In [ ]:
```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import folium
import imageio
from tqdm import tqdm_notebook
from folium.plugins import MarkerCluster
import imageio
import statsmodels.api as sm
import scipy
from itertools import product
import seaborn as sns
from numpy.random import seed
from numpy.random import randint
from numpy import mean
import matplotlib.pyplot as plt
from scipy.stats import shapiro
import collections
from sklearn import preprocessing

from sklearn.model_selection import train_test_split
import tensorflow as tf
from keras.models import Sequential
from keras.layers import Conv2D ,Dense, Flatten ,  MaxPool2D , Input
```

In [ ]:
```
def draw_corr(data,figsize = (12,12)):
    corr =data.corr()
    fig = plt.figure(figsize = figsize)
    # plt.matshow(correlations)
    plt.matshow(corr, cmap= 'RdBu', fignum=fig.number)
    plt.xticks(range(len(corr.columns)), corr.columns, rotation = 'vertical');
    plt.yticks(range(len(corr.columns)), corr.columns);
    plt.grid(False)
    plt.colorbar()


def minmaxscalar_pd(df):
    x = df.values #returns a numpy array
    min_max_scaler = preprocessing.MinMaxScaler()
    x_scaled = min_max_scaler.fit_transform(x)
    df = pd.DataFrame(x_scaled,columns=df.columns)
    return df
```

In [ ]:
```
data= pd.read_csv('weather1.csv')
```

In [ ]:
```
data.head()
```

Out[ ]:

	MinTemp	MaxTemp	Rainfall	Evaporation	Sunshine	WindGustDir	WindGustSpeed	WindDir9am
0	8.0	24.3	0.0	3.4	6.3	NW	30.0	SW
1	14.0	26.9	3.6	4.4	9.7	ENE	39.0	E
2	13.7	23.4	3.6	5.8	3.3	NW	85.0	N
3	13.3	15.5	39.8	7.2	9.1	NW	54.0	WNW
4	7.6	16.1	2.8	5.6	10.6	SSE	50.0	SSE

5 rows × 22 columns

In [ ]:
```
data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 366 entries, 0 to 365
Data columns (total 22 columns):
 #   Column         Non-Null Count  Dtype  
---  ------         --------------  -----  
 0   MinTemp        366 non-null    float64
 1   MaxTemp        366 non-null    float64
 2   Rainfall       366 non-null    float64
 3   Evaporation    366 non-null    float64
 4   Sunshine       363 non-null    float64
 5   WindGustDir    363 non-null    object 
 6   WindGustSpeed  364 non-null    float64
 7   WindDir9am     335 non-null    object 
 8   WindDir3pm     365 non-null    object 
 9   WindSpeed9am   359 non-null    float64
 10  WindSpeed3pm   366 non-null    int64  
 11  Humidity9am    366 non-null    int64  
 12  Humidity3pm    366 non-null    int64  
 13  Pressure9am    366 non-null    float64
 14  Pressure3pm    366 non-null    float64
 15  Cloud9am       366 non-null    int64  
 16  Cloud3pm       366 non-null    int64  
 17  Temp9am        366 non-null    float64
 18  Temp3pm        366 non-null    float64
 19  RainToday      366 non-null    object 
 20  RISK_MM        366 non-null    float64
 21  RainTomorrow   366 non-null    object 
dtypes: float64(12), int64(5), object(5)
memory usage: 63.0+ KB
```

In [ ]:
```
data.describe()
```

Out[ ]:

	MinTemp	MaxTemp	Rainfall	Evaporation	Sunshine	WindGustSpeed	WindSpeed9am
count	366.000000	366.000000	366.000000	366.000000	363.000000	364.000000	359.000000
mean	7.265574	20.550273	1.428415	4.521858	7.909366	39.840659	9.651811
std	6.025800	6.690516	4.225800	2.669383	3.481517	13.059807	7.951929
min	-5.300000	7.600000	0.000000	0.200000	0.000000	13.000000	0.000000
25%	2.300000	15.025000	0.000000	2.200000	5.950000	31.000000	6.000000
50%	7.450000	19.650000	0.000000	4.200000	8.600000	39.000000	7.000000
75%	12.500000	25.500000	0.200000	6.400000	10.500000	46.000000	13.000000
max	20.900000	35.800000	39.800000	13.800000	13.600000	98.000000	41.000000

In [ ]:
```
data2 = data.copy()
```

In [ ]:
```
data2['RainToday'] = data2['RainToday'].replace(['No','Yes'],[0,1])
```

In [ ]:
```
data2['RainToday']
```

Out[ ]:
```
0      0
1      1
2      1
3      1
4      1
      ..
361    0
362    0
363    0
364    0
365    0
Name: RainToday, Length: 366, dtype: int64
```

In [ ]:
```
data2.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 366 entries, 0 to 365
Data columns (total 22 columns):
 #   Column         Non-Null Count  Dtype  
---  ------         --------------  -----  
 0   MinTemp        366 non-null    float64
 1   MaxTemp        366 non-null    float64
 2   Rainfall       366 non-null    float64
 3   Evaporation    366 non-null    float64
 4   Sunshine       363 non-null    float64
 5   WindGustDir    363 non-null    object 
 6   WindGustSpeed  364 non-null    float64
 7   WindDir9am     335 non-null    object 
 8   WindDir3pm     365 non-null    object 
 9   WindSpeed9am   359 non-null    float64
 10  WindSpeed3pm   366 non-null    int64  
 11  Humidity9am    366 non-null    int64  
 12  Humidity3pm    366 non-null    int64  
 13  Pressure9am    366 non-null    float64
 14  Pressure3pm    366 non-null    float64
 15  Cloud9am       366 non-null    int64  
 16  Cloud3pm       366 non-null    int64  
 17  Temp9am        366 non-null    float64
 18  Temp3pm        366 non-null    float64
 19  RainToday      366 non-null    int64  
 20  RISK_MM        366 non-null    float64
 21  RainTomorrow   366 non-null    object 
dtypes: float64(12), int64(6), object(4)
memory usage: 63.0+ KB
```

In [ ]:
```
i = 'RainTomorrow'
data2[i] = data2[i].replace(['No','Yes'],[0,1])
```

In [ ]:
```
data3 = data2.select_dtypes(include=np.number)
```

In [ ]:
```
data3.head()
```

Out[ ]:

