Import Dependencies

```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
from sklearn.utils import resample
from sklearn.model_selection import train_test_split,GridSearchCV,cross_val_score
from sklearn.ensemble import RandomForestClassifier
from sklearn.metrics import classification_report,confusion_matrix,accuracy_score
import pickle
```

Data Collection And Processing

```
#load data set
data=pd.read_csv('/content/Rainfall.csv')
print(type(data))
```

```
<class 'pandas.core.frame.DataFrame'>
```

```
data.shape
```

```
(366, 12)
```

```
data.head()
```

	day	pressure	maxtemp	temparature	mintemp	dewpoint	humidity	cloud	rainfall
0	1	1025.9	19.9	18.3	16.8	13.1	72	49	yes
1	2	1022.0	21.7	18.9	17.2	15.6	81	83	yes
2	3	1019.7	20.3	19.3	18.0	18.4	95	91	yes
3	4	1018.9	22.3	20.6	19.1	18.8	90	88	yes
4	5	1015.9	21.3	20.7	20.2	19.9	95	81	yes

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```
data.tail()
```

	day	pressure	maxtemp	temparature	mintemp	dewpoint	humidity	cloud	rainfal

361	27	1022.7	18.8	17.7	16.9	15.0	84	90	yes
362	28	1026.6	18.6	17.3	16.3	12.8	75	85	yes
363	29	1025.9	18.9	17.7	16.4	13.3	75	78	yes
364	30	1025.3	19.2	17.3	15.2	13.3	78	86	yes
365	31	1026.4	20.5	17.8	15.5	13.0	74	66	no

```
data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 366 entries, 0 to 365
Data columns (total 12 columns):
 #   Column                  Non-Null Count  Dtype  
---  ------                  --------------  -----  
 0   day                     366 non-null    int64  
 1   pressure                366 non-null    float64
 2   maxtemp                 366 non-null    float64
 3   temparature             366 non-null    float64
 4   mintemp                 366 non-null    float64
 5   dewpoint                366 non-null    float64
 6   humidity                366 non-null    int64  
 7   cloud                   366 non-null    int64  
 8   rainfall                366 non-null    object 
 9   sunshine                366 non-null    float64
 10           winddirection  365 non-null    float64
 11  windspeed               365 non-null    float64
dtypes: float64(8), int64(3), object(1)
memory usage: 34.4+ KB
```

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

```
data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 366 entries, 0 to 365
Data columns (total 12 columns):
 #   Column         Non-Null Count  Dtype  
---  ------         --------------  -----  
 0   day            366 non-null    int64  
 1   pressure       366 non-null    float64
 2   maxtemp        366 non-null    float64
 3   temparature    366 non-null    float64
 4   mintemp        366 non-null    float64
 5   dewpoint       366 non-null    float64
 6   humidity       366 non-null    int64  
 7   cloud          366 non-null    int64  
 8   rainfall       366 non-null    object 
 9   sunshine       366 non-null    float64
 10  winddirection  365 non-null    float64
 11  windspeed      365 non-null    float64
dtypes: float64(8), int64(3), object(1)
memory usage: 34.4+ KB
```

```
data=data.drop(columns=["day"])
```

```
data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 366 entries, 0 to 365
Data columns (total 11 columns):
 #   Column         Non-Null Count  Dtype  
---  ------         --------------  -----  
 0   pressure       366 non-null    float64
 1   maxtemp        366 non-null    float64
 2   temparature    366 non-null    float64
 3   mintemp        366 non-null    float64
 4   dewpoint       366 non-null    float64
 5   humidity       366 non-null    int64  
 6   cloud          366 non-null    int64  
 7   rainfall       366 non-null    object 
 8   sunshine       366 non-null    float64
 9   winddirection  365 non-null    float64
 10  windspeed      365 non-null    float64
dtypes: float64(8), int64(2), object(1)
memory usage: 31.6+ KB
```

```
data.isnull().sum()
```

	0
pressure	0
maxtemp	0
temparature	0
mintemp	0
dewpoint	0
humidity	0
cloud	0
rainfall	0
sunshine	0
winddirection	1
windspeed	1

dtype: int64

