Prediction of Air Pressure Using Support Vector Machine Compare with Multi-Layer Perception Model in an Area of North Twenty-Four Parganas, West Bengal

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Abstract:
Lifesaving requires the capacity to foresee the weather. Applications for weather prediction in agriculture, transportation, floods, and other natural phenomena are significant. The prediction of Air Pressure is crucial for weather forecasting. Multiple linear regression is one of the techniques available for Air Pressure prediction.
model. To determine how one independent variable and one dependent variable are related to one another In statistics, the linear regression model is an extremely helpful tool. Multiple linear regression is an extension of the linear regression model. We utilized MATLAB to add the variables to our experiment. Weather forecasting relies heavily on Air Pressure prediction. For the purpose of forecasting rainfall, we have chosen Kolkata, or more specifically, the Dum Dum Metropolitan region in North 24 Parganas. We have investigated additional atmospheric forecasting parameters.
applying a multilayer perceptron to predict Air Pressure. Once we get the coefficient, we have the intended and calculated Air Pressure. We have identified the error.
Now we are applying Support Vector Machine over Multi Linear Preceptron to get better results.

Keyword: Air Pressure prediction, Multi Layer Perceptron Model, Support Vector Machine,Root Mean Square

Introduction:

The earth's Air Pressure is essential to the existence of humans, animals, and vegetation in a particular area.A climate's maximum and minimum Air Pressures define its heat or coldness. To find the highest and lowest Air Pressure, we employ a linear regression model.(7) When measuring a quantifiable outcome, using linear regression is easy. This explanatory variable can be used to make assumptions about values between the observed values and explanatory factors. A linear regression model can be fitted with the least squares method to find the best fitting data. In a basic regression model, y is the dependent variable and x is the independent variable. Another term for multi-layer perception is MLP. The thick layers can transform any input dimension into the desired dimension because they are totally connected. A multilayered perception is a multilayered neural network. Building neural networks involves joining neurons so that some of their outputs can be used as inputs by other neurons.

