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Smart Whether Prediction using Machine Learning Algorithm

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Abstract: *Weather forecasting with traditional technique is mainly done by physical model, still in many parts of the world. Though not neglecting the importance of the model there is an alternative method where recorded data of past can be used for predicting the future weather data. The predicted data may not be exact, but less time consuming and more efficient. Minimum temperature, maximum temperature, average temperature, precipitation percentage these are the common parameters and predicting these with another less resource-based method with some precision will help us going. Machine learning can be used for processing the data based on models like linear regression, functional regression, circular, statistical which processes the data and reduces the error. On comparing the result of model based on different location one can used a model based on requirement. The result obtained then can be analyzed and further improved upon input variables and data size.*

Keywords: Machine learning, MATLAB, Linear Regression with gradient descent method etc.

I. Introduction

The day-to-day surrounding state of a place depending upon the components of the atmosphere like temperature, pressure, humidity, wind speed, rainfall is called the weather. Future prediction of these elements is called Weather Prediction. Air flows from low temperature to high temperature and high is the pressure low is the temperature. The weather of a place depends on the weather of the surrounding area as airflow effects as discussed above. The weather prediction of the area depends on the weather prediction of the surrounding. Vidarbha region is one of the extreme weather regions in India is prone to unprecedented, unexpected rainfall, heat, and cold. Knowing the near accurate how coming day or week will be useful for planning. One of the biggest problems for us was where to start, being an absolute beginner in machine learning cannot be considered an advantage. So we thought of comparing multiple techniques. We started with linear regression and compared its results with many complicated techniques like CNN. Next thing was to decide what exactly we want to achieve with this prediction because the more the number of features to be predicted means more complicated and time-consuming the process will be. So we started with predicting very basic outcomes, minimum temperature while minimum and maximum temperature are input variables. For this we take data of one month of the weather of Vidarbha region, Next time we went for the improved ML algorithm, called gradient descent which decreases the effort by giving direction to the algorithm rather than picking arbitrary points on the cost function to check the global minimum. In this case, we applied linear regression for two variables algorithm, by considering minimum and max temperature as input variables. In the next stage, we increased our data set to 10 years of data and went for the ML model of a higher degree but this also increases the time of the analysis. Hence, we learned the concept of regularization.

II. Literature Survey

Ref. [1] talks about how the complex physical model which are currently being used require high tech computer system which are not feasible for every particular place are requires time and it's outcome depends on nearly all factors responsible for weather change and if something goes wrong at measurement time that be in initial or in the middle or at the end it will lead to error and take long time. Whereas by using the surrounding city's data along with a particular city's data is used to forecast the weather parameters using machine learning is feasible with high return on investment. Where it used Root Mean

Square Deviation (RMSD) method to improvise learning and minimizing Root Mean Square Error (RMSE). By using RMSD they reduced RMSE substantially by obtaining past data and compared at mid-level.

In Ref. [2] as water situation in Australia is shown as extreme in some cases which are flooding and draught, for this reducing water use of individual is temporary or may be few time solutions but can't be permanent. For proper management there is a need of exact data. Detailed study of the trends in parameters of weather or environment with near accurate models makes it easy to manage the extreme situations. The factors include rainfall and temperature. The statistical, global circulation or the combination of both thus can be used. Statistical model requires less iterations and less factor assessment and weather variables are predicted well and thoroughly.

Ref. [3] we studied where it makes comparison between traditional technique and machine learning. The traditional system uses method like ordinary differential equations and then solving complex equations could predict the 10 days weather in advance that too with complete understanding of how weather works, contrary the machine learning is an alternative where, understanding the parameters responsible for the weather change are not to understood completely and it's just the matter of array of data. The two algorithms 3 they used are linear regression and a variation of functional regression. Where the past data is used to train the algorithm.

III. Related Work

Related works included many different and interesting techniques to try to perform weather forecasts. While much of current forecasting technology involves simulations based on physics and differential equations, many new approaches from artificial intelligence used mainly machine learning techniques, mostly neural networks while some drew on probabilistic models such as Bayesian networks. Out of the three papers on machine learning for weather prediction we examined, two of them used neural networks while one used support vector machines. Neural networks seem to be the popular machine learning model choice for weather forecasting because of the ability to capture the non-linear dependencies of past weather trends and future weather conditions, unlike the linear regression and functional regression models that we used. This provides the advantage of not assuming simple linear dependencies of all features over our models. Of the two neural network approaches, one [3] used a hybrid model that used neural networks to model the physics behind weather forecasting while the other [4] applied learning more directly to predicting weather conditions. Similarly, the approach using support vector machines [6] also applied the classifier directly for weather prediction but was more limited in scope than the neural network approaches. Other approaches for weather forecasting included using Bayesian networks. One interesting model [2] used Bayesian networks to model and make weather predictions but used a machine learning algorithm to find the most optimal Bayesian networks and parameters which was quite computationally expensive because of the large amount of different dependencies but performed very well. Another approach [1] focused on a more specific case of predicting severe weather for a specific geographical location which limited the need for fine tuning Bayesian network dependencies but was limited in scope.

Number	Name	Value
1	Classification	Clear
2	Maximum Temperature (F)	57
3	Minimum Temperature (F)	33
4	Mean Humidity	49
5	Mean Atmospheric Pressure (in)	30.13

IV. Conclusion and Future Work

Both linear regression and functional regression were outperformed by professional weather forecasting services, although the discrepancy in their performance decreased significantly for later days, indicating that over longer periods of time, our models may outperform professional ones. Linear regression proved to be a low bias, high variance model whereas functional regression proved to be a high bias, low variance model. Linear regression is inherently a high variance model as it is unstable to outliers, so one way to improve the linear regression model is by collection of more data. Functional regression, how- 5 ever, was high bias, indicating that the choice of model was poor, and that its predictions cannot be improved by further collection of data. This bias could be due to the design choice to forecast weather based upon the weather of the past two days, which may be too short to capture trends in weather that functional regression requires. If the forecast were instead based upon the weather of the past four or five days, the bias of the functional regression model could likely be reduced. However, this would require much more computation time along with retraining of the weight vector w, so this will be deferred to future work.

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