	MinTemp	MaxTemp	Rainfall	Evaporation	Sunshine	WindGustSpeed	WindSpeed9am	WindSpee
0	8.0	24.3	0.0	3.4	6.3	30.0	6.0	
1	14.0	26.9	3.6	4.4	9.7	39.0	4.0	
2	13.7	23.4	3.6	5.8	3.3	85.0	6.0	
3	13.3	15.5	39.8	7.2	9.1	54.0	30.0	
4	7.6	16.1	2.8	5.6	10.6	50.0	20.0	

In [ ]:
```
#discrete random variable
def get_frequencies(values):
    frequencies = {}
    for v in values:
        if v in frequencies:
            frequencies[v] += 1
        else:
            frequencies[v] = 1
    return frequencies
```

```
def get_probabilities(sampledata, freqs):
    probabilities = []
    for k, v in freqs.items():
        probabilities.append(round(v / len(sampledata), 1))
    return probabilities
```

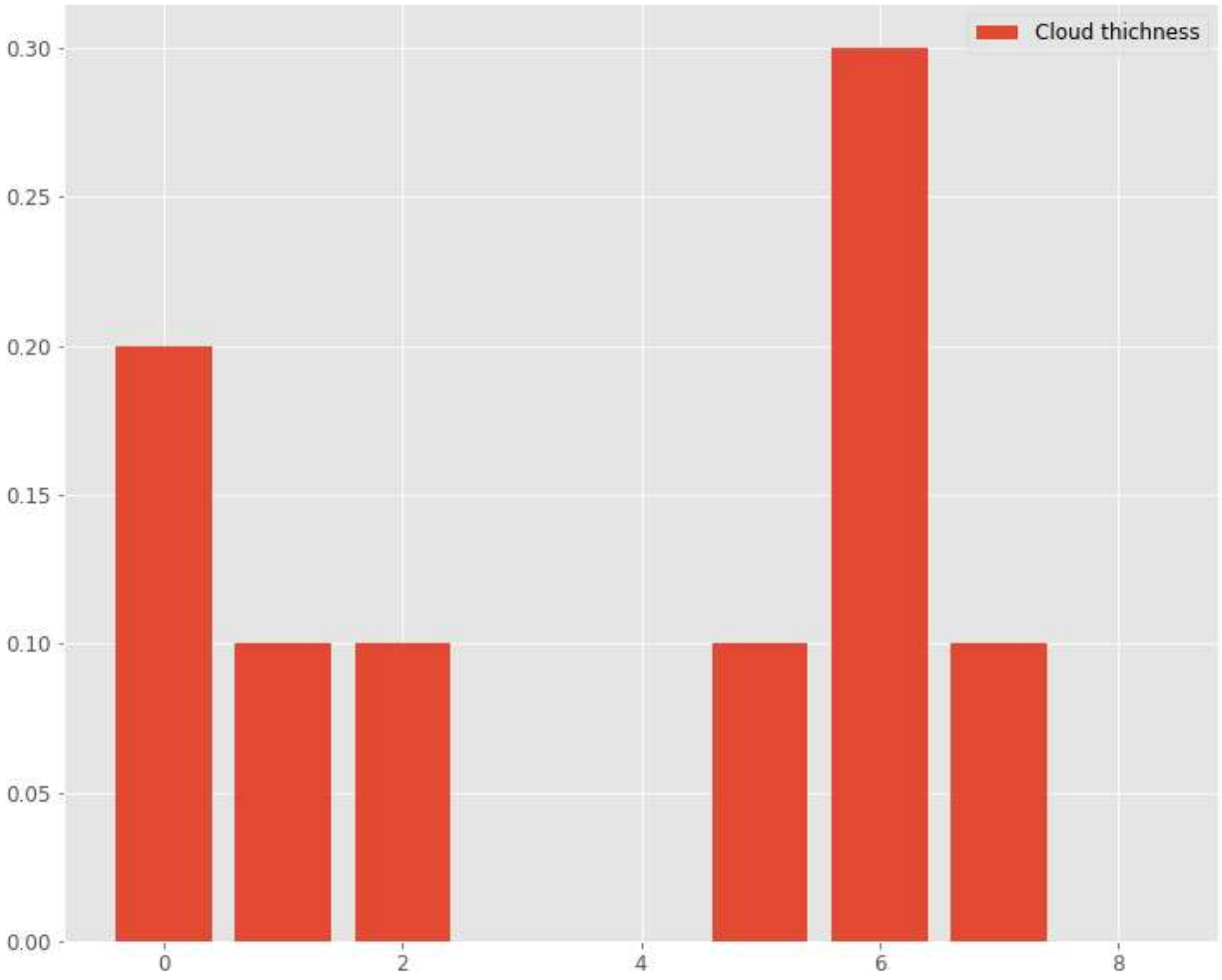
In [ ]:
```
data["Cloud9am"]
```

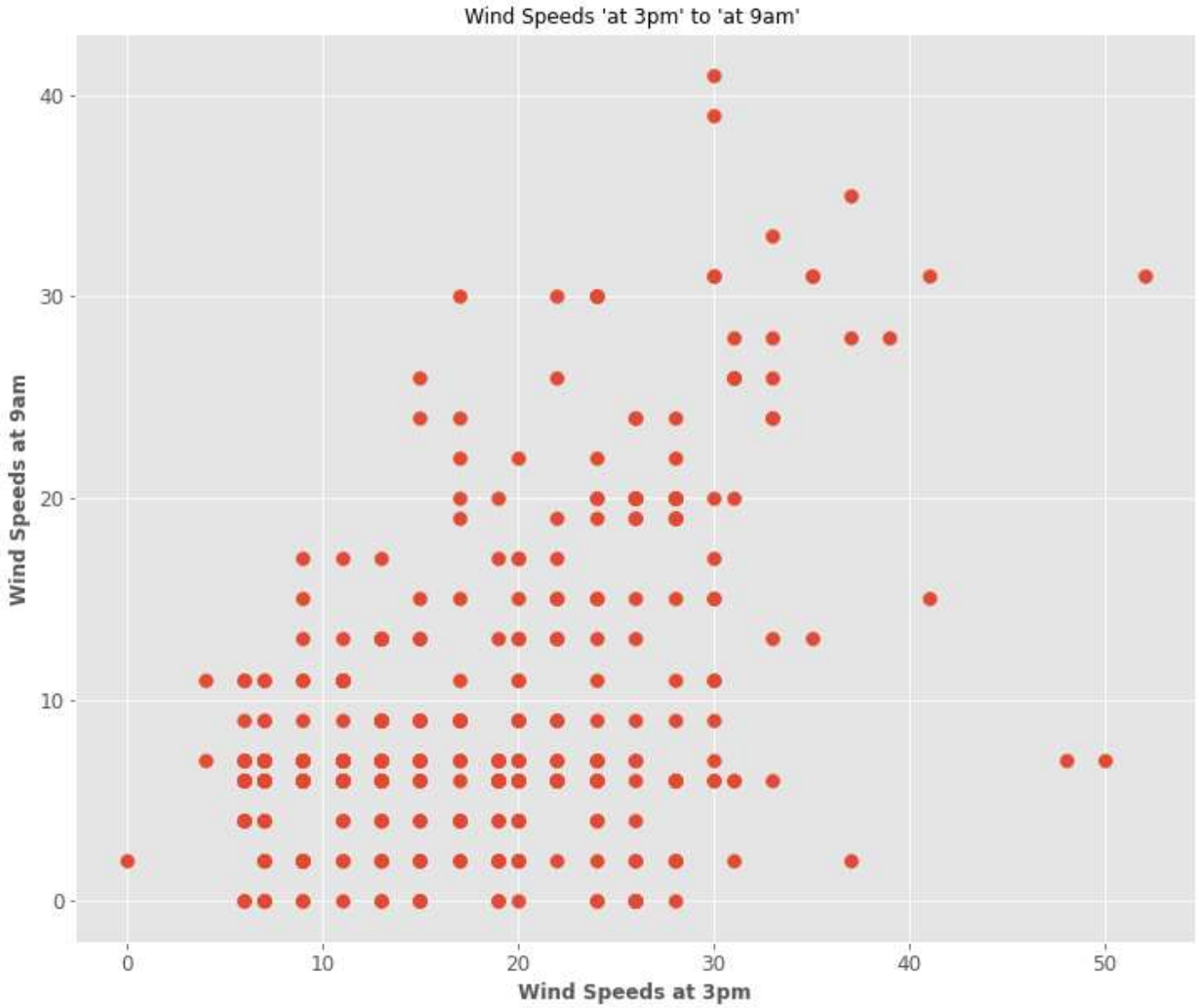
Out[ ]:
```
0      7
1      5
2      8
3      2
4      7
      ..
361    1
362    0
363    3
364    6
365    1
Name: Cloud9am, Length: 366, dtype: int64
```

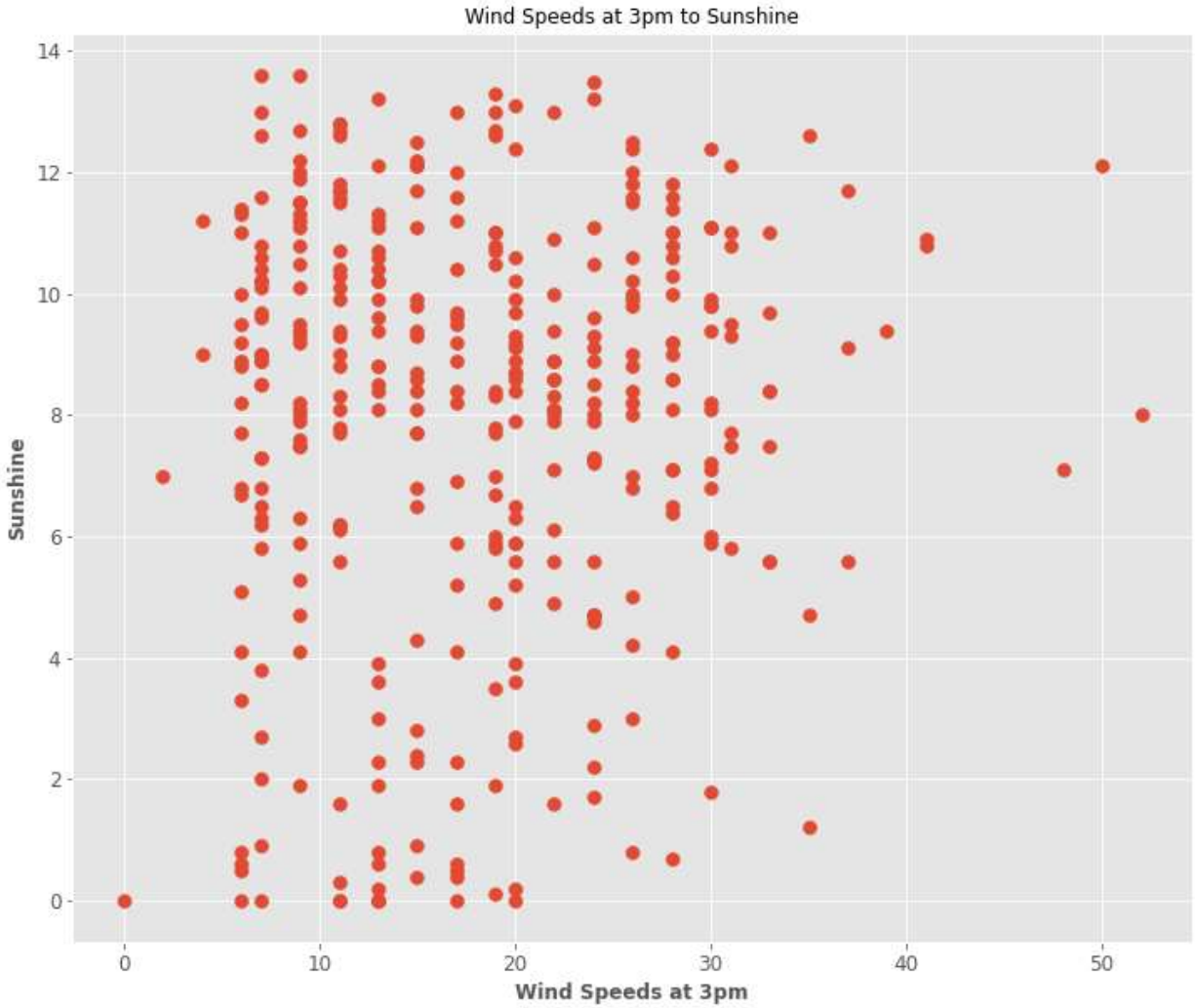
In [ ]:
```
plt.style.use('ggplot')
plt.rcParams['font.family'] = 'sans-serif'
plt.rcParams['font.serif'] = 'Ubuntu'
