FLOOD PREDICTION

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Project Title : Flood prediction using Machine Learning.

INTRODUCTION

Floods are inevitable, but with timely alerts, their effects can be minimized. There are many people who die every year due to devastating floods, the number of people become homeless and many people die due to lack of proper help after a flood. The lack of timely alerts has always been an issue concerning it.

Delay in alerts in flood-prone areas is the biggest loophole of an economy. Conventional systems run a little low in forecasting floods at the right time so that proper actions could be taken before any disaster.

By using machine learning we can predict floods or forecast floods with better accuracy. This project aims at building predictive modeling based on the historical weather data of particular areas in order to predict the occurrence of floods.

The predictive model is built on different machine learning algorithms. The concerned authority monitor this flood prediction system through a web application.

LITERATURE SURVEY

For this project, we need to use classification algorithms as the output we will get is categorical values which is either floods will occur or not so, we need to build the most accurate classification algorithm to get the desired output

In this project,we will be using classification algorithms such as Decision tree, Random forest, KNN, and xgboost. We will train and test the data with these algorithms. From this best model is selected and saved in save format. We will be doing flask integration and cloud deployment.

THEORETICAL ANALYSIS

1. Install Required Libraries.
2. Data Collection.
   - Collect the dataset or Create the dataset
3. DataPreprocessing.
   - Import the Libraries.
   - Importing the dataset.
   - Understanding Data Type and Summary of features.
   - Take care of missing data
   - Data Visualization.
   - Drop the column from DataFrame & replace the missing value.
   - Splitting the Dataset into Dependent and Independent variables
   - Splitting Data into Train and Test.

4. Model Building
   - Training and testing the model
   - Evaluation of Model
   - Saving the Model

5. Application Building
   - Create an HTML file
   - Build a Python Code
6. Final UI
   - Dashboard Of the flask app.

HARDWARE / SOFTWARE REQUIREMENTS

Hardware Requirements :

-> Processor : Intel(R) Core(TM) i3 - 6100U 2.30GHz / Equivalent processor
-> RAM : 4Gb or more
->Storage : A basic hard disk of storing files.

Software requirements :

