International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 05 Issue: 06 | June - 2021 ISSN: 2582-3930

Prediction of Temperature using Multiple Linear Regression Model in an area of North Twenty-four Parganas , West Bengal

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Abstract:
Weather prediction is very much important for protecting lives. Weather prediction is a important application area for agriculture, transportation, flood and others natural phenomena. Temperature prediction is very much important for weather prediction. There are many methods we can apply we predict temperature one is Multi linear regression model. .For establishing relationship between dependant and independent variable Linear Regression model is very useful in statistics. Linear Regression model is extended to Multiple Linear Regression model. In our study we have implemented the variables in MATLAB. Temperature Prediction is very important for weather forecasting. Here we have taken Kolkata, more precisely Dum Dum Metropolitan in North 24 Parganas for rainfall prediction. We have studied others parameters of atmospheric Prediction. Multiple Linear Regression is being used to predict temperature. After getting the coefficient we have got the targeted and calculated temperature. We have calculated the error.
Keyword: Temperature prediction, Multi Linear Regression Model, Root Mean Square

Introduction:
For vegetation ,animal and human livelihood in a particular location in earth temperature is an important parameter. Hot or cold climate depends upon maximum and minimum temperature. We calculate the maximum and minimum temperature by linear regression model.[7]When ever we are doing with measurement of quantitate outcome we can easily use linear regression. As explanatory variable can be used to assume values between the observed values and explanatory variables. A linear regression model can be used for best fitting data using least square method. In simple regression model we can consider y is an dependant variable and independent variable is x.
$Yi=Bo+B_i+X_i+e_i$ i=1,2,3[1]
Focus of the study is to determine the maximum and minimum temperature in Dum Dum area.[3]
To get data point at a line we can use least square method by which we can get a line where data are calculated for the temperature in Dum Dum municipality area.[1]
The difference between linear regression model is simple linear regression model fits in straight line and multiple regression model fits in plane. In multiple linear regression model coefficient contributes of each independent variables and least square is used for regression coefficient in 2.
Prediction of temperature is one of the most important task for analyzing atmospheric conditions.
Weather forecasting is an application in physics , statistical and empirical methods. Once human lived in cave then they tried to build shelters after many year they need to know about the temperature very before the day that's why can plan their schedule according to weather.
In 1910, British scientist Lewis Fry Richardson made a technique for weather prediction.
Prediction of Temperature is important to decide atmospheric changes in weather. Temperature prediction is very important for lives and property. It's very important for agriculture. Dum Dum constitutes the main entrance of the city. It has the importance of international and domestic transportation. This is being an important commercial and grooming metropolis connected by Dum Dum air part.
Weather prediction gives future information for metrological location. Weather affects everyone may be in every day. Weathers simply refer to the temperature, rainfall, humidity air pressure etc.
Prediction of weather is can be a crucial factor for the aviation industry. Detecting any major changes in regard to temperature or rainfall can help in assessing any possibility of adverse weather condition.
So, this study may help in extrapolating the data to make more precise and meaningful prediction of weather.

discussed the prediction of atmospheric parameter is very important for living and property.
Scott H Brown has discussed in Multiple Linear Regression Analysis: A Matrix Approach with MATLAB in 2009 that using linear regression we can calculate the coefficient of the parameters and we can predict the next day's minimum and maximum temperature.[1]
In A Simple Weather Forecasting Model Using Mathematical Regression paper published in January 2012 ,Paras and Sanjay Mathur have discussed about the Multiple Linear Regression can be easily understood by the medium educated farmer . Rainfall prediction which is very important for cultivation is dependent on temperature. So temperature prediction is becoming very important for weather forecasting.
The learning or training process uses a supervised learning algorithm that compares the model output to the target output and then adjusts the weight of the connection in a backward manner.
Here they have use mean square error(MSE)and the correlation coefficient(R) were used to evaluate the performance.

Methodology:
Linear regression is a model which demonstrates one output model from different input models. Linear regression models belong to statistical as well as machine learning.
For a simple regression model on dependent variable x and y will be Y=B0+B1X.
With Matlab we can design linear regression model which is helping to calculate temperature for Dum Dum metrological area.

