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Review Paper On Weather Forecast Using cloud Computing Technique

(Pradiction of weather)

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Abstract — *Weather forecasting is the application of science and technology to predict the state of the atmosphere for a given location. Ancient weather forecasting methods usually relied on observed patterns of events, also termed pattern recognition. For example, it might be observed that if the sunset was particularly red, the following day often brought fair weather. However, not all of these predictions prove reliable. Here this system will predict weather based on parameters such as temperature, humidity and wind. This system is a web application with effective graphical user interface. User will login to the system using his user ID and password. User will enter current temperature; humidity and wind, System will take this parameter and will predict weather from previous data in database.*

The role of the admin is to add previous weather data in database, so that system will calculate weather based on these data. Weather forecasting system takes parameters such as temperature, humidity, and wind and will forecast weather based on previous record therefore this prediction will prove reliable. This system can be used in Air Traffic, Marine, Agriculture, Forestry, Military, and Navy etc. Weather forecasting is mainly concerned with the prediction of weather condition in the given future time. Weather forecasts provide critical information about future weather.

Keywords- *All City weather, Data mining, weather forecasting, clustering, ANNs, JSON, Soil Fertility, Crop Yield, Agriculture .*

I. INTRODUCTION

Weather prediction is an important application to predict the state of the atmosphere of a given location. Weather prediction has a wide usage in many fields like disaster management, military, agriculture, construction etc. As farming depends on various factors like type of soil, water and climate, farmers can be helped to choose their crops based on the seasons by monitoring the seasonal changes in weather [13]. Since weather condition in a day changes continuously, predicting the weather accurately is a cumbersome task for meteorologists. Climate is the long term effect but weather is a short term effect. Weather can be simply defined as a day-by-day variations, whereas climate is the long term mixture of those variations. Instruments like thermometers, barometers can be used to measure weather but the study of climate depends on statistics [6].

Weather prediction describes the present state of the atmosphere that changes. Atmospheric conditions are obtained by Satellite, Observation from Ships, Aircrafts and Ground. This information are collected and sent to meteorological centers for further process. Analyzing the meteorological data is essential for applications like rainfall, temperature, energy application studies and cloud conditions. Several weather prediction methods are used for analyzing the weather data [12]

This technique used to find the hidden information from large amount of structured and unstructured data clustering. Cloud computing is also defined as the process of extracting useful information from databases. Cloud computing is seen as an important tool for searching interesting patterns and transforms data into business intelligence. Because users may not have any idea regarding their patterns in data and they search for several kinds of patterns. Cloud Computing techniques are used to specify the useful patterns from data and also it focuses the search for interesting patterns. Cloud computing techniques are also very popular because they are more flexible and efficient for analysis than the traditional methods. Cloud Computing tasks can be categorized into types namely descriptive, exploratory, inferential and predictive. First, describes about the general properties of the existing data and the last, describes based on inference on available data. Cloud Computing is considered as a step by step process of "Knowledge Discovery from Databases". There are several steps like Data collection, Preprocessing known as Data cleaning, Data Selection, Data Transformation [14].

1.1 CLUSTERING

Clustering can be simply defined as similar items are grouped together into a single unit. Clustering comes under the unsupervised classification of data. The items or attributes that has same characteristics are belong to one cluster and items with different characteristics belong to another cluster. Clustering is useful for analyzing a large dataset if we do not have any prior knowledge about the partition of data [14].

1.2 TIME SERIES MODELING

Time Series Modeling is a statistical technique which is used to predict the future values of an attribute. Here the independent variable is the time and the dependent variable is the attribute under question.

1.3 STATE OF ART

In 2015 the statement for weather analysis and forecasting was published by American Meteorological Society (AMS). This statement describes the current state and importance of weather forecasting. Forecasting plays a vital role in providing products and services to community. And also save life and property in disaster management. Based on weather about 90% of the emergencies are declared by the Federal Emergency Management Agency. Also more than 7000 road death happens is attributed to weather [2].

There are several data mining techniques used to predict the weather condition in an effective way. In 2012, Folorunsho Olaiya used Artificial Neural Network and Decision Tree Algorithm to investigate rainfall, maximum temperature and wind speed. The results are compared with actual weather data and rules are formed for classifying weather parameters [6]. In 2014, Divya Chauhan and Jawahar Thakur provides a study of decision tree, k- means clustering, k-Nearest Neighbor which describes that for higher accuracy in weather prediction, decision tree and k-means clustering techniques yields good results than traditional approaches [5]. Data mining techniques has wide applications in different fields. In 2014, Rajini kanth applied data mining techniques in agriculture field. In agriculture, farming depends mainly on weather conditions. Weather condition consists of various seasons around the world and so it is necessary to predict the weather very often. For this it requires machine learning algorithms like J48 classification along with linear regression analysis to provide a better result for predicting weather [13].

2. MATERIALS AND METHOD

2.1 Data Collection

The data used for this work was collected from the Centre for Earth and Atmospheric Sciences department, Pune University. The data includes the measurements of temperature (°C), relative humidity (%) and wind speed (km/hr) collected at a height /altitude of 2m, 8m, 16m and 50m above the ground level. The data contains the above weather attributes collected at an interval of 10 minutes[14].

2.2 DATA CLEANING

Data cleaning (Pre-processing) is an important and critical step in Data mining process. Raw data that includes noise, incomplete and inconsistent values which affect the accuracy of data in analysis is need to be pre-processed to improve the quality of data and also to achieve better results. The Null values are checked and removed from the attributes. Outliers are imputed and duplicate records are also removed. Finally, the cleaned data is transformed for further data mining process [14].