->Anaconda Software
->Visual Studio code / Spyder Software

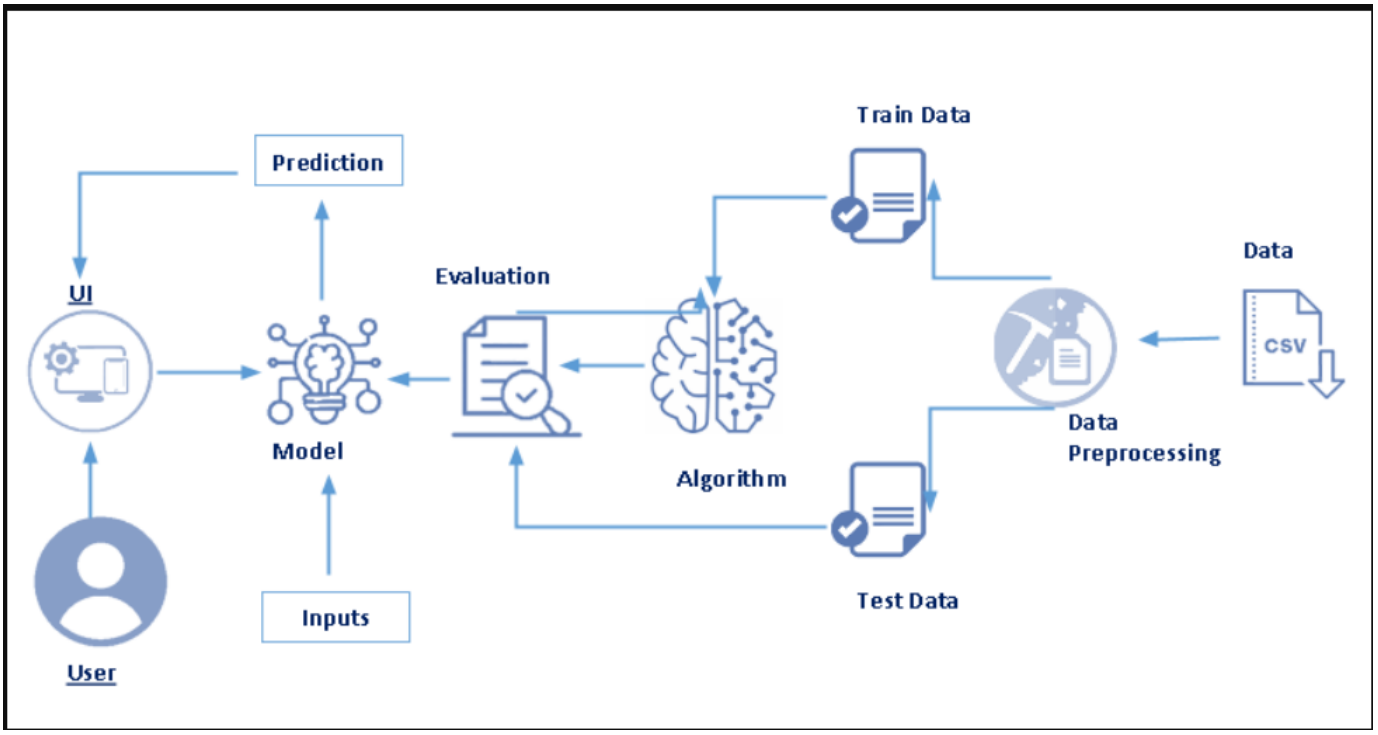
EXPERIMENTAL INVESTIGATIONS

Category: Machine Learning

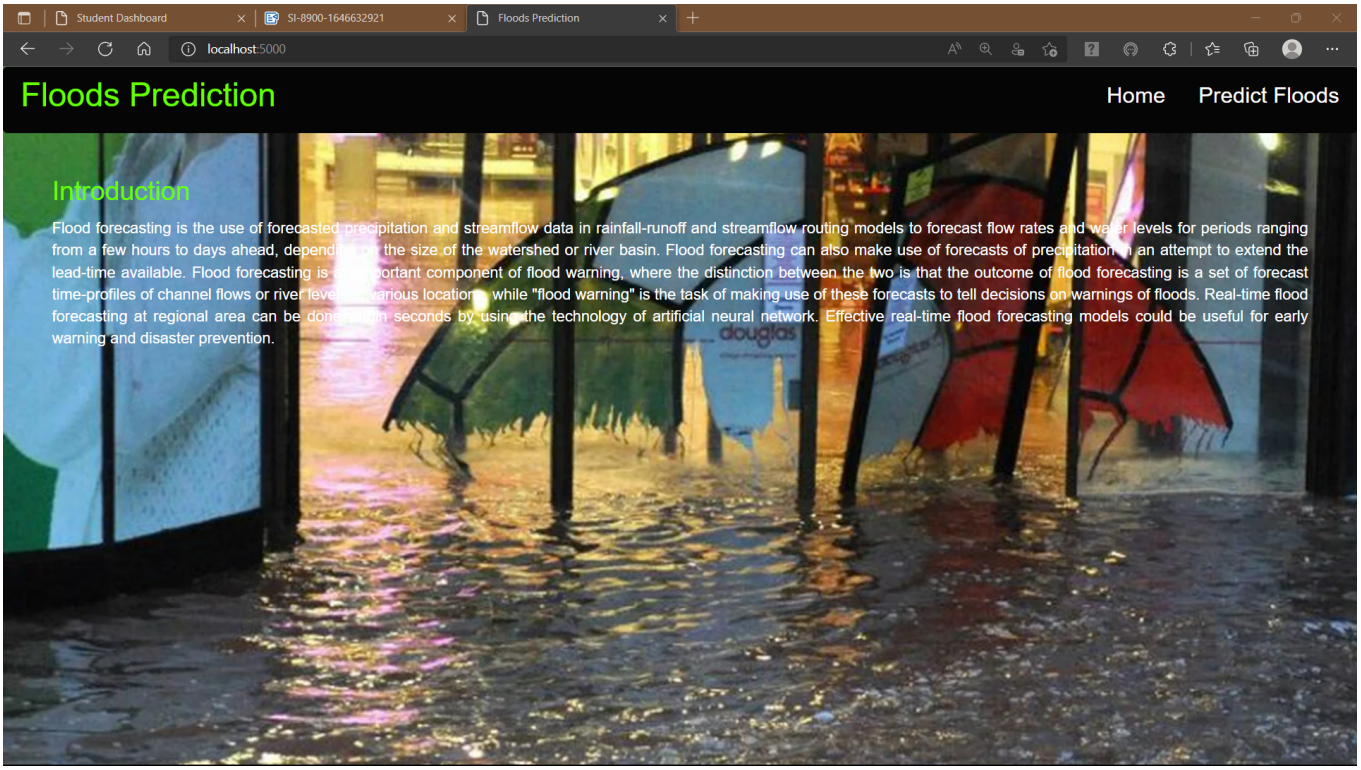
Skills Required:
Python,Python Web Frame Works,Python For Data Analysis,Exploratory Data Analysis,Data Preprocessing Techniques,Machine Learning

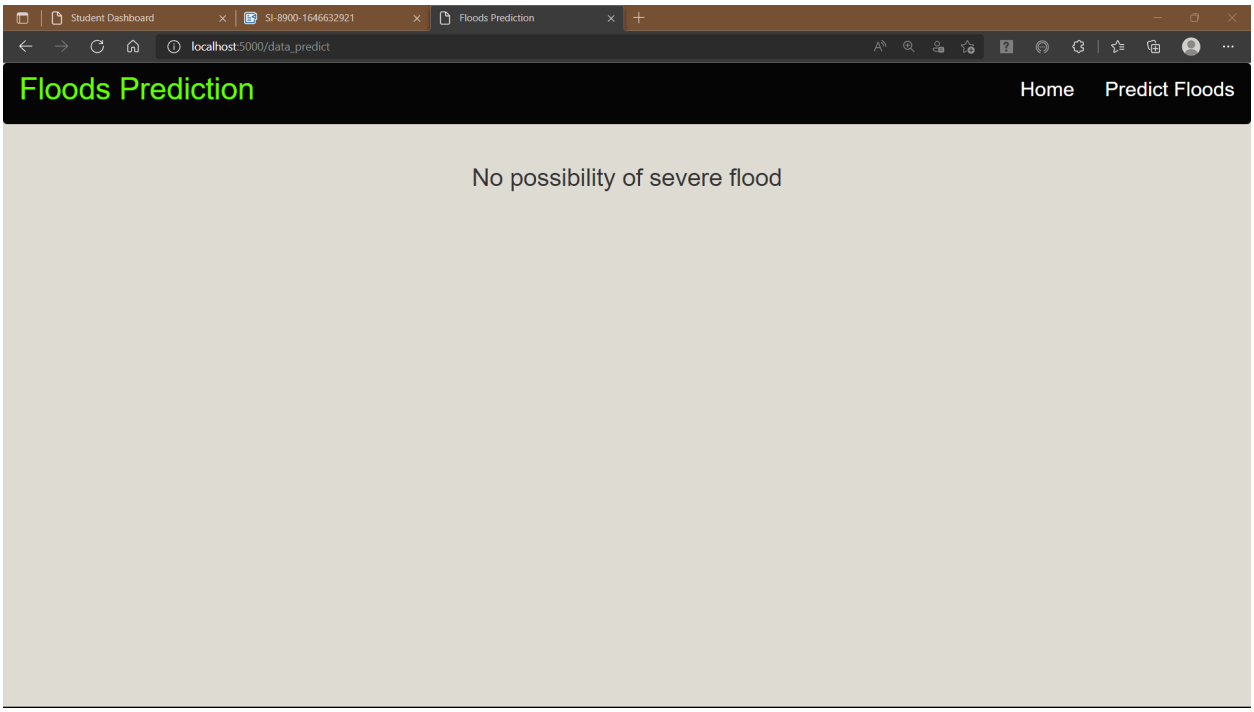
While working on the solution, I have seen the dataset of the floods and its quite frequent to see the whether forecast change drastically and cloud cover increases , rainfalls in the months April to June and lastly floods occur.There is interconnection of all the factors which leads to floods.

