Imported Dataset

In [71]:
```
import pandas as pd
df = pd.read_csv("weatherHistory.csv")
df.head()
```

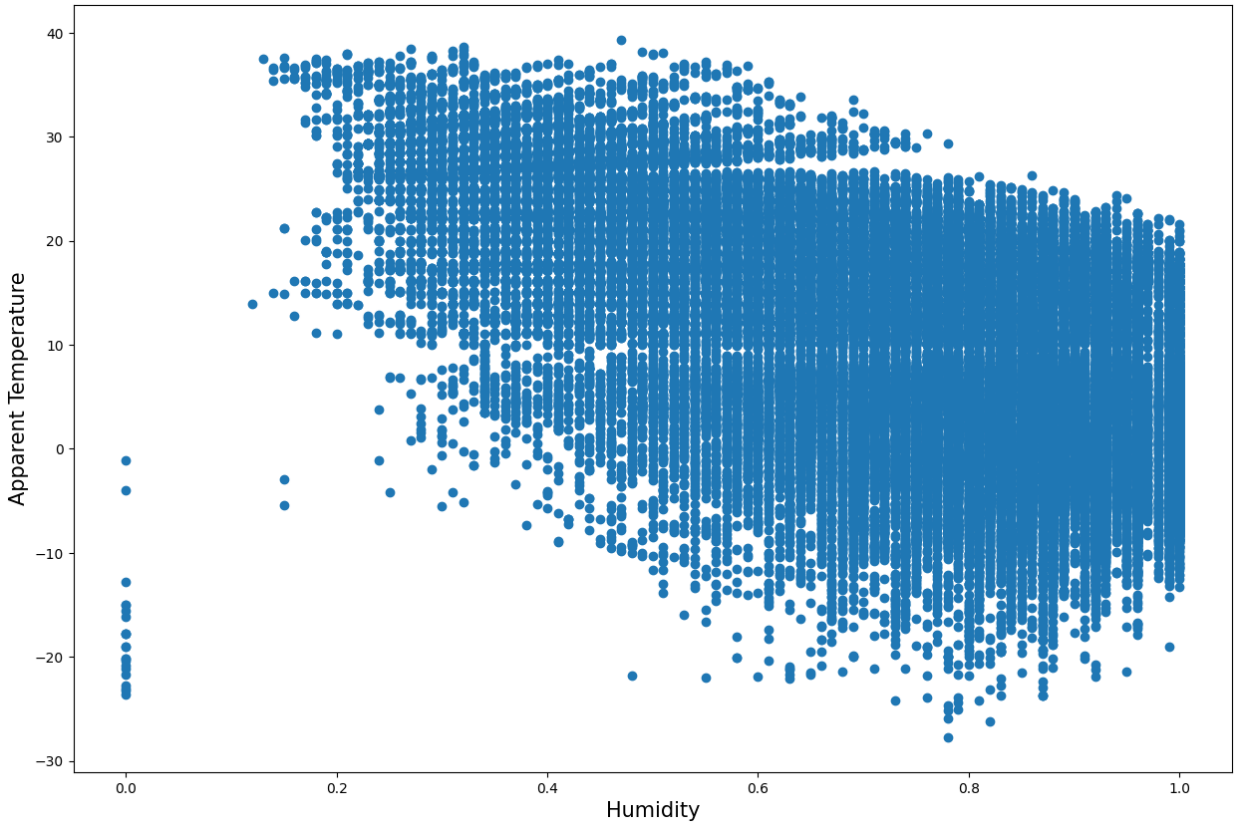
Out[71]:

	Formatted Date	Summary	Precip Type	Temperature (C)	Apparent Temperature (C)	Humidity	Wind Speed (km/h)	Wind Bearing (degrees)	Vis
0	2006-04-01 00:00:00.000 +0200	Partly Cloudy	rain	9.472222	7.388889	0.89	14.1197	251.0	15
1	2006-04-01 01:00:00.000 +0200	Partly Cloudy	rain	9.355556	7.227778	0.86	14.2646	259.0	15
2	2006-04-01 02:00:00.000 +0200	Mostly Cloudy	rain	9.377778	9.377778	0.89	3.9284	204.0	14
3	2006-04-01 03:00:00.000 +0200	Partly Cloudy	rain	8.288889	5.944444	0.83	14.1036	269.0	15
4	2006-04-01 04:00:00.000 +0200	Mostly Cloudy	rain	8.755556	6.977778	0.83	11.0446	259.0	15

Temperature and humidity have an inversely proportional relationship. The humidity will decrease as temperature rises.