plt.rcParams['font.monospace'] = 'Ubuntu Mono'
plt.rcParams['font.size'] = 14
plt.rcParams['axes.labelsize'] = 12
plt.rcParams['axes.labelweight'] = 'bold'
plt.rcParams['axes.titlesize'] = 12
plt.rcParams['xtick.labelsize'] = 12
plt.rcParams['ytick.labelsize'] = 12
plt.rcParams['legend.fontsize'] = 12
plt.rcParams['figure.titlesize'] = 12
plt.rcParams['image.cmap'] = 'jet'
plt.rcParams['image.interpolation'] = 'none'
plt.rcParams['figure.figsize'] = (12, 10)
plt.rcParams['axes.grid']=True
plt.rcParams['lines.linewidth'] = 2
plt.rcParams['lines.markersize'] = 8
colors = ['xkcd:pale orange', 'xkcd:sea blue', 'xkcd:pale red', 'xkcd:sage green', 'xk
'xkcd:scarlet']




sample = data["Cloud9am"]
calculated_frequencies = get_frequencies(sample)
print(calculated_frequencies)
calculate_probabilities = get_probabilities(sample, calculated_frequencies)
print("prob", calculate_probabilities)
x_axis = list(set(sample))

plt.bar(x_axis, calculate_probabilities)
plt.legend(["Cloud thichness"])
plt.show()

plt.scatter(data['WindSpeed3pm' ]  ,data[ "WindSpeed9am"] )
plt.title("Wind Speeds 'at 3pm' to 'at 9am' ")
```