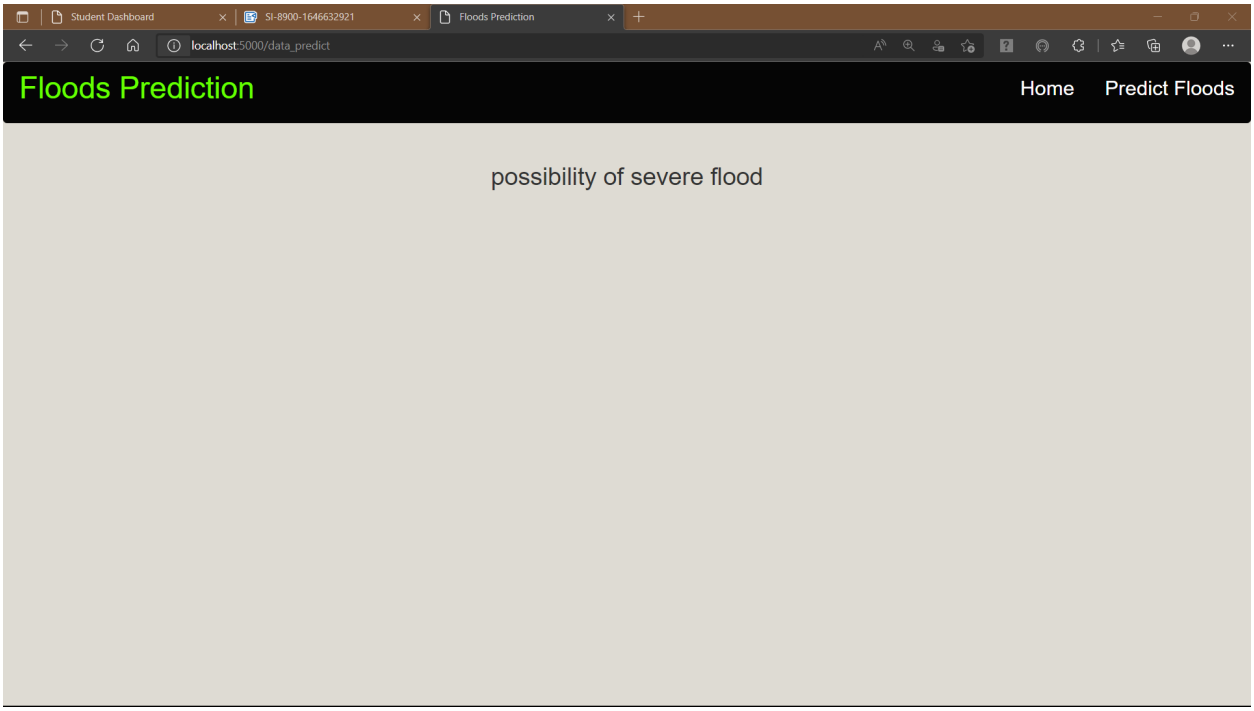
FLOW CHART



RESULT




Student Dashboard
SI-8900-1646632921
Floods Prediction
localhost:5000/data_predict
Floods Prediction
Home
Predict Floods
No possibility of severe flood


Student Dashboard
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Floods Prediction
Home
Predict Floods
possibility of severe flood

ADVANTAGES AND DISADVANTAGES

ADVANTAGES :
->The main purpose of flood warning is to save life by allowing people, support and emergency services time to prepare for flooding.
->The model which I built is 96 % accurate so one can rely on the prediction done by the model.
->With the help of this model , you can determine and manage environmental and water resource systems.
->Knowledge about the characteristics of a river's drainage basin, such as soil-moisture conditions, ground temperature, snowpack, topography, vegetation cover, and impermeable land area, which can help to predict how extensive and damaging a flood might become.

DISADVANTAGES :
->One of the algorithm used in this model is Random Forest, where it can become a plot as it gets prediction accuracy on complex problems is usually inferior to Gradient - Boosted Trees.

APPLICATIONS

The applications in flood prediction can be classified according to flood resource variables, i.e., water level, river flood, soil moisture, rainfall–discharge, precipitation, river inflow, peak flow, river flow, rainfall–runoff, flash flood, rainfall, streamflow, seasonal stream flow.

CONCLUSION

The summary of the project is that even though Floods are inevitable, they can be prevented with accurate measures like predicting the outcomes, changes to be taken to be on the safe side like building dams, reservoirs etc..and especially the technology has taken huge turn so, it will be matter of time before we gain control on what we are challenged.

FUTURE SCOPE

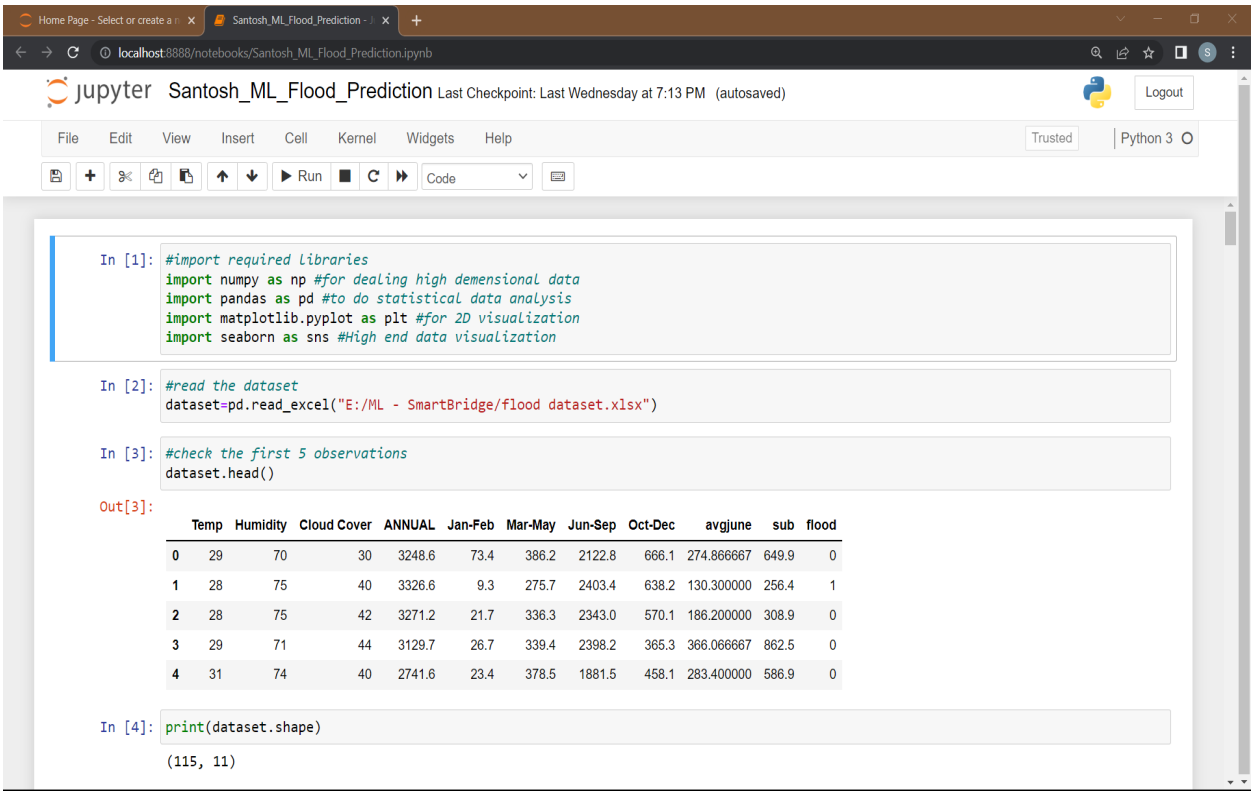
There can be future changes can be made to my model by adding the data like water level, soil moisture, average temperature of the area, rainfall - discharge , precipitation , drainage systems in the area etc.... in the dataset makes even more accurate and since the data will be enhanced, the analysis becomes the key part in the prediction.

BIBILOGRAPHY

There are some references which are to be considered while making the project.