```
data["winddirection"].unique()
```

```
array([ 80.,  50.,  40.,  20.,  30.,  60.,  70.,  10., 200., 220., 120.,
       190., 210., 300., 240., 180., 230.,  90., 170., 150., 100., 130.,
        nan, 160., 270., 280., 250., 260., 290., 350., 110., 140.])
```

```
#handling missing Value
data["winddirection"].fillna(data["winddirection"].mode()[0])
data['windspeed'].fillna(data['windspeed'].mean())
```

	windspeed
0	26.3
1	15.3
2	14.2
3	16.9
4	13.7
...	...
361	18.4
362	25.9
363	33.4
364	20.9
365	23.3

366 rows × 1 columns

dtype: float64

```
data.isna().sum()
```

	0
pressure	0
maxtemp	0
temparature	0
mintemp	0
dewpoint	0
humidity	0

humidity	0
cloud	0
rainfall	0
sunshine	0
winddirection	1
windspeed	1

dtype: int64

```
data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 366 entries, 0 to 365
Data columns (total 11 columns):
 #   Column         Non-Null Count  Dtype  
---  ------         --------------  -----  
 0   pressure       366 non-null    float64
 1   maxtemp        366 non-null    float64
 2   temparature    366 non-null    float64
 3   mintemp        366 non-null    float64
 4   dewpoint       366 non-null    float64
 5   humidity       366 non-null    int64  
 6   cloud          366 non-null    int64  
 7   rainfall       366 non-null    object 
 8   sunshine       366 non-null    float64
 9   winddirection  365 non-null    float64
 10  windspeed      365 non-null    float64
dtypes: float64(8), int64(2), object(1)
memory usage: 31.6+ KB
```

```
#converting yes & no to 1 and o respectively
data['rainfall']=data['rainfall'].map({'yes':1,'no':0})
```

```
data['rainfall'].unique()
```

```
array([1, 0])
```

```
data.head()
```

	pressure	maxtemp	temparature	mintemp	dewpoint	humidity	cloud	rainfall	sunsl
0	1025.9	19.9	18.3	16.8	13.1	72	49	1	
1	1022.0	21.7	18.9	17.2	15.6	81	83	1	
2	1019.7	20.3	19.3	18.0	18.4	95	91	1	
3	1018.9	22.3	20.6	19.1	18.8	90	88	1	

3	1018.9	22.3	20.6	19.1	18.8	90	88	1
4	1015.9	21.3	20.7	20.2	19.9	95	81	1

Next steps: Generate code with data View recommended plots New interactive sheet

Exploraty Data Analysis(EDA)

