report(y_test,pred))
```

```
WITH K=17


[[128]]


              precision    recall  f1-score   support

           0       1.00      1.00      1.00       128
```

```
          accuracy                           1.00       128
         macro avg       1.00      1.00      1.00       128
      weighted avg       1.00      1.00      1.00       128
```

```
knn.score(X_test, y_test)
```

```
1.0
```

```
from sklearn import metrics
print("Accuracy:",metrics.accuracy_score(y_test, pred))
print("Precision:",metrics.precision_score(y_test, pred))
print("Recall:",metrics.recall_score(y_test, pred))
```

```
Accuracy: 1.0
Precision: 0.0
Recall: 0.0
```

Prediction

```
#prediction using knn
classes={0:'safe',1:'On Fire'}
x_new=[[12, 4, 9 ,11 ,92, 133]]
y_predict=knn.predict(x_new)
print(classes[y_predict[0]])
```

```
safe
```

SVM

```
from sklearn.impute import SimpleImputer

imputer = SimpleImputer(strategy="mean")
X = imputer.fit_transform(X)
X_test = imputer.transform(X_test)
```

```
from sklearn.ensemble import HistGradientBoostingClassifier

model = HistGradientBoostingClassifier()
model.fit(X_train, y_train)
predictions = model.predict(X_test)
```

```
#prediction using svm
classes={0:'safe',1:'On Fire'}
x_new=[[12, 4, 9 ,11 ,92, 133]]
y_predict=svc.predict(x_new)
print(classes[y_predict[0]])
```

Decision Tree

```
!pip install scikit-learn
from sklearn.impute import SimpleImputer
from sklearn.tree import DecisionTreeClassifier
from sklearn import metrics
from sklearn.model_selection import train_test_split
```

```
Requirement already satisfied: scikit-learn in /usr/local/lib/python3.10/dist-packages (1.2.2)
Requirement already satisfied: numpy>=1.17.3 in /usr/local/lib/python3.10/dist-packages (from scikit-learn) (1.25.2)
Requirement already satisfied: scipy>=1.3.2 in /usr/local/lib/python3.10/dist-packages (from scikit-learn) (1.11.4)
Requirement already satisfied: joblib>=1.1.1 in /usr/local/lib/python3.10/dist-packages (from scikit-learn) (1.4.0)
Requirement already satisfied: threadpoolctl>=2.0.0 in /usr/local/lib/python3.10/dist-packages (from scikit-learn) (3.4.0)
```

```
import pandas as pd
```

```
X = pd.DataFrame(X)
```

```
missing_values = X.isnull().sum()
print(missing_values)
```

```
0    0
1    0
2    0
3    0
4    0
5    0
dtype: int64
```

```
imputer = SimpleImputer(strategy="mean")
X = imputer.fit_transform(X)
```

```
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.3, random_state=101)
d_tree = DecisionTreeClassifier()
d_tree.fit(X_train, y_train)
```

```
predicted = d_tree.predict(X_test)
print(metrics.classification_report(y_test, predicted))
print(metrics.confusion_matrix(y_test, predicted))
print("Accuracy:", metrics.accuracy_score(y_test, predicted))
print("Precision:", metrics.precision_score(y_test, predicted))
print("Recall:", metrics.recall_score(y_test, predicted))
```

```
                  precision    recall  f1-score   support

               0       1.00      0.99      1.00       109
               1       0.00      0.00      0.00         0

        accuracy                           0.99       109
       macro avg       0.50      0.50      0.50       109
    weighted avg       1.00      0.99      1.00       109

    [[108   1]
     [  0   0]]
    Accuracy: 0.9908256880733946
    Precision: 0.0
    Recall: 0.0
```

```
#prediction using decision tree
classes={0:'safe',1:'On Fire'}
x_new=[[12, 4, 9 ,11 ,92, 133]]
y_predict=d_tree.predict(x_new)
print(classes[y_predict[0]])
```

```
safe
```

Naive Bayes

```
import pandas as pd

# Convert X to a pandas.DataFrame object
X = pd.DataFrame(X)

# Calculate the sum of missing values for each column
missing_values = X.isnull().sum()

# Print the missing values
print(missing_values)
```

```
0    0
1    0
2    0
3    0
4    0
5    0
dtype: int64
```

```
from sklearn.impute import SimpleImputer
imputer = SimpleImputer(strategy="mean")
X = imputer.fit_transform(X)
```

```
from sklearn.naive_bayes import GaussianNB
```

```
# fit a Naive Bayes model to the data
G_NB = GaussianNB()
G_NB.fit(X_train,y_train)

# make predictions
predict = G_NB.predict(X_test)

# summarize the fit of the model
print(metrics.classification_report(y_test, predict))
print(metrics.confusion_matrix(y_test, predict))

print("Accuracy:",metrics.accuracy_score(y_test, predict))
print("Precision:",metrics.precision_score(y_test, predict))
print("Recall:",metrics.recall_score(y_test, predict))
```

```
                   precision    recall  f1-score   support

                0       1.00      1.00      1.00       109

         accuracy                           1.00       109
        macro avg       1.00      1.00      1.00       109
     weighted avg       1.00      1.00      1.00       109

     [[109]]
     Accuracy: 1.0
     Precision: 0.0
     Recall: 0.0
```

```
#prediction using naive bayes
classes={0:'safe',1:'On Fire'}
x_new=[[12, 4, 9 ,11 ,92, 133]]
y_predict=G_NB.predict(x_new)
print(classes[y_predict[0]])
```

```
     safe
```

Random Forest

```
!pip install scikit-learn
```

```
     Requirement already satisfied: scikit-learn in /usr/local/lib/python3.10/dist-packages (1.2.2)
     Requirement already satisfied: numpy>=1.17.3 in /usr/local/lib/python3.10/dist-packages (from scikit-learn) (1.25.2)
     Requirement already satisfied: scipy>=1.3.2 in /usr/local/lib/python3.10/dist-packages (from scikit-learn) (1.11.4)
     Requirement already satisfied: joblib>=1.1.1 in /usr/local/lib/python3.10/dist-packages (from scikit-learn) (1.4.0)
     Requirement already satisfied: threadpoolctl>=2.0.0 in /usr/local/lib/python3.10/dist-packages (from scikit-learn) (3.4.0)
```

```
from sklearn.ensemble import RandomForestClassifier
from sklearn import metrics
from sklearn.model_selection import train_test_split
```

```
import pandas as pd

# Convert X to a pandas.DataFrame object
X = pd.DataFrame(X)

# Calculate the sum of missing values for each column
missing_values = X.isnull().sum()

# Print the missing values
print(missing_values)
```

```
     0    0
     1    0
     2    0
     3    0
     4    0
     5    0
     dtype: int64
```

```
# Drop rows with missing values
X = X.dropna()
y = y.dropna()

# OR

# Impute missing values
from sklearn.impute import SimpleImputer
imputer = SimpleImputer(strategy='mean')
X = imputer.fit_transform(X)


X_train, X_test, y_train, y_test = train_test_split(X,y, test_size=0.3,random_state=101)

random_forest = RandomForestClassifier()
random_forest.fit(X_train,y_train)

predict = random_forest.predict(X_test)

print(metrics.classification_report(y_test, predict))
print(metrics.confusion_matrix(y_test, predict))
```