URL - 1 : Flood prediction - Oxford Reference
URL - 2 :Flood Forecasting - an overview | ScienceDirect Topics

APPENDIX - SOURCE CODE



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Run | Code

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

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 115 entries, 0 to 114
Data columns (total 11 columns):
 #   Column       Non-Null Count  Dtype
---  ------       --------------  -----
 0   Temp         115 non-null    int64
 1   Humidity     115 non-null    int64
 2   Cloud Cover  115 non-null    int64
 3   ANNUAL       115 non-null    float64
 4   Jan-Feb      115 non-null    float64
 5   Mar-May      115 non-null    float64
 6   Jun-Sep      115 non-null    float64
 7   Oct-Dec      115 non-null    float64
 8   avgjune      115 non-null    float64
 9   sub          115 non-null    float64
 10  flood        115 non-null    int64
dtypes: float64(7), int64(4)
memory usage: 10.0 KB
None
```

In [6]:
```
dataset.columns
```

Out[6]:
```
Index(['Temp', 'Humidity', 'Cloud Cover', 'ANNUAL', 'Jan-Feb', 'Mar-May',
       'Jun-Sep', 'Oct-Dec', 'avgjune', 'sub', 'flood'],
      dtype='object')
```

In [7]:
```
dataset.describe().T
```

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Run | Code

In [7]:
```
dataset.describe().T
```

Out[7]:

	count	mean	std	min	25%	50%	75%	max
Temp	115.0	29.600000	1.122341	28.0	29.000000	30.000000	31.000000	31.000000
Humidity	115.0	73.852174	2.947623	70.0	71.000000	74.000000	76.000000	79.000000
Cloud Cover	115.0	36.286957	4.330158	30.0	32.500000	36.000000	40.000000	44.000000
ANNUAL	115.0	2925.487826	422.112193	2068.8	2627.900000	2937.500000	3164.100000	4257.800000
Jan-Feb	115.0	27.739130	22.361032	0.3	10.250000	20.500000	41.600000	98.100000
Mar-May	115.0	377.253913	151.091850	89.9	276.750000	342.000000	442.300000	915.200000
Jun-Sep	115.0	2022.840870	386.254397	1104.3	1768.850000	1948.700000	2242.900000	3451.300000
Oct-Dec	115.0	497.636522	129.860643	166.6	407.450000	501.500000	584.550000	823.300000
avgjune	115.0	218.100870	62.547597	65.6	179.666667	211.033333	263.833333	366.066667
sub	115.0	439.801739	210.438813	34.2	295.000000	430.600000	577.650000	982.700000
flood	115.0	0.139130	0.347597	0.0	0.000000	0.000000	0.000000	1.000000

In [8]:
```
#checking null values
dataset.isnull().any()
```

Out[8]:
```
Temp           False
Humidity       False
Cloud Cover    False
ANNUAL         False
Jan-Feb        False
```

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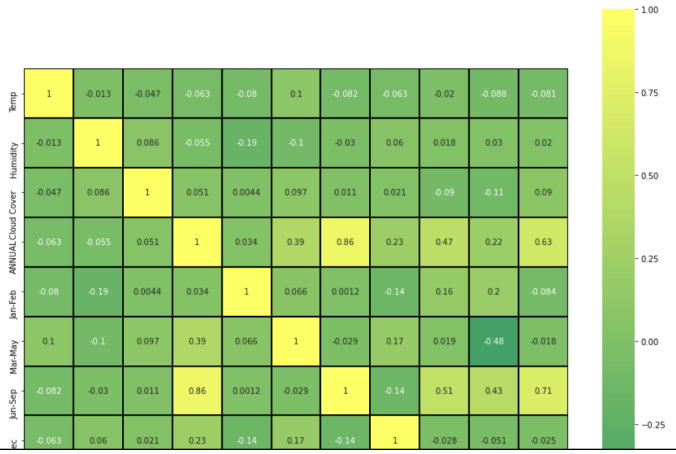
Run Code

In [9]:
```
#Correlation
dataset.corr()
```

Out[9]:

	Temp	Humidity	Cloud Cover	ANNUAL	Jan-Feb	Mar-May	Jun-Sep	Oct-Dec	avgjune	sub	flood
Temp	1.000000	-0.012727	-0.046568	-0.063014	-0.080076	0.099519	-0.081965	-0.063034	-0.019751	-0.088331	-0.080946
Humidity	-0.012727	1.000000	0.085824	-0.054767	-0.185965	-0.101232	-0.029583	0.059739	0.017656	0.029981	0.020250
Cloud Cover	-0.046568	0.085824	1.000000	0.051166	0.004376	0.096645	0.010833	0.020966	-0.089843	-0.106455	0.089801
ANNUAL	-0.063014	-0.054767	0.051166	1.000000	0.033639	0.387790	0.861190	0.232069	0.474644	0.220009	0.626874
Jan-Feb	-0.080076	-0.185965	0.004376	0.033639	1.000000	0.066479	0.001178	-0.143670	0.164691	0.201266	-0.084446
Mar-May	0.099519	-0.101232	0.096645	0.387790	0.066479	1.000000	-0.029007	0.171805	0.019183	-0.475750	-0.017598
Jun-Sep	-0.081965	-0.029583	0.010833	0.861190	0.001178	-0.029007	1.000000	-0.141467	0.511113	0.431997	0.705202
Oct-Dec	-0.063034	0.059739	0.020966	0.232069	-0.143670	0.171805	-0.141467	1.000000	-0.028055	-0.050862	-0.024852
avgjune	-0.019751	0.017656	-0.089843	0.474644	0.164691	0.019183	0.511113	-0.028055	1.000000	0.780445	0.379778
sub	-0.088331	0.029981	-0.106455	0.220009	0.201266	-0.475750	0.431997	-0.050862	0.780445	1.000000	0.349828
flood	-0.080946	0.020250	0.089801	0.626874	-0.084446	-0.017598	0.705202	-0.024852	0.379778	0.349828	1.000000

In [10]:
```
import seaborn as sns
fig=plt.gcf()
fig.set_size_inches(15,15)
fig=sns.heatmap(dataset.corr(),annot=True,cmap='summer',
                linewidths=1,linecolor='k',square=True,
                mask=False, vmin=-1, vmax=1,
                cbar_kws={"orientation": "vertical"},cbar=True)
```



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Run Code

In [11]:
```
dataset.drop(["Oct-Dec"],axis=1,inplace=True)
```

In [12]:
```
dataset.head()
```

Out[12]:

	Temp	Humidity	Cloud Cover	ANNUAL	Jan-Feb	Mar-May	Jun-Sep	avgjune	sub	flood
0	29	70	30	3248.6	73.4	386.2	2122.8	274.866667	649.9	0
1	28	75	40	3326.6	9.3	275.7	2403.4	130.300000	256.4	1
2	28	75	42	3271.2	21.7	336.3	2343.0	186.200000	308.9	0
3	29	71	44	3129.7	26.7	339.4	2398.2	366.066667	862.5	0
4	31	74	40	2741.6	23.4	378.5	1881.5	283.400000	586.9	0

In [13]:
```
dataset['flood'].value_counts()
```

Out[13]:
```
0    99
1    16
Name: flood, dtype: int64
```

In [14]:
```
#independent features
x=dataset.iloc[:,2:7].values
```

In [15]:
```
#dependent feature
y=dataset.iloc[:,9:].values
```

In [16]:
```
x.shape
```

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Run Code

In [17]:
```
y.shape
```

Out[17]:
```
(115, 1)
```

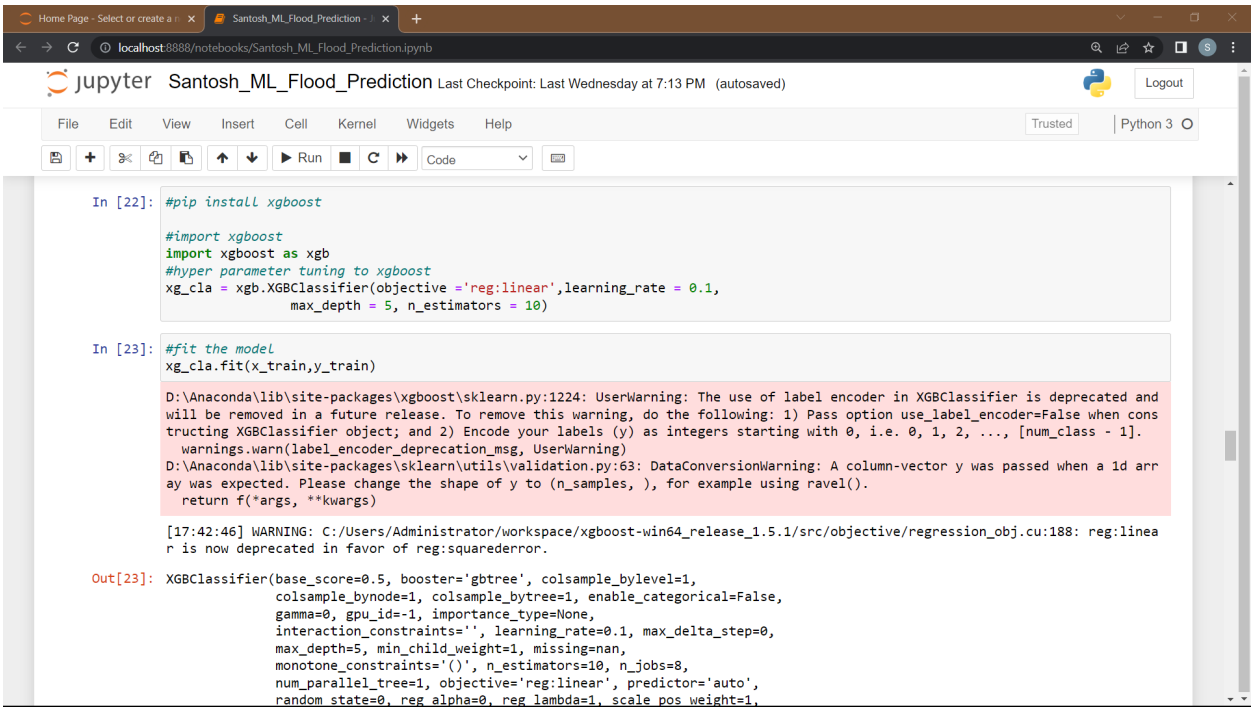
In [18]:
```
#split the data into train and test set from our x and y
#import train_test_split fucntion
from sklearn.model_selection import train_test_split
x_train,x_test,y_train,y_test = train_test_split(x,y,test_size=0.25,random_state=10)
```

In [19]:
```
#checking the shape of our 4 variables
print(x_train.shape)
print(x_test.shape)
print(y_train.shape)
print(y_test.shape)
```