Here we are using Y as the maximum and minimum temperature. X as the input matrix of maximum and minimum temperature, humidity, air pressure and vapor pressure. Then we are calculating the coefficient as B.
Then we are finding out the next day maximum and minimum temperature as predicted .After day we know about the actual temperature and predicted temperature. And we are getting absolute error.
y=X'
A=y*X
K=A^-1
B=K*y*Y

Proposed Method:
Multiple Linear Regression (MLR) is used to determine a mathematical relationship among a number of random variables.
$Y_i=B_0+B_1X_1+B_2X_2+B_3X_3+B_4X_4+B_5X_5+B_6X_6+B_7X_7+B_8X_8$
B_i=Regression coefficient
X_1= Maximum Air Pressure
X_2= Minimum Air Pressure
X_3=Maximum Vapor Pressure
X_4=Minimum Air Pressure
X_3=Maximum humidity
X_6=Minimum humidity
X_7=Maximum Temperature
X_8=Minimum Temperature

At macro level weather forecasting is done by gathering of data by remote sensing satellite.
The variables defining weather condition are temperature, humidity, air pressure, rainfall etc.
Now we are entering data to or training system.
Entering data Linear Regression model we are getting coefficient.
And tasting the data we are getting the next day temperature.

Data Analysis and Organization:

We have taken eight parameters those are maximum air pressure, minimum air pressure, maximum vapor pressure, minimum vapor pressure, maximum humidity, minimum humidity, maximum temperature and minimum temperature.

Maximum Air Pressure (Pascal)	Minimum Air Pressure (Pascal)	Maximum Vapor Pressure (Pascal)	Minimum Vapor Pressure ((Pascal))	Maximum humidity ($gm.m^{-3}$)	Minimum Humidity ($gm.m^{-3}$)	Maximum Temperature (Celsius)	Minimum Temperature (Celsius)
1018.9	1013.9	15.8	15.1	071	067	25.5	14.1
1017.5	1015.5	16.5	14.3	077	051	26.3	15.0
1017.5	1013.8	16.9	15.2	077	057	26.5	18.7
1017.9	1013.8	15.1	14.9	070	054	27.7	15.3
1017.0	1014.1	15.8	15.2	070	059	25.9	13.6
1014.6	1012.6	15.8	15.3	070	059	25.39	13.6
1014.6	1014.3	19.4	17.4	094	063	27.0	14.3
1016.0	1010.1	20.6	19.7	065	024	27.8	15.0
…							
…..							
1014.3	1011.7	19.5	15.5	086	050	26.0	13.8
1015.0	1010.5	17.8	11.4	064	060	26.0	13.8

Here we have taken 8 parameter s for calculating maximum and minimum temperature.

Calculated Maximum Temperature:

Calculated Temp	Targeted Temp	CT-TT	(CT-TT)^2
25.042	29	-3.958	15.665764
20.73	28	-7.27	52.8529
24.991	26.3	-1.309	1.713481
28.723	27	1.723	2.968729
26.62	30.6	-3.98	15.8404
27.897	26.7	1.197	1.432809
29.514	30.9	-1.386	1.920996
31.473	29.6	1.873	3.508129
20.747	26.4	-5.653	31.956409
24.909	28.2	-3.291	10.830681
			138.690298

So, we can get Root Mean Square Error(RMSE) to calculate error for maximum temperature. The formula RMSE is:

$$RMSE = \sqrt{\frac{\sum_{i=1}^{N} (Predicted_i - Actual_i)^2}{N}}$$

So the Root Mean Square:
√138.69/10=3.71

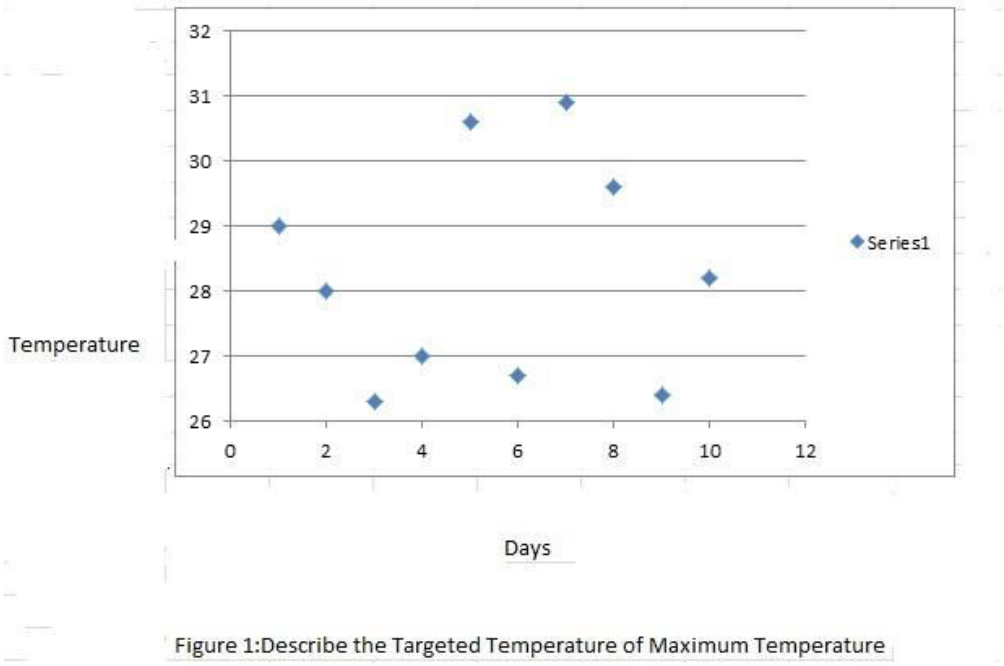

Figure 1:Describe the Targeted Temperature of Maximum Temperature

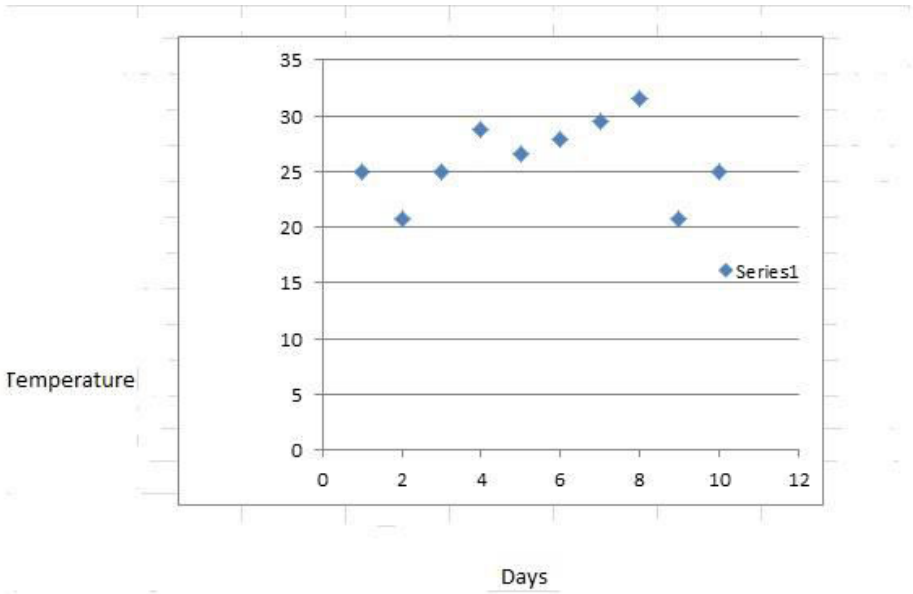

Figure 2:Represent the Calculated Temerature from Maximum Temperature

Calculated Minimum Temperature:

Targeted Tmin	Calculated Tmin	Error	Absolute Error
15	18	3	9
13.7	14.6	0.9	0.81
15.3	11.188	-4.112	16.90854
13.6	17	3.4	11.56
14.3	21.511	7.211	51.99852
15	21	6	36
13.8	13.5	-0.3	0.09
13.8	14.7	0.9	0.81
			127.1771