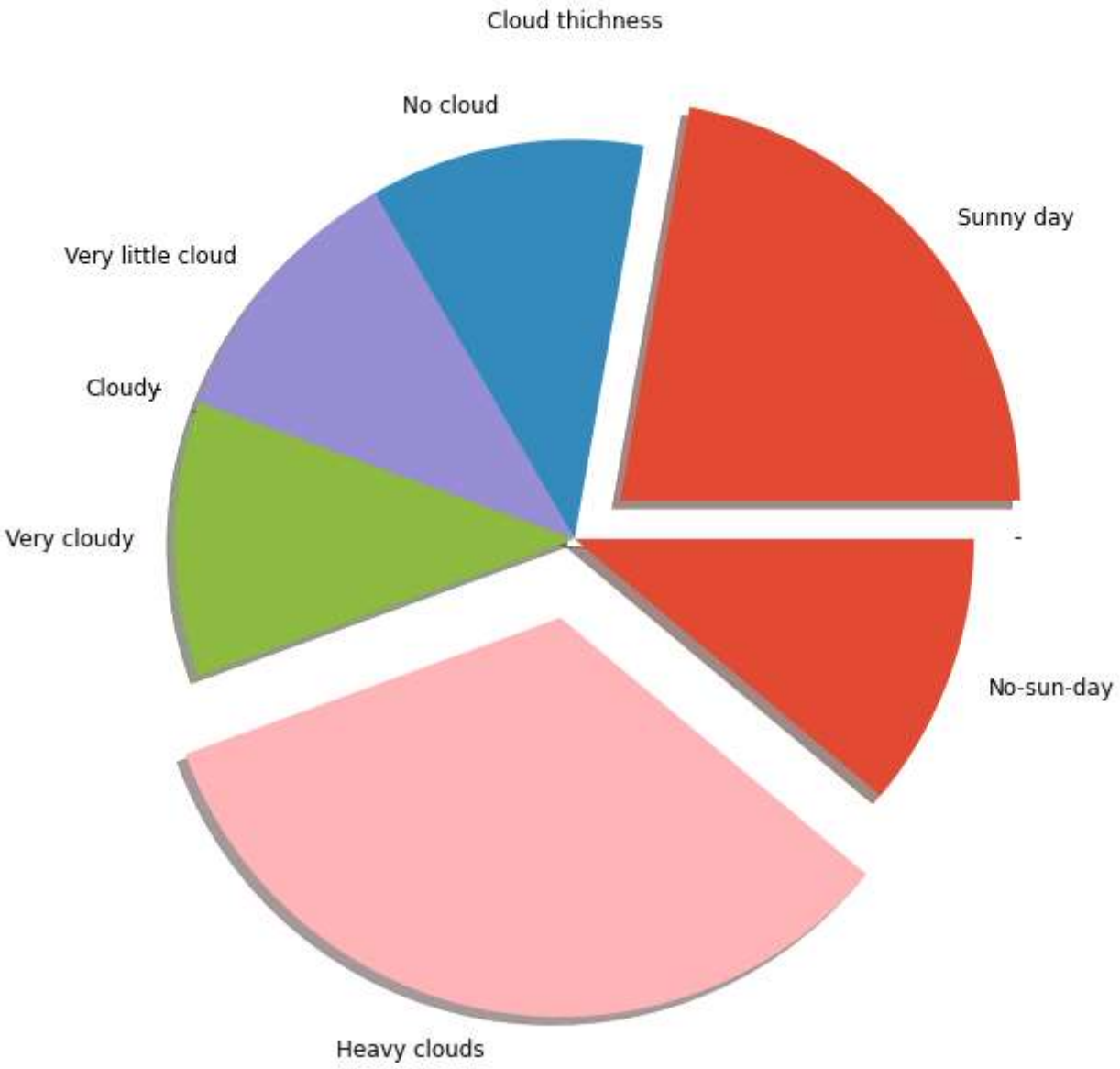
```
plt.xlabel("Wind Speeds at 3pm")
plt.ylabel("Wind Speeds at 9am")
plt.show()


plt.scatter(data['WindSpeed3pm' ]  ,data[ "Sunshine"] )
plt.title("Wind Speeds at 3pm to Sunshine")
plt.xlabel("Wind Speeds at 3pm")
plt.ylabel("Sunshine")
plt.show()



mylabels= ["Sunny day","No cloud","Very little cloud","-","Cloudy","Very cloudy","Heav
myexplode = [0.15,0,0,0,0,0,0.2,0,0]
plt.pie(calculate_probabilities,labels =mylabels,explode = myexplode, shadow = True)
plt.title("Cloud thichness")
plt.show()
```

```
{7: 86, 5: 23, 8: 40, 2: 17, 4: 9, 6: 25, 1: 116, 0: 33, 3: 17}
prob [0.2, 0.1, 0.1, 0.0, 0.0, 0.1, 0.3, 0.1, 0.0]
```