```
(86, 5)
(29, 5)
(86, 1)
(29, 1)
```

In [20]:
```
#import Standardscaler
from sklearn.preprocessing import StandardScaler
#create object to Standardscaler class
sc=StandardScaler()
x_train=sc.fit_transform(x_train)
x_test=sc.fit_transform(x_test)
```

In [21]:
```
#import dump class from joblib
```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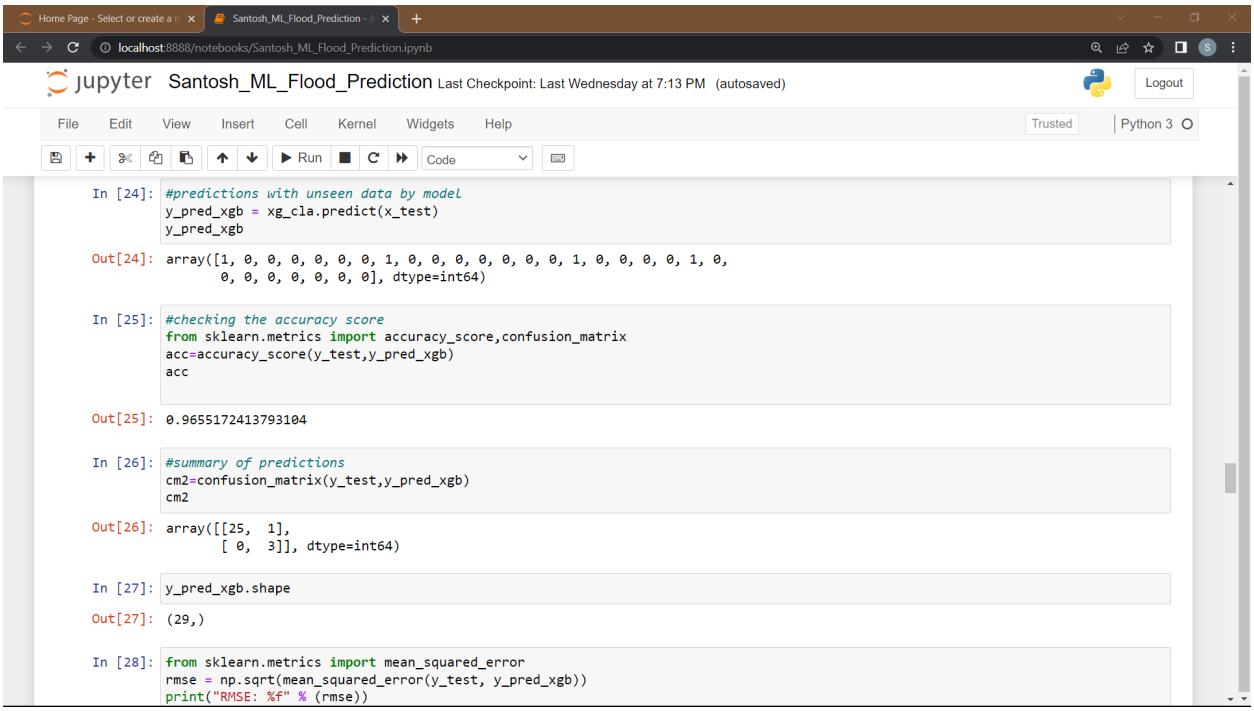
Python 3
Run
Code
In [22]:
#pip install xgboost
#import xgboost
import xgboost as xgb
#hyper parameter tuning to xgboost
xg_cla = xgb.XGBClassifier(objective ='reg:linear',learning_rate = 0.1,
max_depth = 5, n_estimators = 10)
In [23]:
#fit the model
xg_cla.fit(x_train,y_train)
D:\Anaconda\lib\site-packages\xgboost\sklearn.py:1224: UserWarning: The use of label encoder in XGBClassifier is deprecated and will be removed in a future release. To remove this warning, do the following: 1) Pass option use_label_encoder=False when constructing XGBClassifier object; and 2) Encode your labels (y) as integers starting with 0, i.e. 0, 1, 2, ..., [num_class - 1].
warnings.warn(label_encoder_deprecation_msg, UserWarning)
D:\Anaconda\lib\site-packages\sklearn\utils\validation.py:63: DataConversionWarning: A column-vector y was passed when a 1d array was expected. Please change the shape of y to (n_samples,), for example using ravel().
return f(*args, **kwargs)
[17:42:46] WARNING: C:/Users/Administrator/workspace/xgboost-win64_release_1.5.1/src/objective/regression_obj.cu:188: reg:linear is now deprecated in favor of reg:squarederror.
Out[23]:
XGBClassifier(base_score=0.5, booster='gbtree', colsample_bylevel=1,
colsample_bynode=1, colsample_bytree=1, enable_categorical=False,
gamma=0, gpu_id=-1, importance_type=None,