2.3 DATA SELECTION

In this step, relevant data that are suitable for analysis was decided/finalized/obtained and retrieved from the dataset. The weather dataset records/contains the temperature, wind speed and humidity at four different levels of altitude recorded for every ten minutes. The weather dataset has 15 attributes such as date, time, temperature (TEMP) measured in degree Celsius, relative humidity (RH) measured in percentage and wind speed (WS) measured in km/hr at different altitudes 2, 8, 16 & 50 meters. Rainfall attribute in the data set has high percentage of missing values. So it is not used in the analysis [14].

2.4 DATA TRANSFORMATION:

Data is aggregated by day and month in order to obtain daily and monthly readings. The attributes are scaled for normalization whose range is between 0.0 and 1.0 [14].

2.5 EXPERIMENTAL DESIGN

R is a language and environment for statistical and graphical techniques, and is highly extensible. R studio v3.3.1 is used to analyze the meteorological data.

Table 1
Comparison of Algorithm

A. Algorithm for classifying the weather data	*B. Algorithm for Forecast using Neural Networks*
1. Read the dataset	1. Split data into training and test set
2. Preprocessing: clean , remove outliers , scale data	2. Convert the training data into time series
3. Cluster the data with average temperature, average humidity and average wind speed	3. Smoothen the time series using Sliding Window/ Holt winters function
4. Find the accuracy	4. Create time series model using nnetar
5. Visualize the results	5. Forecast / Predict the future values using the model
	6. Report the accuracy of the model by comparing with test data.

Can be attributed to the presence of outliers in the data. Results of clustering on average temperature & humidity show that the weather attributes can be group into five groups. Comparing against the original data shows that all months of the year has days falling into these 5 clusters. The ratio of the within cluster sum of square to the total sum of squares is 80%

Results of clustering on average temperature & wind speed show that the weather attributes can be grouped into five groups. Comparing against the original data shows that all months of the year has days falling into these 5 clusters. The ratio of the within cluster sum of square to the total sum of squares is 74% [14].

The Figure 1(a) shows the original time series followed by the forecasted values of maximum temperature

Using neutral network model.

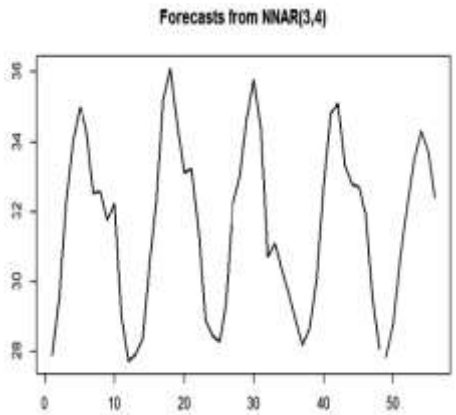

Figure 1 (a): NNETAR: Original Vs Predicted

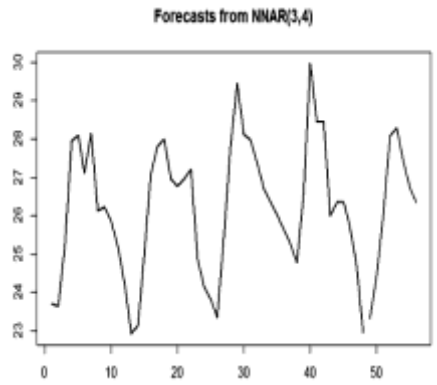

Figure 2: (a) NNETAR: Original Vs Predicted

The Figure 2(a) shows the original time series followed by the forecasted values of minimum temperature using neural network model.

The below table 2 shows the evaluation metrics for maximum and minimum values of temperature, relative humidity and wind speed modeled by using neural networks. Among the above, the model for forecasting the maximum and minimum temperature is acceptable and the model for forecasting maximum and minimum humidity is relatively acceptable. The model for wind speed is rejected due to very high MAPE value [14].

Table 2
NNETAR Training and Test data Statistics

	Temperature				*Relative Humidity*				*Wind Speed*			
	Maximum		*Minimum*		*Maximum*		*Minimum*		*Maximum*		*Minimum*	
	Training Data	*Test Data*	*Training Data*	*Test Data*	*Training Data*	*Test Data*	*Training Data*	*Test Data*	*Training Data*	*Test Data*	*Training Data*	*Test Data*
ME	0.0350	0.7644	-0.0078	-0.674	0.1975	-7.930	0.4024	-6.103	0.0258	0.0885	0.0199	-0.232
RMSE	0.8794	0.9945	1.1438	1.1065	4.8211	8.5922	4.8550	11.969	0.3320	0.4572	0.1620	0.232
MAPE	1.9875	2.3044	3.8830	2.8164	4.2796	9.2022	6.0590	21.139	10.2681	12.687	17.464	
56.620												

3 CONCLUSION AND FUTURE WORKS:

Review paper on weather Forecasting Using Cloud Computing Technique will presents the conclusion of cloud computing conducted on the weather data collected in Centre for Earth and Atmospheric Sciences in Amravati and other city following the CRISP cloud computing framework. The initial exploratory data analysis brings out the daily maximum, minimum temperature, the correlation between the weather attributes, the average daily temperature and the trend of the monthly temperature. This system is useful for prediction of minimum and maximum temperature in the nature [14].

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