Wind Speeds 'at 3pm' to 'at 9am'
Wind Speeds at 9am
Wind Speeds at 3pm
0
10
20
30
40
50

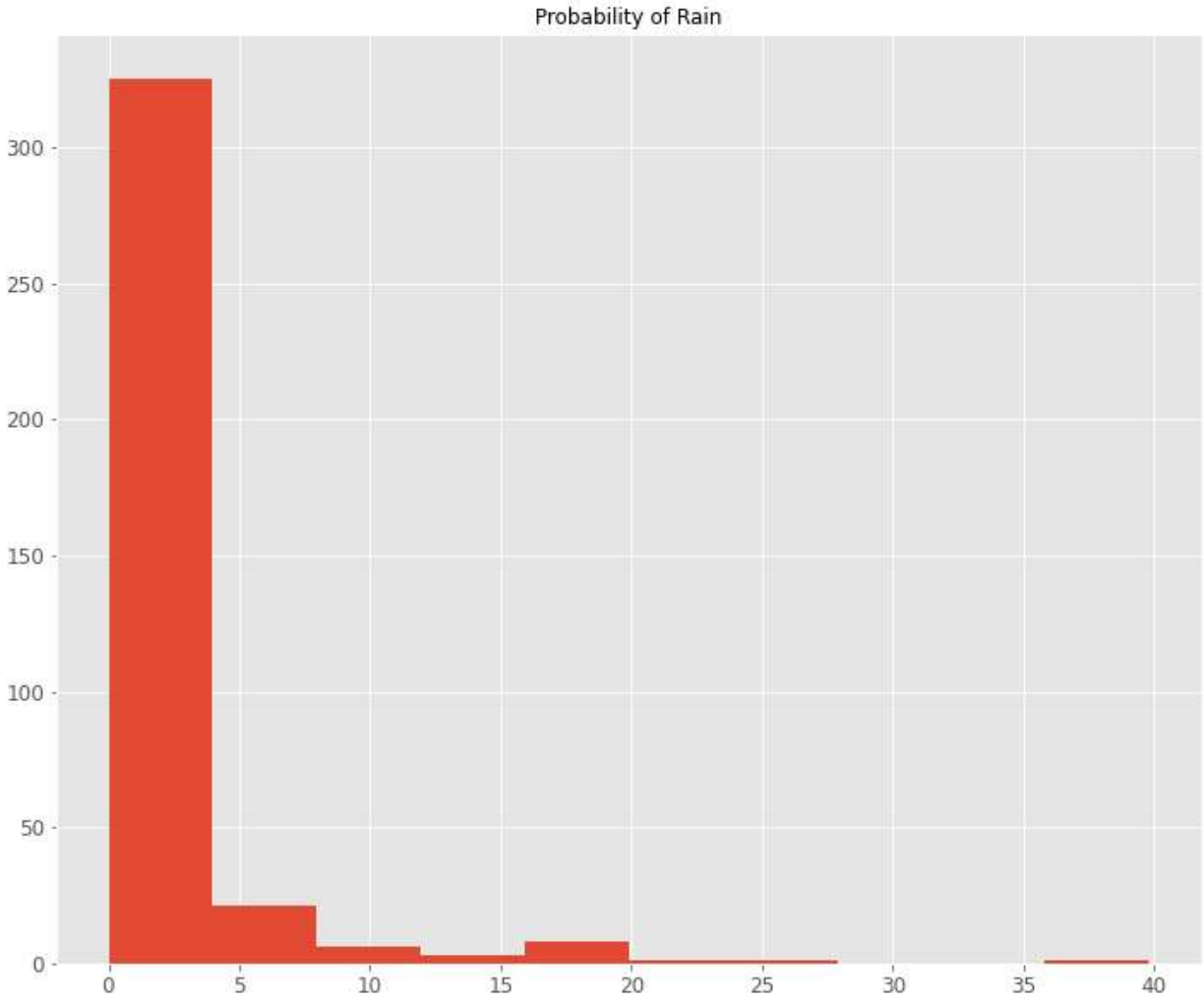

Wind Speeds at 3pm to Sunshine
Sunshine
Wind Speeds at 3pm
0
2
4
6
8
10
12
14
0
10
20
30
40
50