```
data.shape
```

```
(366, 11)
```

```
#setting plot style for all the plot
sns.set_style("whitegrid")
```

```
data.describe()
```

	pressure	maxtemp	temparature	mintemp	dewpoint	humidity	cl
count	366.000000	366.000000	366.000000	366.000000	366.000000	366.000000	366.00
mean	1013.742623	26.191257	23.747268	21.894536	19.989071	80.177596	71.12
std	6.414776	5.978343	5.632813	5.594153	5.997021	10.062470	21.79
min	998.500000	7.100000	4.900000	3.100000	-0.400000	36.000000	0.00
25%	1008.500000	21.200000	18.825000	17.125000	16.125000	75.000000	58.00
50%	1013.000000	27.750000	25.450000	23.700000	21.950000	80.500000	80.00
75%	1018.100000	31.200000	28.600000	26.575000	25.000000	87.000000	88.00
max	1034.600000	36.300000	32.400000	30.000000	26.700000	98.000000	100.00

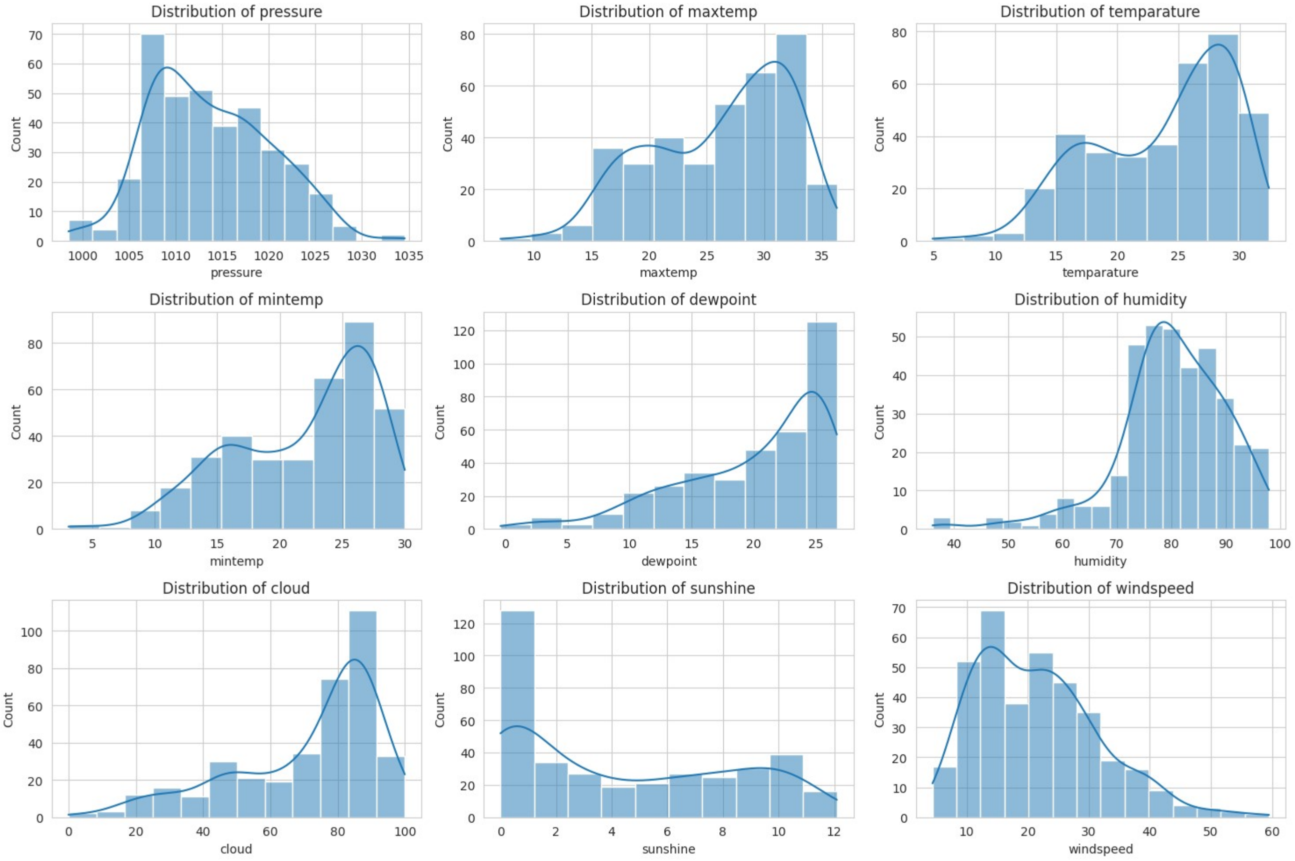
```
data.columns
```

```
Index(['pressure', 'maxtemp', 'temparature', 'mintemp', 'dewpoint', 'humidity',
       'cloud', 'rainfall', 'sunshine', 'winddirection', 'windspeed'],
      dtype='object')
```

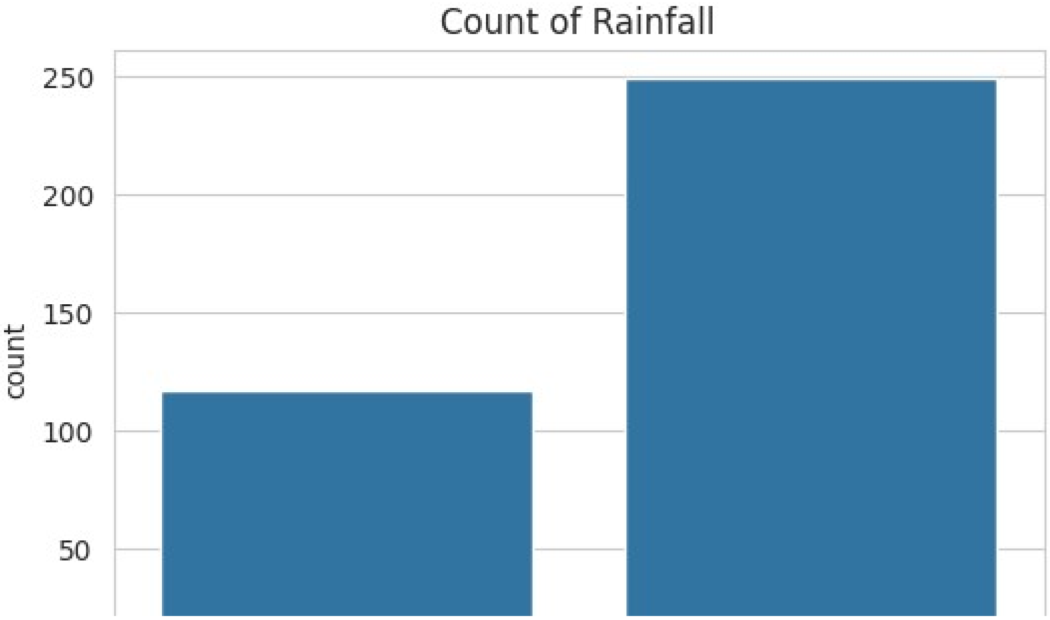
```
plt.figure(figsize=(15,10))
```