In [72]:
```
import matplotlib.pyplot as plt
plt.figure(figsize=(15,10))
plt.xlabel('Humidity', fontsize=15)
plt.ylabel('Apparent Temperature', fontsize=15)
plt.scatter(df['Humidity'], df['Apparent Temperature (C)'])
```

Out[72]: <matplotlib.collections.PathCollection at 0x7f939c62d910>



Dividing dataset into train set and test set

In [73]:
```
x= df["Humidity"]
y= df["Apparent Temperature (C)"]
test_size = int(len(x)*0.3)
train_size = len(x)-test_size
x_train = x[:train_size]
y_train = y[:train_size]
x_test = x[-test_size:]
y_test = y[-test_size:]
```

Linear Regression model

In [74]:

```
class Regressor():
    def __init__(self,x,y):
        self.x = x
        self.y = y
    def Find_w(self):
        X = self.x.mean()
        Y = self.y.mean()
        sum_prod_x_y=0
        sum_diff_x = 0
        for (xi,yi) in zip(self.x,self.y):
            sum_prod_x_y=sum_prod_x_y+((yi-Y) * (xi-X))
            sum_diff_x = sum_diff_x + ((xi-X)**2)
        w = sum_prod_x_y/sum_diff_x
        return w
    def Find_d(self):
        w = self.Find_w()
        Y = self.y.mean()
        X = self.x.mean()
        d = Y - w*X
        return d
    def fit(self,x_test):
        w = self.Find_w()
        d = self.Find_d()
        y_pred = []
        if type(x_test) == float or type(x_test)==int:
            y_p = (w*x_test)+d
            y_pred.append(y_p)
        for xi in x_test:
            y_p = (w*xi)+d
            y_pred.append(y_p)
        return y_pred
```

Training Model and predictions

In [88]:
```
reg = Regressor(x_train,y_train)
y_pred = reg.fit(x_test)
y_pred
```

```
 19.144522338627723,
 19.82707907061082,
 20.850914168585476,
 22.557305998543224,
 22.557305998543224,
 22.898584364534777,
 23.239862730526326,
 22.216027632551672,
 22.557305998543224,
 19.82707907061082,
 12.660233384788267,
 11.63639828681362,
 7.1997795289234645,
 6.517222796940363,
 3.445717503016411,
 8.223614626898112,
 8.564892992889664,
 6.175944430948814,
 7.541057894915017,
 10.612563188838966
```

Mean Square error of Regression Model

In [89]:
```
def mean_square_error(y_test,y_pred):
    msq_err = 0
    for (y_t,y_p) in zip(y_test,y_pred):
        msq_err = msq_err+((y_p-y_t)**2)/len(y_test)
    return msq_err**(1/2)
mse1=mean_square_error(y_test,y_pred)
mse1
```

Out[89]:
```
8.02520124902258
```

L1 regularization Model

In [77]:
```
class L1_Regression():
    def __init__(self,x_train,y_train,lamda):
        self.x = x_train
        self.y = y_train
        self.lamda = lamda
    def Find_w(self):
        alpha = self.lamda
        X = self.x.mean()
        Y = self.y.mean()
        a = X/(1+alpha)
        b = Y/(1+alpha)
        N = len(self.x)
        sum_prod_x_y=0
        sum_diff_x = 0
        for (xi,yi) in zip(self.x,self.y):
            sum_prod_x_y=sum_prod_x_y+((yi-Y) * (xi-X))
            sum_diff_x = sum_diff_x + ((xi-X)**2)
        w = (sum_prod_x_y+(N*alpha*b*a))/(sum_diff_x-(alpha*N*(a**2)))
        return w
    def Find_d(self):
        X = self.x.mean()
        Y = self.y.mean()
        w = self.Find_w()
        d=(Y-w*X)/(1+self.lamda)
        return d
    def fit(self,x_test):
        w = self.Find_w()
        d = self.Find_d()
        y_pred = []
        if type(x_test) == float or type(x_test)==int:
            y_p = (w*x_test)+d
            y_pred.append(y_p)
        for xi in x_test:
            y_p = (w*xi)+d
            y_pred.append(y_p)
        return y_pred
```