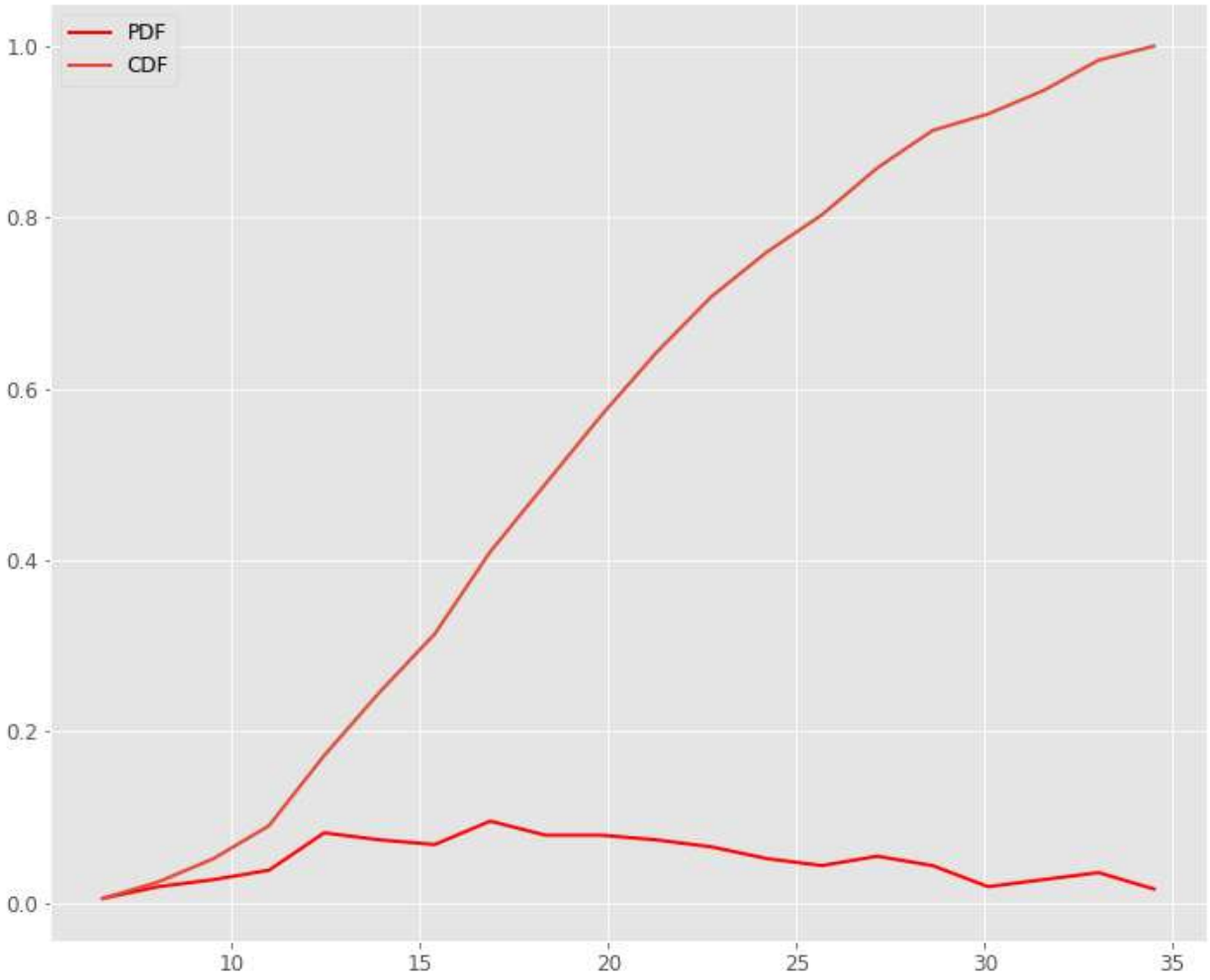
In [ ]:
```
#Central limit theorem

# seed the random number generator, so that the experiment is #replicable
seed(1)
# generate a sample of men's weights
Rainfall = data['Rainfall']
# print(Rainfall)
print('The average probability of rain is {} %'.format(mean(Rainfall)))

plt.hist(Rainfall)
plt.title('Probability of Rain')
plt.show()
stat, p = shapiro(Rainfall)



print('Statistics={}, p={}'.format(stat, p))
alpha = 0.05
if p > alpha:
    print('Sample looks Normal (do not reject H0)')
else:
    print('Sample does not look Normal(rejectH0)')
```

```
# initializing
Temp3pm = data['Temp3pm']

# getting data of the histogram
count, bins_count = np.histogram(Temp3pm, bins=20)

# finding the PDF of the histogram using count values
pdf = count / sum(count)

# using numpy np.cumsum to calculate the CDF
# We can also find using the PDF values by looping and adding
cdf = np.cumsum(pdf)

# plotting PDF and CDF
plt.plot(bins_count[1:], pdf, color="red", label="PDF")
plt.plot(bins_count[1:], cdf, label="CDF")
plt.legend()
plt.show()

#NAIEVE BAYES
def bayesTheorem(pA, pB, pBA):
    return pA * pBA / pB
#define function for Bayes' theorem
def bayesTheorem(pA, pB, pBA):
    return pA * pBA / pB

#define probabilities
pRain = 0.2
pCloudy = 0.4
pCloudyRain = 0.85

#use function to calculate conditional probability
print(bayesTheorem(pRain, pCloudy, pCloudyRain))
```

```
The average probability of rain is 1.4284153005464482 %
```




```
Statistics=0.38883382081985474, p=2.9762369019118345e-33
Sample does not look Normal(rejectH0)
```




```
0.425
```