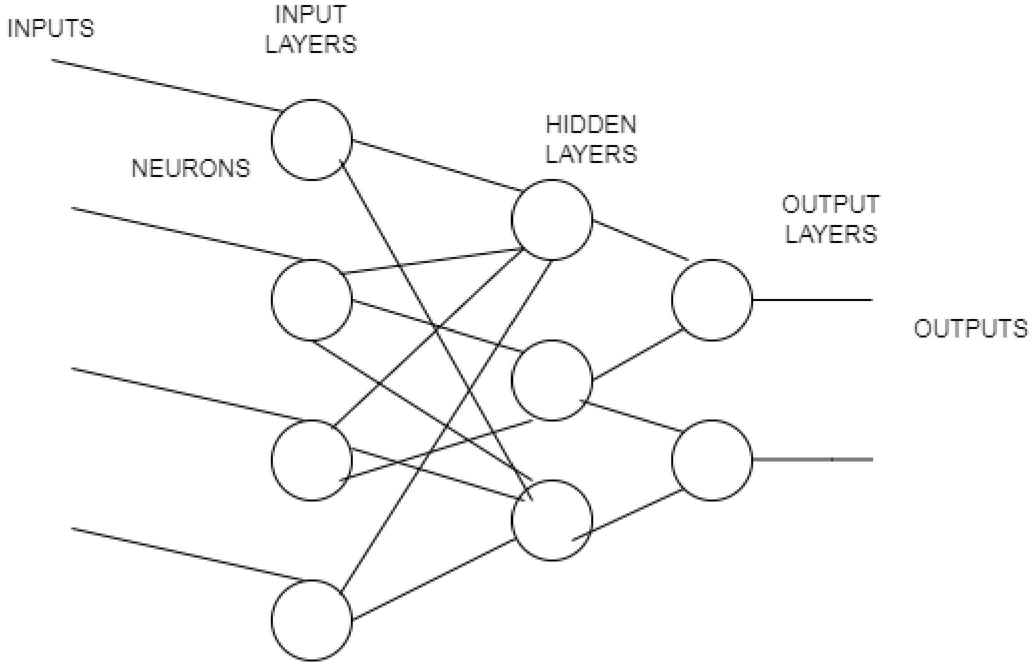

Figure 1:Multi-Layer Perceptron Model

Multilayer Perceptron model mathematical model
$wnxn - \theta = w1x1 + w2x2 + \cdots +$
Determining the hottest and lowest Air Pressures in the Dum Dum region is the primary objective of the study.[3]
To create a line with data points that depicts the Air Pressure in the Dum Dum municipality, we might apply the least squares method.[1]While multilayer layer perceptrons fit in a plane, simple linear regression models fit in a straight line. The two kinds of linear regression models differ in this way. The Multi Layer Perceptron Model incorporates the coefficients of each independent variable, and the least squares approach is utilized in step two to get the regression coefficient.
One of the most important responsibilities in atmospheric condition analysis is Air Pressure prediction.In physics, weather forecasting is a statistical and empirical technique. Many years ago, when people first started building cave shelters, they had to know the Air Pressure far in advance of the day in order to modify their routines according to the weather.

Methodology:
One example of how different input models might lead to a single output model is provided by the linear regression model. Linear regression models are used in two fields: machine learning and statistics.Y=B0+B1X is the formula for a simple regression model with dependent variables x and y.
We can use Matlab to develop a linear regression model that will allow us to calculate the Air Pressure in the Dum Dum meteorological area.
On the other hand, since we're using Multi-Layer Percepotron, the equation will be
$wnxn - \theta = w1x1 + w2x2 + \cdots +$

The multi-layer perceptron (MLP) is a representation of an artificial neural network technique with multiple layers. One perceptron can handle problems that are differentially linear, but non-linear instances are not a good fit for this approach.
Y stands for the highest and lowest Air Pressures in this instance. The highest and lowest values of Air Pressure, vapor pressure, air pressure, and humidity are represented by the input matrix X. Next, we compute the coefficient using B.
The next step is to determine the predicted highest and lowest Air Pressures for the next day.Day by day, we discover how the actual and predicted Air Pressures differ. Furthermore, we're getting glaring errors.
K=A^-1, y=X', A=y*X, and B=K*y*Y

Proposed Method:
With Multi-Layer Perceptron (MLP), a mathematical relationship between multiple random variables can be found.
w1 + w2 + ⋯ + wnxn − θ = 0 w1, w2, w3,...The input variables are x1, x2,..., xn, and the coefficients are wn.
The eight parameters that we have chosen are the maximum Air Pressure, minimum Air Pressure, maximum humidity, minimum humidity, maximum vapor pressure, minimum vapor pressure, maximum Temperature, and minimum Temperature.

Minimum Air Pressure	Maximum Air Pressure	Minimum Vapor Pressure	Maximum Vapor Pressure	Minimum Humidity	Maximum Humidity	Maximum Temperature	Minimum Temperature
998.4	998.7	32.6	34.2	71	76	33.2	26.8
995.5	996.8	34.0	33.6	79	80	34.3	36.4
992.7	997.7	34.4	32.8	75	89	33.5	25.6
997.0	1000.7	32.4	31.1	079	095	31.4	25.4
999.5	1002.7	31.9	30.5	83	93	26.6	25.5
1004.4	1003.0	29.3	31.9	077	095	30.7	25.0
992.7	997.7	34.4	32.8	75	78	26.5	25.5
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998.5	1003.0	29.3	31.9	077	095	31.4	25.4
997.5	999.0	33.6	25.5	82	90	26.4	24.2
996.2	996.4	32.6	33.0	96	87	31.0	25.6
993.9	996.7	33.4	33.4	86	86	31	25
996.7	1001.2	32.8	33.8	78	80	32.6	25.2

Calculated Minimum Air Pressure:

Calculated Air Pressure	Targeted Air Pressure	CT-TT	(CT-TT)^2
995.5	998.4	-2.9	8.41
992.7	995.5	0.7	0.49

997.0	992.7	.0.1	0.01
999.5	997.0	.0.2	9.61
1004.4	999.5	.0.3	2.25
998.5	1004.4	.0.4	3.61
997.5	998.5	.0.5	1.69
996.2	997.5	.0.6	0.49
993.9	996.2	.0.7	0.04
996.7	993.9	.0.8	0.25
998.5	996.7	.0.9	10.89
999.7	998.5	.0.10	3.61
TOTAL			41.35