```
for i,column in enumerate(['pressure', 'maxtemp', 'temparature', 'mintemp', 'dewpoint', '
       'cloud',  'sunshine',  'windspeed'],1):
  plt.subplot(3,3,i)
  sns.histplot(data[column],kde=True)
```

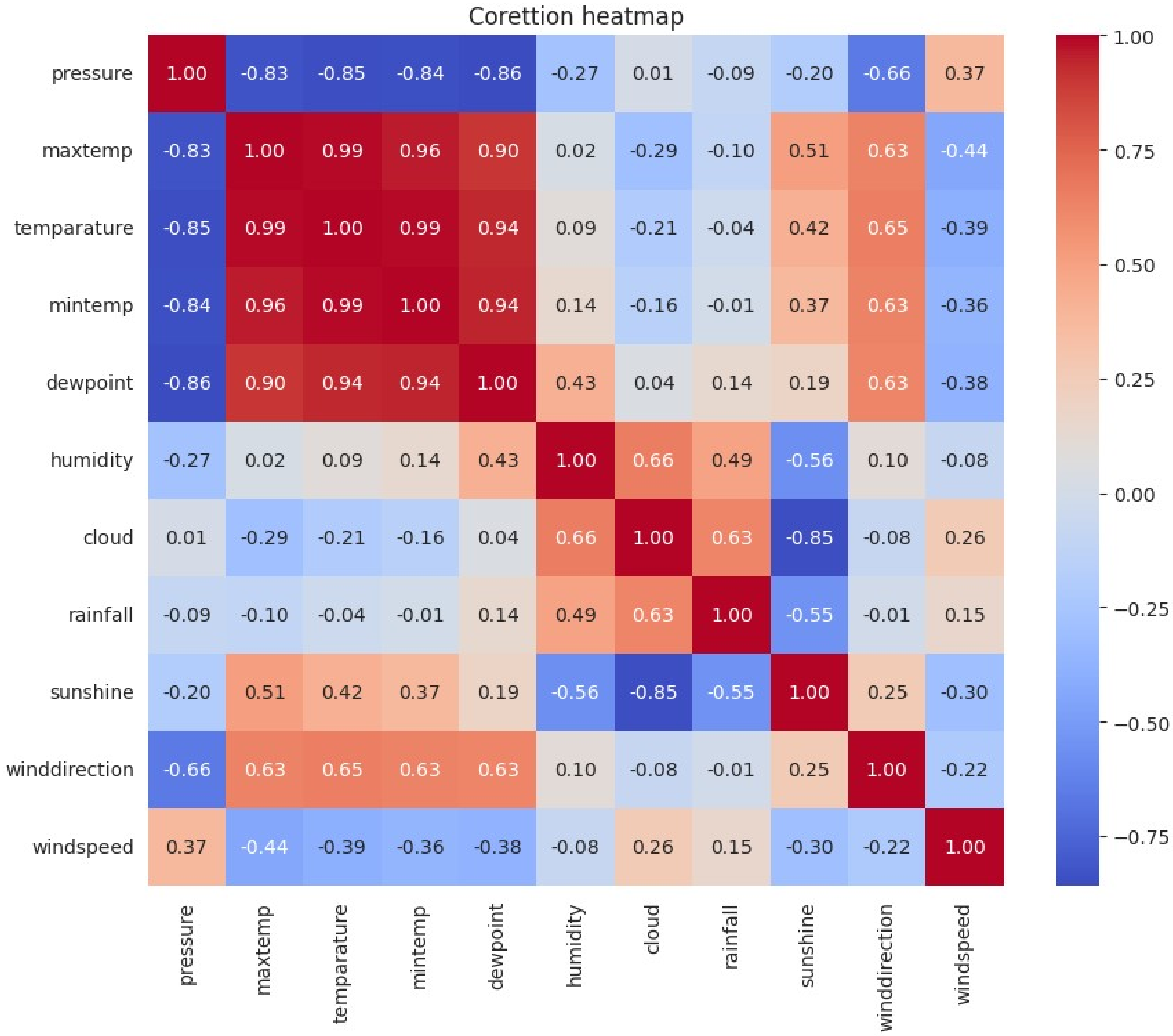
```
    plt.title(f"Distribution of {column}")