Training the model and predictions

In [91]:
```
reg2 = L1_Regression(x_train,y_train,5)
y_pred2 = reg2.fit(x_test)
y_pred2
```

```
 8.186119230172526,
 8.495761561344725,
 8.495761561344725,
 8.495761561344725,
 8.573172144137775,
 8.573172144137775,
 8.495761561344725,
 8.263529812965576,
 8.573172144137775,
 8.263529812965576,
 8.263529812965576,
 8.031298064586428,
 7.56683456782813,
 7.0249604882767835,
 6.328265243139337,
 5.78639116358799,
 5.7089805807949405,
 6.328265243139337,
 7.334602819448981,
```

Mean square error of L1 regularization model

In [92]:
```
mse2=mean_square_error(y_test,y_pred2)
mse2
```

Out[92]: 11.658151476346172

L2 regularization Model

In [80]:
```
class L2_Regression():
    def __init__(self,x_train,y_train,lamda):
        self.x = x_train
        self.y = y_train
        self.lamda = lamda
    def Find_w(self):
        a = self.lamda/2
        X = self.x.mean()
        Y = self.y.mean()
        sum_xi_X_2 = 0
        sum_xi_X =0
        sum_yi_xi =0
        for (xi,yi) in zip(self.x,self.y):
            sum_yi_xi = sum_yi_xi + ((yi-Y)*(xi-X))
            sum_xi_X = sum_xi_X + (xi-X)
            sum_xi_X_2 = sum_xi_X_2 + ((xi-X)**2)
        w = (sum_yi_xi - a*sum_xi_X)/sum_xi_X_2
        return w
    def Find_d(self):
        a = self.lamda/2
        X = self.x.mean()
        Y = self.y.mean()
        w = self.Find_w()
        d = (Y-w*X)+a
        return d
    def fit(self,x_test):
        w = self.Find_w()
        d = self.Find_d()
        y_pred = []
        if type(x_test) == float or type(x_test)==int:
            y_p = (w*x_test)+d
            y_pred.append(y_p)
        for xi in x_test:
            y_p = (w*xi)+d
            y_pred.append(y_p)
        return y_pred
```

Training the model and predictions

In [93]:
```
reg3 = L2_Regression(x_train,y_train,5)
y_pred3 = reg3.fit(x_test)
y_pred3
```

Out[93]:
```
[13.453841554830518,
 16.18406848276292,
 16.18406848276292,
 18.91429541069532,
 21.644522338627727,
 22.327079070610825,
 23.350914168585476,
 25.057305998543228,
 25.057305998543228,
 25.398584364534777,
 25.73986273052633,
 24.71602763255168,
 25.057305998543228,
 22.327079070610825,
 15.160233384788267,
 14.13639828681362,
 9.699779528923468,
 9.017222796940366,
 5.945717503016411,
```

Mean Square error L2 regularization model

In [94]:
```
mse3=mean_square_error(y_test,y_pred3)
mse3
```

Out[94]:
```
7.9891194292056
```

In [83]:
```
print('Mean Square Error of Linear regression model',mse1)
print('Mean Square Error of Linear regression model with L1 regulariza
print('Mean Square Error of Linear regression model with L2 regulariza
```

```
Mean Square Error of Linear regression model 8.02520124902258
Mean Square Error of Linear regression model with L1 regularization 1
1.658151476346172
Mean Square Error of Linear regression model with L2 regularization 7
.9891194292056
```

Best Fit model(Linear regression with L2 regularization)

In [95]:
```
import matplotlib.pyplot as plt
w = reg3.Find_w()
d = reg3.Find_d()
plt.figure(figsize=(50,30))
plt.xlabel('Humidity', fontsize=15)
plt.ylabel('Temperature', fontsize=15)
plt.scatter(x_test, y_test, s=300, linewidths=3, edgecolor='black')
plt.plot(x_test, d + w*x_test, c = 'r', linewidth=2.5, alpha=1, solid_
#plt.scatter(x=x_train.mean(), y=y_train.mean(), marker='*', s=10**2.5
```

Out[95]: [<matplotlib.lines.Line2D at 0x7f939a4d5970>]