Now Root Mean Square Formula

$\sqrt{(CT-TT)^2/(N)}$

=1.856

The mathematical Formula $w_1x_1 + w_2x_2 + \cdots + w_nx_n - \theta = 0$

Calculated Air Pressure	Targeted Air Pressure
995.5	998.4
992.7	995.5
997.0	992.7
999.5	997.0
1004.4	999.5
998.5	1004.4
997.5	998.5
996.2	997.5
993.9	996.2
996.7	993.9
998.5	996.7
999.7	998.5
Total=11997.6	Total=11993.6

Mean of Calculated Lowest Air Pressure=999.8 Pascal
And Maiden is close to 998.5 Pascal
For Targeted Temperature 999.4
And Maiden 998.5 Pascal
So for a two dimensional field we can think the targeted and calculated Air Pressure is

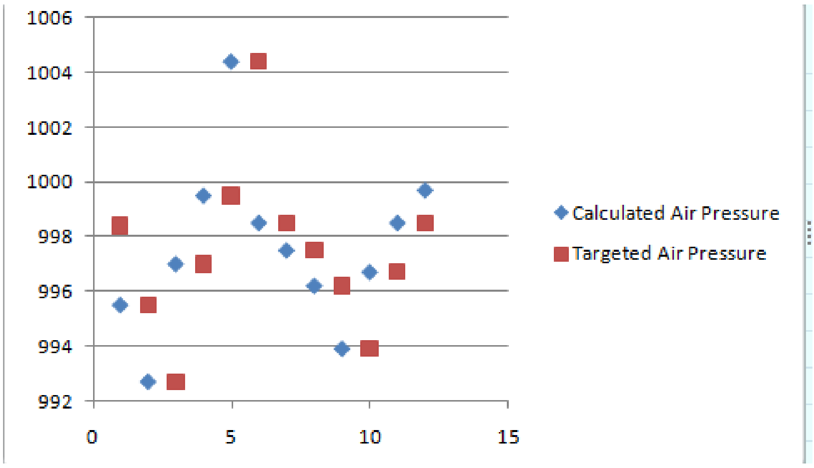


Figure 2: Calculated and Targeted Minimum Air Pressure

Calculated Maximum Air Pressure:

Calculated Air Pressure	Targeted Air Pressure	CT-TT	(CT-TT)^2
996.8	998.7	-1.9	3.61
997.7	996.8	0.9	0.81
1000.7	997.7	3	9
1002.7	1000.7	2	4
1003.0	1002.7	0.3	0.09
997.7	1003.0	-5.3	28.09
1003.0	997.7	5.3	28.09
999.0	1003.0	-4	16
996.4	999.0	-2.6	6.76
996.7	996.4	0.3	0.09
1001.2	996.7	4.5	20.25
1002.7	1001.2	1.5	2.25
TOTAL			119.04

Now Root Mean Square Formula =
$\sqrt{(CT-TT)^2/(N)}$
=3.149
The mathematical Formula $w_1x_1 + w_2x_2 + \cdots + w_nx_n - \theta = 0$

Calculated Air Pressure	Targeted Air Pressure
996.8	998.7
997.7	996.8
1000.7	997.7
1002.7	1000.7
1003.0	1002.7
997.7	1003.0

1003.0	997.7
999.0	1003.0
996.4	999.0
996.7	996.4
1001.2	996.7
1002.7	1001.2
Total=11997.6	Total=11993.6

Mean of Calculated Highest Air Pressure=999.8 Pascal
And Maiden is close to 997.5 Pascal
For Targeted Temperature 999.4
And Maiden 1003.0.5 Pascal