plt.tight_layout()
plt.show()
```



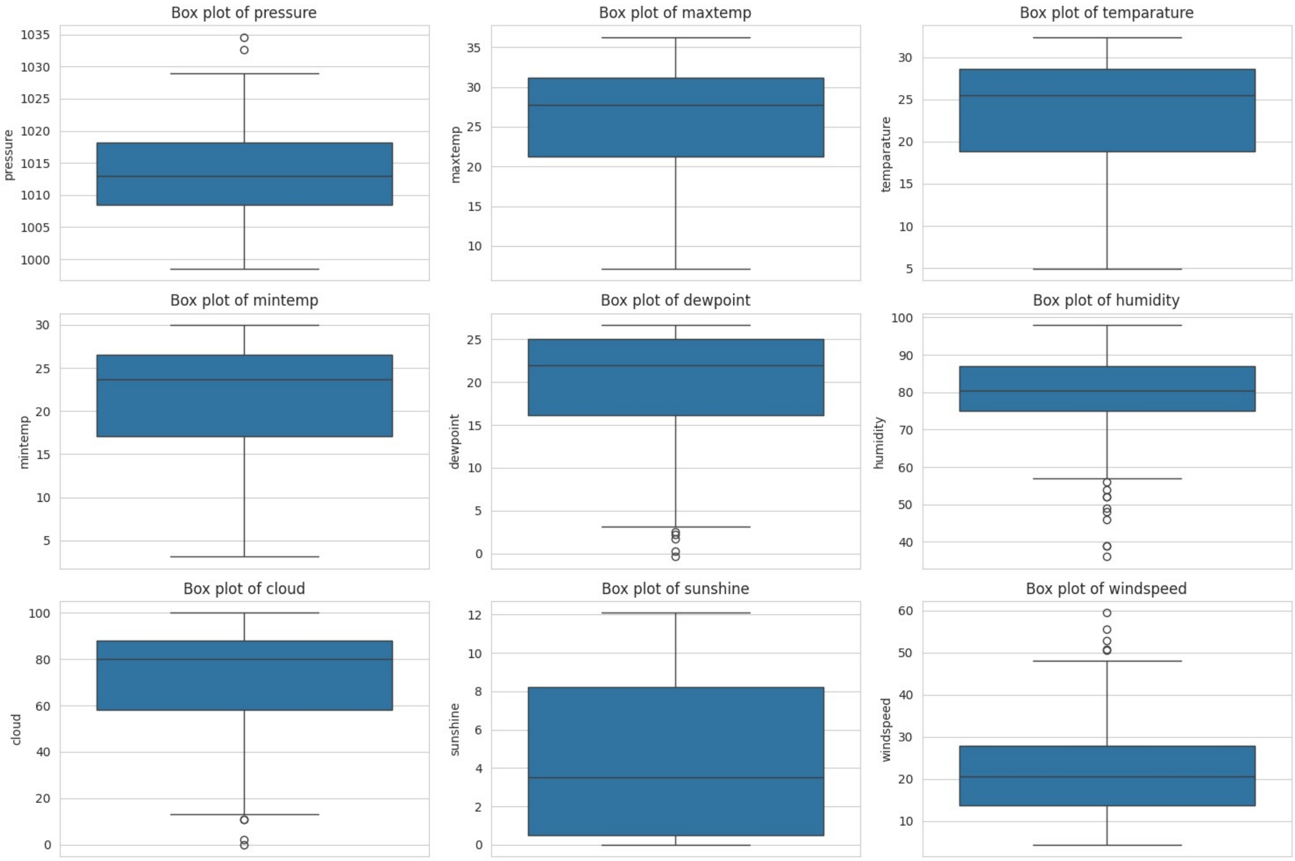
```
plt.figure(figsize=(6,4))
sns.countplot(x="rainfall",data=data)
plt.title("Count of Rainfall")
plt.show()
```