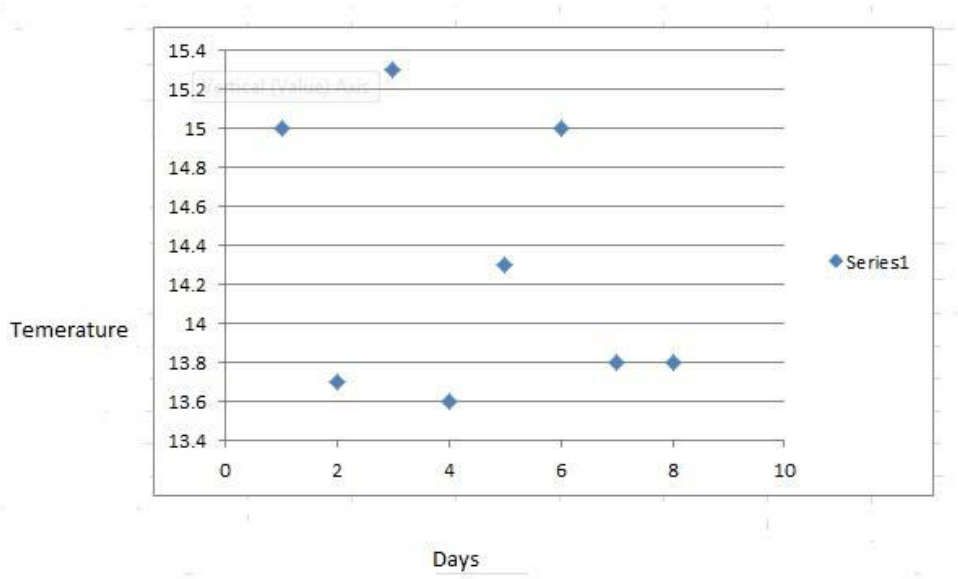

Figure 3:Represents the Targetted Temerature in Minimum Temperature

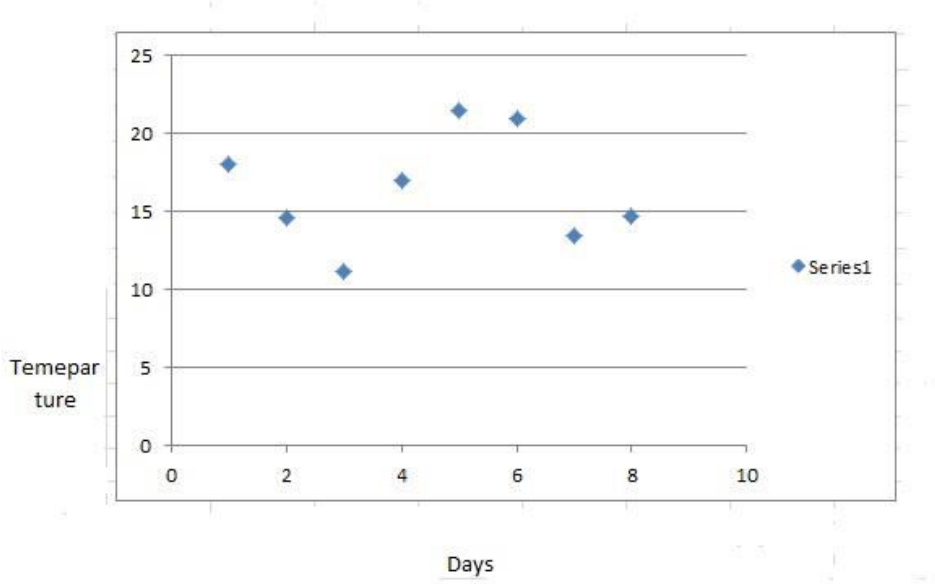

Figure 4:Calculated Teemrature for Minimum Temperature

So, we can get Root Mean Square Error(RMSE) to calculate error for minimum temperature. The formula RMSE is

$$RMSE = \sqrt{\frac{\sum_{i=1}^{N} (Predicted_i - Actual_i)^2}{N}}$$

Here Root mean Square:
√127.17/10=3.5

Conclusion:

Using Multiple linear regression we get a purpose for calculating minimum and maximum Temperature and its estimate model. It is known to all for weather minimum and maximum temperature is how much important. After calculating minimum and maximum temperature we have used root mean square to get minimum error for prediction which will give a approximate accurate results.

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