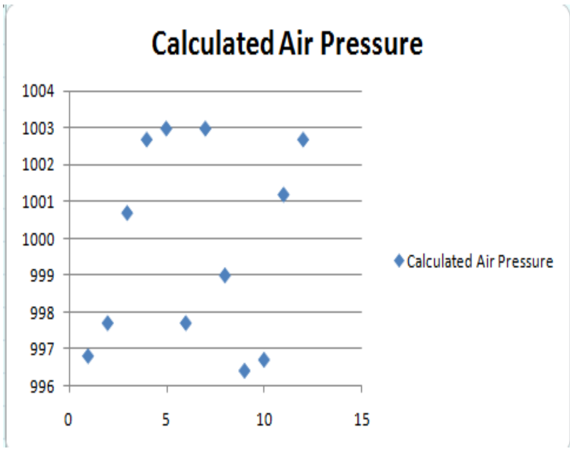


Fig3: Calculated Highest Air Pressure

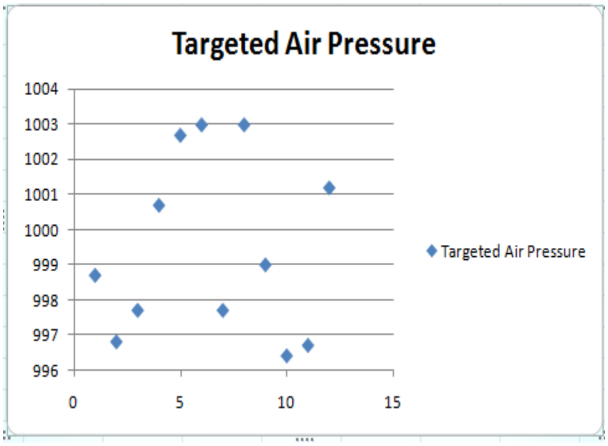


Fig4: Targeted Highest Air Pressure

Support Vector Machine:

Support Vector Machines (SVMs) are versatile machine learning algorithms that are effective in managing high-dimensional data and nonlinear relationships. SVM algorithms are very effective as we try to find the maximum separating hyperplane between the different classes available in the target feature. SVMs can be used for a variety of tasks, such as text classification, image classification, spam detection, handwriting identification, gene expression analysis, face detection, and anomaly detection.

$Y=w^T X+b$

$Y= w^T X+b>=0$

$Y= w^T X+b<=0$

After Applying Support Vector Machine We get the Result

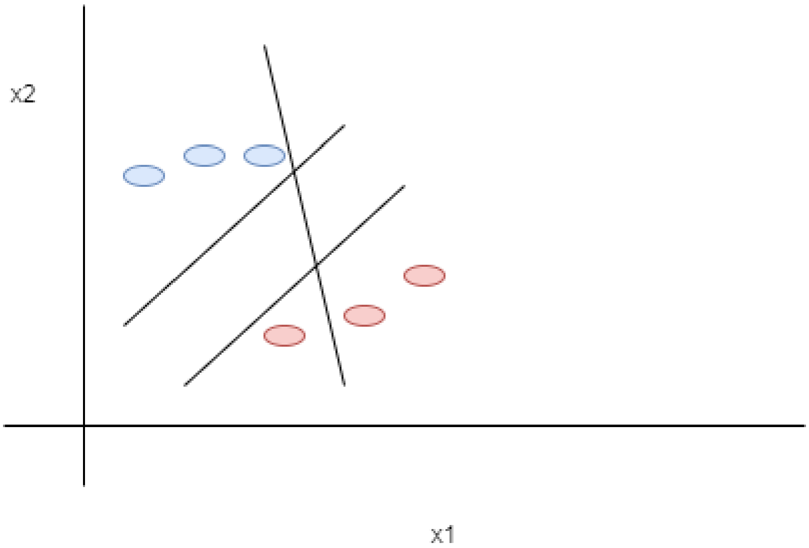


Fig 5: Support Vectors in Hyper Plane

Results:

Minimum Air Pressure:

Calculated Air Pressure	Targeted Air Pressure	CA-TA	(CA_TA)^2
997.7	996.8	0.9	0.81
997.0	992.7	.0.1	0.01
993.9	996.2	.0.7	0.04
TOTAL			0.86