interaction_constraints='', learning_rate=0.1, max_delta_step=0,
max_depth=5, min_child_weight=1, missing=nan,
monotone_constraints='()', n_estimators=10, n_jobs=8,
num_parallel_tree=1, objective='reg:linear', predictor='auto',
random_state=0, reg_alpha=0, reg_lambda=1, scale_pos_weight=1,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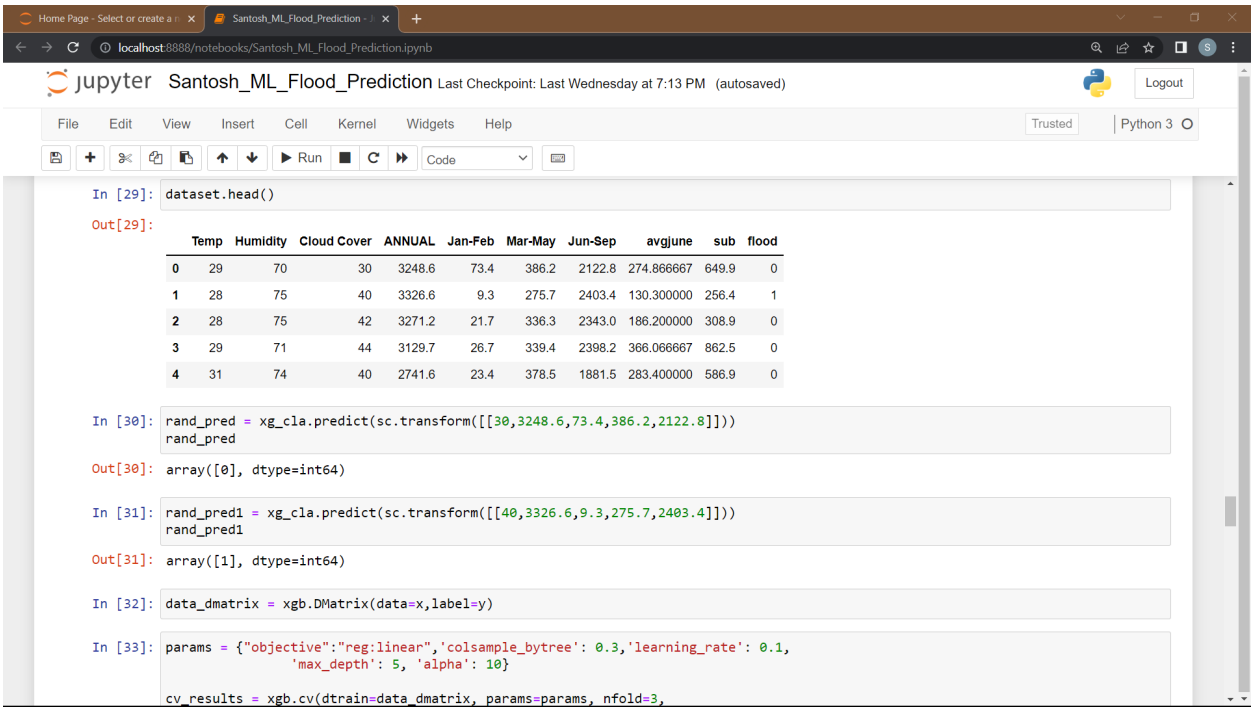
Python 3
Run
Code
In [24]:
#predictions with unseen data by model
y_pred_xgb = xg_cla.predict(x_test)
y_pred_xgb
Out[24]:
array([1, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 1, 0,
0, 0, 0, 0, 0, 0, 0], dtype=int64)
In [25]:
#checking the accuracy score
from sklearn.metrics import accuracy_score,confusion_matrix
acc=accuracy_score(y_test,y_pred_xgb)
acc
Out[25]:
0.9655172413793104
In [26]:
#summary of predictions
cm2=confusion_matrix(y_test,y_pred_xgb)
cm2
Out[26]:
array([[25, 1],
[0, 3]], dtype=int64)
In [27]:
y_pred_xgb.shape
Out[27]:
(29,)
In [28]:
from sklearn.metrics import mean_squared_error
rmse = np.sqrt(mean_squared_error(y_test, y_pred_xgb))
print("RMSE: %f" % (rmse))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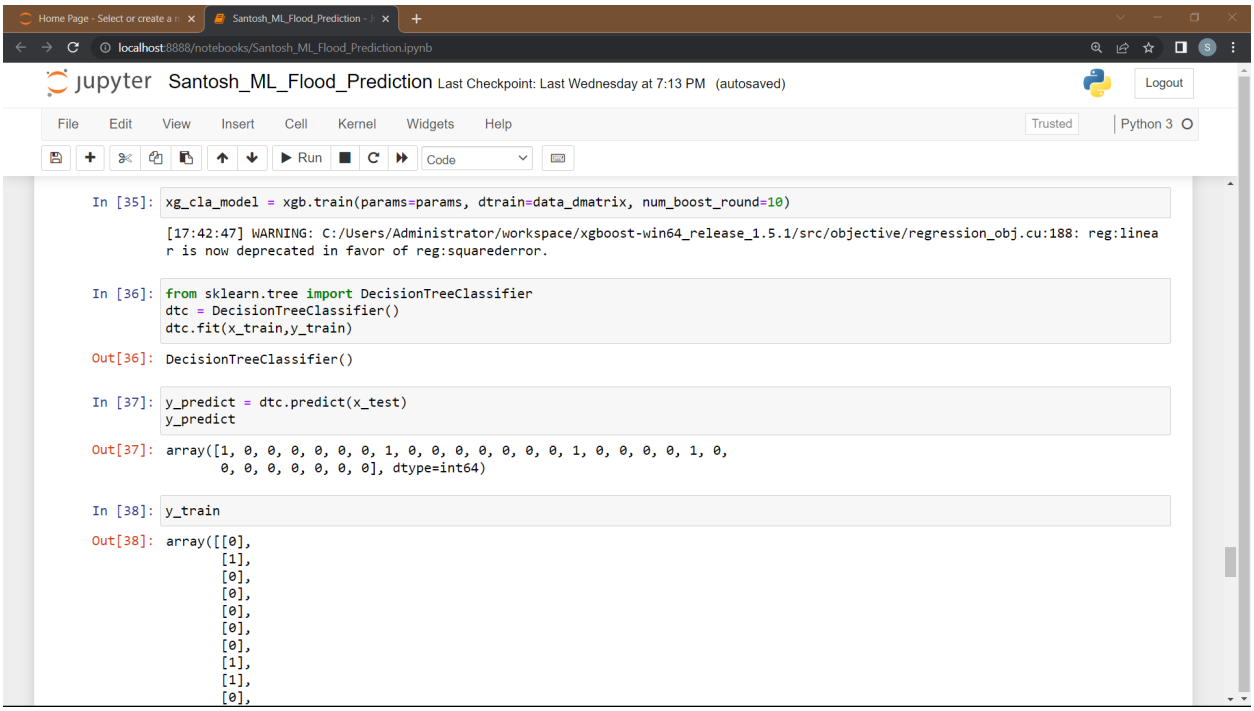
Trusted
Python 3
Run
Code
In [29]:
dataset.head()
Out[29]:
Temp Humidity Cloud Cover ANNUAL Jan-Feb Mar-May Jun-Sep avgjune sub flood
0 29 70 30 3248.6 73.4 386.2 2122.8 274.866667 649.9 0
1 28 75 40 3326.6 9.3 275.7 2403.4 130.300000 256.4 1
2 28 75 42 3271.2 21.7 336.3 2343.0 186.200000 308.9 0
3 29 71 44 3129.7 26.7 339.4 2398.2 366.066667 862.5 0
4 31 74 40 2741.6 23.4 378.5 1881.5 283.400000 586.9 0
In [30]:
rand_pred = xg_cla.predict(sc.transform([[30,3248.6,73.4,386.2,2122.8]]))
rand_pred
Out[30]:
array([0], dtype=int64)
In [31]:
rand_pred1 = xg_cla.predict(sc.transform([[40,3326.6,9.3,275.7,2403.4]]))