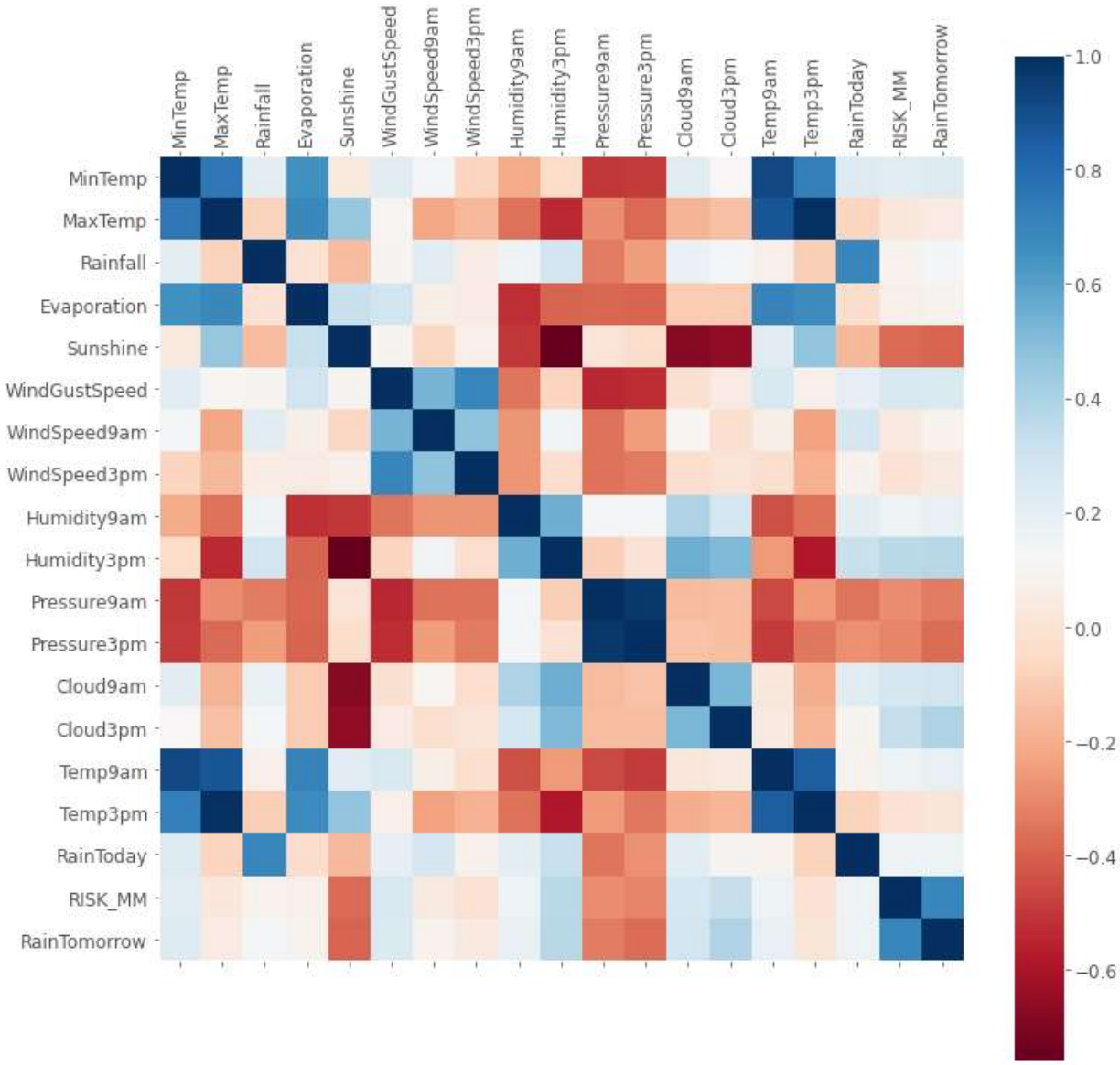
In [ ]:
```
data3.head()
```

Out[ ]:

	MinTemp	MaxTemp	Rainfall	Evaporation	Sunshine	WindGustSpeed	WindSpeed9am	WindSpee
0	8.0	24.3	0.0	3.4	6.3	30.0	6.0	
1	14.0	26.9	3.6	4.4	9.7	39.0	4.0	
2	13.7	23.4	3.6	5.8	3.3	85.0	6.0	
3	13.3	15.5	39.8	7.2	9.1	54.0	30.0	
4	7.6	16.1	2.8	5.6	10.6	50.0	20.0	

In [ ]:
```
draw_corr(data3)
```

```
C:\Users\Mario\AppData\Local\Temp\ipykernel_16792\3479777238.py:9: MatplotlibDeprecat
ionWarning: Auto-removal of grids by pcolor() and pcolormesh() is deprecated since 3.
5 and will be removed two minor releases later; please call grid(False) first.
  plt.colorbar()
```



In [ ]:
```
data3 = minmaxscalar_pd(data3)
```

In [ ]:
```
outputs = data3["RainTomorrow"]
inputs = data3.drop(["RainTomorrow"], axis=1)
```

In [ ]:
```
print(inputs.shape,outputs.shape)
inputs.head()
```

```
(366, 18) (366,)
```

Out[ ]:

	MinTemp	MaxTemp	Rainfall	Evaporation	Sunshine	WindGustSpeed	WindSpeed9am	WindSpee
0	0.507634	0.592199	0.000000	0.235294	0.463235	0.200000	0.146341	0.3
1	0.736641	0.684397	0.090452	0.308824	0.713235	0.305882	0.097561	0.3
2	0.725191	0.560284	0.090452	0.411765	0.242647	0.847059	0.146341	0.1
3	0.709924	0.280142	1.000000	0.514706	0.669118	0.482353	0.731707	0.4
4	0.492366	0.301418	0.070352	0.397059	0.779412	0.435294	0.487805	0.5

In [ ]:
```
y= outputs.to_numpy()
X = inputs.to_numpy()
```

In [ ]:
```
len(X[np.isnan(X)])
```

Out[ ]:
```
12
```

In [ ]:
```
X[np.isnan(X)] = 0
```

In [ ]:
```
X[np.isnan(X)]
```

Out[ ]:
```
array([], dtype=float64)
```

In [ ]:
```
X_train, X_test, y_train, y_test = train_test_split( X, y, test_size=0.23, random_stat
```

In [ ]:
```
print([i.shape for i in [ X_train, X_test, y_train, y_test]])
```

```
[(281, 18), (85, 18), (281,), (85,)]
```

In [ ]:
```
model_predict_rain_1 = Sequential(
     [
        tf.keras.Input(shape=(18,)),    #specify input size
        Dense(25,activation='relu', name = 'layer1'),
        Dense(15,activation='relu', name = 'layer2'),
        Dense(2,activation='softmax', name = 'layer3')

    ], name = "rain_prediction" )
```

In [ ]:
```
tf.keras.utils.enable_interactive_logging()
model_predict_rain_1.summary()
```

```
Model: "rain_prediction"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 layer1 (Dense)              (None, 25)                475

 layer2 (Dense)              (None, 15)                390

 layer3 (Dense)              (None, 2)                 32

=================================================================
Total params: 897
Trainable params: 897
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 layer1 (Dense)              (None, 25)                475

 layer2 (Dense)              (None, 15)                390

 layer3 (Dense)              (None, 2)                 32

=================================================================
Total params: 897
Trainable params: 897
Non-trainable params: 0
_________________________________________________________________
```

In [ ]:
```
model_predict_rain_1.compile(
    metrics=['accuracy'],
    loss=tf.keras.losses.SparseCategoricalCrossentropy(from_logits=True),
    optimizer=tf.keras.optimizers.Adam(0.001),
)
```

In [ ]:
```
epochs = 200
tf.get_logger().setLevel('WARNING')
tf.keras.utils.disable_interactive_logging()
model_predict_rain_1.fit(X_train, y_train ,   epochs=epochs,verbose=1, validation_spli
tf.keras.utils.enable_interactive_logging()
```

In [ ]:
```
acc =model_predict_rain_1.evaluate(X_test,y_test)
print(f'accuracy = {acc[1]}')
```

```
3/3 [==============================] - 0s 6ms/step - loss: 0.4361 - accuracy: 0.9176
accuracy = 0.9176470637321472
```

In [ ]:
```
model_predict_rain_2 = Sequential(
     [
        tf.keras.Input(shape=(18,)),    #specify input size
        Dense(128,activation='relu'),
         Dense(64,activation='relu'),
        Dense(15,activation='relu'),
        Dense(2,activation='softmax')

    ], name = "rain_prediction2" )
```