Error=0.5354

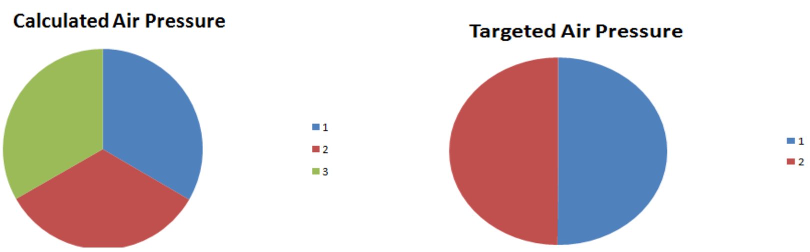


Fig:6 a) Calculted Air Pressure 6 b) Targeted Air Pressure

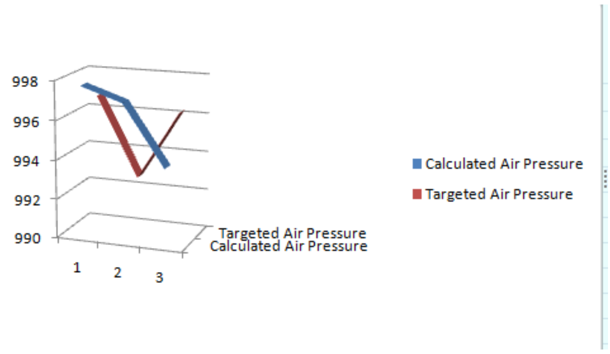
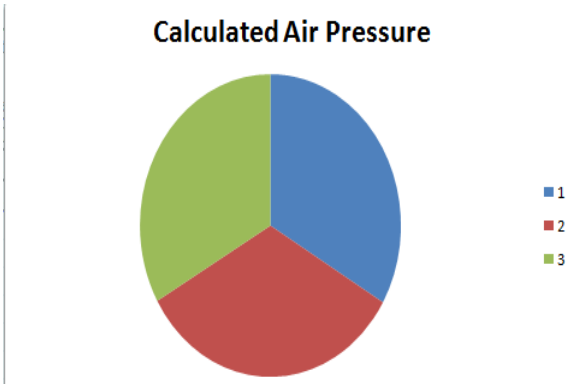


Fig 7: Hyper Plane is giving less Variance for Minimum Air Pressure

Maximum Air Pressure:

Calculated Air Pressure	Targeted Air Pressure	CA-TA	(CA_TA)^2
1003.0	1002.7	0.3	0.09
996.7	996.4	0.3	0.09
997.7	996.8	0.9	0.81
TOTAL			0.99

Error=0.9949



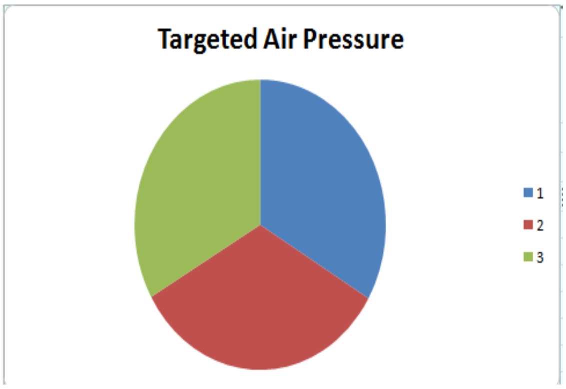


Fig: 8(a) Calculated Maximum Air Pressure Fig: 8(b) Targeted Maximum Air Pressure

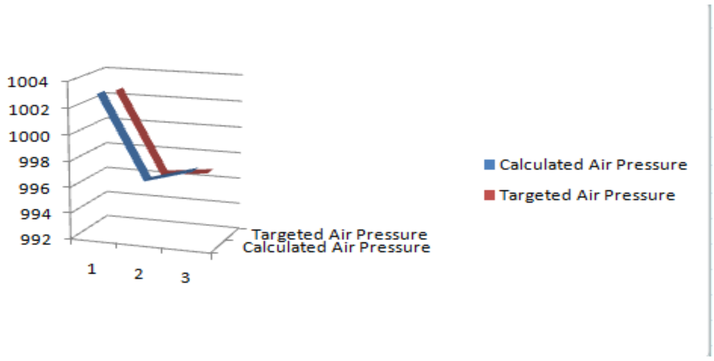


Fig:9: Hyper Plane is giving less Variance for Maximum Air Pressure

Conclusion:

Support Vector Machine is used instead of Multi Layer Perceptron is used to attain the goal of identifying the lowest and highest Air Pressure together with its approximated model. The importance of the lowest and maximum Air Pressures for the weather is well known. After figuring out the lowest and maximum Air Pressures, we used root mean square to get the minimum prediction error, which will yield results that are roughly accurate.

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