rand_pred1
Out[31]:
array([1], dtype=int64)
In [32]:
data_dmatrix = xgb.DMatrix(data=x,label=y)
In [33]:
params = {"objective":"reg:linear",'colsample_bytree': 0.3,'learning_rate': 0.1,
'max_depth': 5, 'alpha': 10}
cv_results = xgb.cv(dtrain=data_dmatrix, params=params, nfold=3,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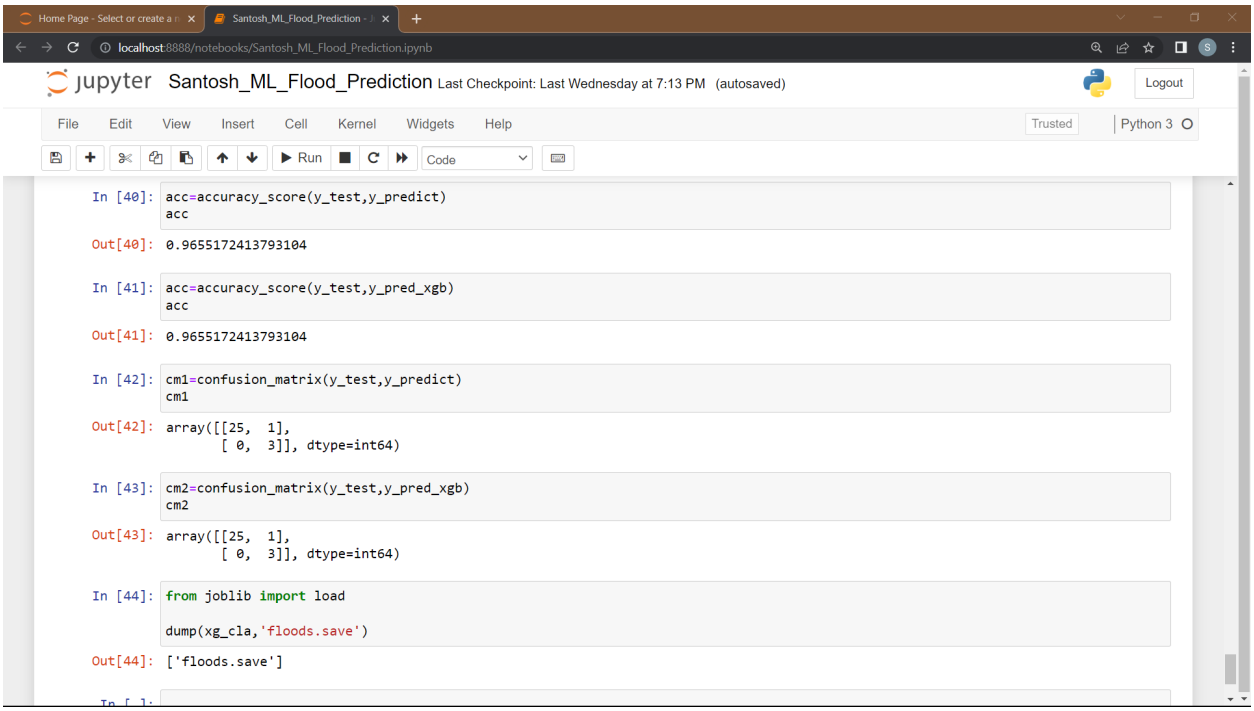
Trusted
Python 3
Run
Code
In [35]:
xg_cla_model = xgb.train(params=params, dtrain=data_dmatrix, num_boost_round=10)
[17:42:47] WARNING: C:/Users/Administrator/workspace/xgboost-win64_release_1.5.1/src/objective/regression_obj.cu:188: reg:linea
r is now deprecated in favor of reg:squarederror.
In [36]:
from sklearn.tree import DecisionTreeClassifier
dtc = DecisionTreeClassifier()
dtc.fit(x_train,y_train)
Out[36]:
DecisionTreeClassifier()
In [37]:
y_predict = dtc.predict(x_test)
y_predict
Out[37]:
array([1, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 1, 0,
0, 0, 0, 0, 0, 0, 0], dtype=int64)
In [38]:
y_train
Out[38]:
array([[0],
[1],
[0],
[0],
[0],
[0],
[0],
[1],
[1],
[0],



Santosh_ML_Flood_Prediction Last Checkpoint: Last Wednesday at 7:13 PM (autosaved)

Logout

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Trusted Python 3

Run Code

In [40]:
```
acc=accuracy_score(y_test,y_predict)
acc
```

Out[40]: 0.9655172413793104

In [41]:
```
acc=accuracy_score(y_test,y_pred_xgb)
acc
```

Out[41]: 0.9655172413793104

In [42]:
```
cm1=confusion_matrix(y_test,y_predict)
cm1
```

Out[42]:
```
array([[25,  1],
       [ 0,  3]], dtype=int64)
```

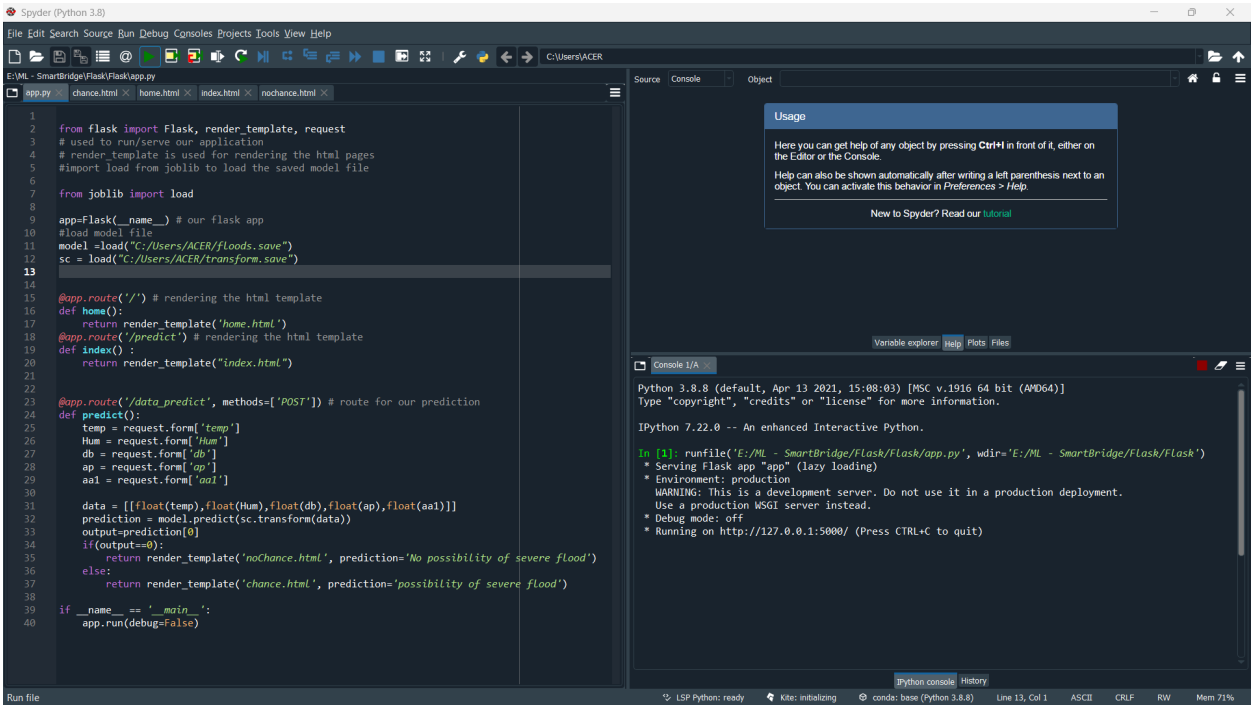
In [43]:
```
cm2=confusion_matrix(y_test,y_pred_xgb)
cm2
```

Out[43]:
```
array([[25,  1],
       [ 0,  3]], dtype=int64)
```

In [44]:
```
from joblib import load