```
#corelation matrix
plt.figure(figsize=(10,8))
sns.heatmap(data.corr(),annot=True,cmap="coolwarm",fmt=".2f")
plt.title("Corettion heatmap")
plt.show()
```



```
plt.figure(figsize=(15,10))

for i,column in enumerate(['pressure', 'maxtemp', 'temparature', 'mintemp', 'dewpoint', '
       'cloud',  'sunshine',  'windspeed'],1):
  plt.subplot(3,3,i)
  sns.boxplot(data[column],)
  plt.title(f"Box plot of {column}")
plt.tight_layout()
plt.show()
```



```
#data Preproessing
data=data.drop(columns=['maxtemp','temparature','mintemp'])
```

```
data.head()
```

	pressure	dewpoint	humidity	cloud	rainfall	sunshine	winddirection	windspeed
0	1025.9	13.1	72	49	1	9.3	80.0	26.3
1	1022.0	15.6	81	83	1	0.6	50.0	15.3
2	1019.7	18.4	95	91	1	0.0	40.0	14.2
3	1018.9	18.8	90	88	1	1.0	50.0	16.9
4	1015.9	19.9	95	81	1	0.0	40.0	13.7

Next steps: Generate code with data View recommended plots New interactive sheet

```
data['rainfall'].value_counts()
```

	count
rainfall	
1	249
0	117

dtype: int64

```
#sepaate majority
df_majority=data[data['rainfall']==1]
df_minority=data[data['rainfall']==0]
```

```
print(df_majority.shape)
print(df_minority.shape)
```

```
(249, 8)
(117, 8)
```

```
df_majority_downsample=resample(df_majority,replace=False,n_samples=len(df_minority),rand
```

```
df_majority_downsample.shape
```

```
(117, 8)
```

```
df_downsampled=pd.concat([df_majority_downsample,df_minority])
```

```
df_downsampled.shape
```

```
(234, 8)
```

```
df_downsampled.head()
```

	pressure	dewpoint	humidity	cloud	rainfall	sunshine	winddirection	windspee
188	1005.9	25.6	77	53	1	10.5	270.0	11.
9	1017.5	15.5	85	91	1	0.0	70.0	37.
137	1012.3	20.1	80	86	1	0.3	80.0	39.
89	1018.3	16.3	79	89	1	2.4	40.0	14.
157	1008.8	24.7	91	80	1	2.2	20.0	11.

Next Generate code with df_downsampled View recommended plots New interactive sheet steps:

```
df_downsampled =df_downsampled.sample(frac=1,random_state=42).reset_index(drop=True)
```

```
df_downsampled.head()
```

	pressure	dewpoint	humidity	cloud	rainfall	sunshine	winddirection	windspeed
0	1022.2	14.1	78	90	1	0.0	30.0	28.5
1	1013.4	19.5	69	17	0	10.5	70.0	12.4
2	1006.1	24.4	74	27	0	10.8	220.0	8.7
3	1007.6	24.8	85	84	1	1.8	70.0	34.8
4	1021.2	8.4	66	18	0	10.1	20.0	24.4

Next steps: Generate code with `df_downsampled` View recommended plots New interactive sheet

```
df_downsampled['rainfall'].value_counts()
```

	count
rainfall	
1	117
0	117

dtype: int64

```
#splitt features and target as x and y
x=df_downsampled.drop(columns=['rainfall'])
y=df_downsampled['rainfall']
```