In [ ]:
```
model_predict_rain_2.summary()
```

```
Model: "rain_prediction2"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 dense_12 (Dense)            (None, 128)               2432

 dense_13 (Dense)            (None, 64)                8256

 dense_14 (Dense)            (None, 15)                975

 dense_15 (Dense)            (None, 2)                 32

=================================================================
Total params: 11,695
Trainable params: 11,695
Non-trainable params: 0
_________________________________________________________________
```

```
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 dense_12 (Dense)            (None, 128)               2432

 dense_13 (Dense)            (None, 64)                8256

 dense_14 (Dense)            (None, 15)                975

 dense_15 (Dense)            (None, 2)                 32

=================================================================
Total params: 11,695
Trainable params: 11,695
Non-trainable params: 0
_________________________________________________________________
```

In [ ]:
```
model_predict_rain_2.compile(

#     metrics=['accuracy'],
    loss=tf.keras.losses.SparseCategoricalCrossentropy(),
    metrics=[tf.keras.metrics.SparseCategoricalAccuracy()],
    optimizer=tf.keras.optimizers.Adam(0.0001),
)
```

In [ ]:
```
epochs = 1000
tf.keras.utils.disable_interactive_logging()
model_predict_rain_2.fit(X_train, y_train ,   epochs=epochs,verbose=1, validation_spli
tf.keras.utils.enable_interactive_logging()
```

In [ ]:
```
acc =model_predict_rain_2.evaluate(X_test,y_test)
print(f'accuracy = {acc[1]}')
```

```
3/3 [==============================] - 0s 4ms/step - loss: 0.4690 - sparse_categorica
l_accuracy: 0.9176
3/3 [==============================] - 0s 4ms/step - loss: 0.4690 - sparse_categorica
l_accuracy: 0.9176
accuracy = 0.9176470637321472
```

In [ ]:
```
y_preds = model_predict_rain_2.predict(X)
```

```
12/12 [==============================] - 0s 2ms/step
```

In [ ]:

```python
got_wrong= 0
for i in range(y.shape[0]):
    y_pred_value = np.where(y_preds[i]==np.max(y_preds[i]))[0][0]
    got_wrong += abs(y_pred_value-y[i])
    print(f'The Real Value is: {y[i]}\t The Predicted value is: {y_pred_value}')
print(f'got {got_wrong} wrong from {y.shape[0]} example')
```

```
The Real Value is: 1.0   The Predicted value is: 1
The Real Value is: 1.0   The Predicted value is: 1
The Real Value is: 1.0   The Predicted value is: 1
The Real Value is: 1.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 1.0   The Predicted value is: 1
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 1.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 1.0   The Predicted value is: 1
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 1.0   The Predicted value is: 1
The Real Value is: 1.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 1.0   The Predicted value is: 1
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 1.0   The Predicted value is: 1
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 1.0   The Predicted value is: 1
The Real Value is: 1.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 1.0   The Predicted value is: 1
The Real Value is: 1.0   The Predicted value is: 1
The Real Value is: 1.0   The Predicted value is: 1
The Real Value is: 1.0   The Predicted value is: 1
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 1.0   The Predicted value is: 1
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 1.0   The Predicted value is: 1
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
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The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
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The Real Value is: 0.0   The Predicted value is: 0
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The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 1.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 1.0   The Predicted value is: 1
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 1.0   The Predicted value is: 1
The Real Value is: 1.0   The Predicted value is: 1
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 1.0   The Predicted value is: 1
The Real Value is: 1.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 1.0   The Predicted value is: 0
The Real Value is: 1.0   The Predicted value is: 1
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 1.0   The Predicted value is: 1
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 1.0   The Predicted value is: 1
The Real Value is: 1.0   The Predicted value is: 1
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 1.0   The Predicted value is: 1
The Real Value is: 1.0   The Predicted value is: 1
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 1.0   The Predicted value is: 1
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The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
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The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 1.0   The Predicted value is: 1
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
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The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 1.0   The Predicted value is: 1
The Real Value is: 1.0   The Predicted value is: 1
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
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The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 1.0   The Predicted value is: 1
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
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The Real Value is: 1.0   The Predicted value is: 1
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The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 1.0   The Predicted value is: 1
The Real Value is: 0.0   The Predicted value is: 0
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The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
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The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 1.0   The Predicted value is: 1
The Real Value is: 1.0   The Predicted value is: 1
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
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The Real Value is: 0.0   The Predicted value is: 0
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The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 1.0   The Predicted value is: 1
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The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 1.0   The Predicted value is: 1
The Real Value is: 1.0   The Predicted value is: 1
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 1.0   The Predicted value is: 1
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
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The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 1.0   The Predicted value is: 1
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The Real Value is: 0.0   The Predicted value is: 0
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The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 1.0   The Predicted value is: 1
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 1.0   The Predicted value is: 1
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
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The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 1.0   The Predicted value is: 1
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 1.0   The Predicted value is: 1
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 1.0   The Predicted value is: 1
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 1.0   The Predicted value is: 1
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 1.0   The Predicted value is: 1
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
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The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
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The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 1.0   The Predicted value is: 1
The Real Value is: 1.0   The Predicted value is: 1
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
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The Real Value is: 0.0   The Predicted value is: 0
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The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 1.0   The Predicted value is: 1
The Real Value is: 1.0   The Predicted value is: 1
The Real Value is: 1.0   The Predicted value is: 1
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The Real Value is: 0.0   The Predicted value is: 0
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The Real Value is: 0.0   The Predicted value is: 0
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The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 1.0   The Predicted value is: 1
The Real Value is: 1.0   The Predicted value is: 1
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 1.0   The Predicted value is: 1
The Real Value is: 0.0   The Predicted value is: 0
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The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 1.0   The Predicted value is: 1
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
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The Real Value is: 0.0   The Predicted value is: 0
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The Real Value is: 0.0   The Predicted value is: 0
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The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
The Real Value is: 0.0   The Predicted value is: 0
got 8.0 wrong from 366 example
```

In [ ]:
```
y_preds[211]
```

Out[ ]:
```
array([0.49364486, 0.5063551 ], dtype=float32)
```