dump(xg_cla,'floods.save')
```

Out[44]: ['floods.save']



Spyder (Python 3.8)

File Edit Search Source Run Debug Consoles Projects Tools View Help

E:\ML - SmartBridge\Flask\Flask\app.py

app.py chance.html home.html index.html nochance.html

```
from flask import Flask, render_template, request
# used to run/serve our application
# render_template is used for rendering the html pages
#import load from joblib to load the saved model file

from joblib import load

app=Flask(__name__) # our flask app
#load model file
model =load("C:/Users/ACER/floods.save")
sc = load("C:/Users/ACER/transform.save")


@app.route('/') # rendering the html template
def home():
    return render_template('home.html')
@app.route('/predict') # rendering the html template
def index() :
    return render_template("index.html")


@app.route('/data_predict', methods=['POST']) # route for our prediction
def predict():
    temp = request.form['temp']
    Hum = request.form['Hum']
    db = request.form['db']
    ap = request.form['ap']
    aa1 = request.form['aa1']

    data = [[float(temp),float(Hum),float(db),float(ap),float(aa1)]]
    prediction = model.predict(sc.transform(data))
    output=prediction[0]
    if(output==0):
        return render_template('noChance.html', prediction='No possibility of severe flood')
    else:
        return render_template('chance.html', prediction='possibility of severe flood')

if __name__ == '__main__':
    app.run(debug=False)
```

Usage

Here you can get help of any object by pressing **Ctrl+I** in front of it, either on the Editor or the Console.

Help can also be shown automatically after writing a left parenthesis next to an object. You can activate this behavior in *Preferences > Help*.

New to Spyder? Read our tutorial

Variable explorer Help Plots Files

Console 1/A

```
Python 3.8.8 (default, Apr 13 2021, 15:08:03) [MSC v.1916 64 bit (AMD64)]
Type "copyright", "credits" or "license" for more information.

IPython 7.22.0 -- An enhanced Interactive Python.

In [1]: runfile('E:/ML - SmartBridge/Flask/Flask/app.py', wdir='E:/ML - SmartBridge/Flask/Flask')
 * Serving Flask app "app" (lazy loading)
 * Environment: production
   WARNING: This is a development server. Do not use it in a production deployment.
   Use a production WSGI server instead.
 * Debug mode: off
 * Running on http://127.0.0.1:5000/ (Press CTRL+C to quit)
```

IPython console History

Run file

LSP Python: ready Kite: initializing conda: base (Python 3.8.8) Line 13, Col 1 ASCII CRLF RW Mem 71%