```
print(x)
```

```
     pressure  dewpoint  humidity  cloud  sunshine  winddirection  windspeed
0      1022.2      14.1        78     90       0.0           30.0       28.5
1      1013.4      19.5        69     17      10.5           70.0       12.4
2      1006.1      24.4        74     27      10.8          220.0        8.7
3      1007.6      24.8        85     84       1.8           70.0       34.8
4      1021.2       8.4        66     18      10.1           20.0       24.4
..        ...       ...       ...    ...       ...            ...        ...
229    1008.1      25.4        86     75       5.7           20.0        9.5
230    1010.1      19.9        91     89       0.0           70.0       31.8
231    1020.6      14.7        91     88       0.3           50.0       24.4
```

```
232    1008.3      24.1         74      29        5.7            10.0        4.4
233    1005.0      26.1         87      82        2.2           160.0       12.6

[234 rows x 7 columns]
```

```
#splitting the data into training data and test data
x_train,x_test,y_train,y_test=train_test_split(x,y,test_size=0.2,random_state=42)
```

```
x_test.shape
```

```
(47, 7)
```

Model Training

```
rf_model=RandomForestClassifier(random_state=42)

param_grid_rf ={
    'n_estimators':[50,100,200],
    'max_features':['sqrt','log2'],
    'max_depth':[None,10,20,30],
    'min_samples_split':[2,5,10],
    'min_samples_leaf':[1,2,4]


    }
```

```
grid_search_rf=GridSearchCV(estimator=rf_model,param_grid=param_grid_rf,cv=5,n_jobs=-1,ve
grid_search_rf.fit(x_train,y_train)
```

```
Fitting 5 folds for each of 216 candidates, totalling 1080 fits
▸              GridSearchCV
                                   i ?
▸           best_estimator_:
        RandomForestClassifier
   ▸ RandomForestClassifier  ?
```

```
best_rf_model=grid_search_rf.best_estimator_
print("best_rf_model:" ,grid_search_rf.best_params_)
```

```
best_rf_model: {'max_depth': 10, 'max_features': 'sqrt', 'min_samples_leaf': 1, 'min_
```

Model Evalution

```
cv_scores=cross_val_score(best_rf_model,x_train,y_train,cv=5)
print("CV scores:",cv_scores)
print("Mean CV score:",np.mean(cv_scores))
```

```
CV scores: [0.71052632 0.78947368 0.86486486 0.83783784 0.89189189]
Mean CV score: 0.818918918918919
```

```
#test set performance
y_pred=best_rf_model.predict(x_test)
print("Classification Report:\n",classification_report(y_test,y_pred))
print("Confusion Matrix:\n",confusion_matrix(y_test,y_pred))
print("Accuracy Score:",accuracy_score(y_test,y_pred))
```

```
Classification Report:
               precision    recall  f1-score   support

           0       0.77      0.71      0.74        24
           1       0.72      0.78      0.75        23

    accuracy                           0.74        47
   macro avg       0.75      0.75      0.74        47
weighted avg       0.75      0.74      0.74        47

Confusion Matrix:
 [[17  7]
 [ 5 18]]
Accuracy Score: 0.7446808510638298
```

Prediction on unkown data

```
input_data=(1015.9,19.9,95,81,0.0,40.0,13.7)
input_df =pd.DataFrame([input_data],columns=['pressure', 'dewpoint', 'humidity', '
       'winddirection', 'windspeed'])
prediction=best_rf_model.predict(input_df)
print("Prediction result:",'Rainfall' if prediction[0]==1 else 'No Rainfall')
```

```
Prediction result: Rainfall
```

```
#save model and feture names to a pickel file

model_data={"model":best_rf_model,"features_names":x.columns.tolist()}
with open("model.pkl","wb") as file:
  pickle.dump(model_data,file)
```

Load the saves model and file and use it for predition

```
import pickle
import pandas as pd


#load the trained model and fetures names from the pickel file
with open("model.pkl","rb") as file:
  model_data=pickle.load(file)


model=model_data["model"]
feture_names=model_data['features_names']


input_data=(1015.9,19.9,95,81,0.0,40.0,13.7)
input_df =pd.DataFrame([input_data],columns=feture_names)


prediction=model.predict(input_df)
print("Prediction result:",'Rainfall' if prediction[0]==1 else 'No Rainfall')
```

```
     Prediction result: Rainfall
```

Start coding or generate with AI.