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Rainfall Prediction using Machine Learning and Neural Network

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Abstract: Predicting the amount of daily rainfall improves agricultural productivity and secures food and water supply to keep citizens healthy. To predict rainfall, several types of research have been conducted using data mining and machine learning techniques of different countries' environmental datasets. An erratic rainfall distribution in the country affects the agriculture on which the economy of the country depends on. Wise use of rainfall water should be planned and practiced in the country to minimize the problem of the drought and flood occurred in the country. The main objective of this study is to identify the relevant atmospheric features that cause rainfall and predict the intensity of daily rainfall using machine learning techniques. The Pearson correlation technique was used to select relevant environmental variables which were used as an input for the machine learning model. Two commonly used models predict seasonal rainfall such as Linear and Non- Linear models. The first models are ARIMA Model. While using Artificial Neural Network (ANN) predicting rainfall can be done using Back Propagation NN, Cascade NN or Layer Recurrent Network. Artificial NN is same as Biological Neural Networks.
Keyword's: Machine Learning, LASSO regression, ANN (Artificial Neural Network) SVM (Support Vector Machine) approach, ARIMA MODEL (Auto Regressive Integrated Moving Average), Naive Bayes.

I. INTRODUCTION

Nowadays, rainfall is considered to be one of the most liable factors for most of the significant things in the world. In India, agriculture is one of the most important factors in deciding the economy of the country and agriculture is totally dependent on the rainfall.

Apart from agriculture, rainfall is also more important in coastal areas around the world by getting to know the rainfall is very much necessary to protect their lives from the floods and heavy rainfall. In some of the areas which are having drought, to establish a rainfall harvester, proper prediction of rainfall is necessary. In this project we are dealing with predicting of rainfall using Machine learning and Neural networks.

In this, we are executing a comparative study of machine learning approaches and neural network approaches then accordingly selects the perfect approach for prediction of rainfall. First the preprocess is performed, i.e. representing the input dataset in graph form. Such as histogram, bar graph etc. In ML techniques, LASSO (Least absolute shrinkage and selection operator) regression is used and ANN (Artificial Neural Network) approach is used for neural network. After the calculation, accuracy and errors of the LASSO and ANN is been compared and accordingly the conclusion is made. In this, the prediction of rainfall is made with the approach which has highest accuracy in the outcomes. The prediction of rainfall is done with the dataset which has the information related to rainfall.

II. MOTIVATION

Rainfall information in the past helps farmers better manage their crops, leading to economic growth in the country. Prediction of precipitation is beneficial to prevent flooding that saves people's lives and property. The most important thing is to accurately determine the rainfall for active use of rainfall for water resources, crops, pre-planning of water resources and for agricultural purposes. In earlier rainfall information benefits the farmers for better managing their crops and properties from heavy rainfall.

A. Objectives
1) To helps farmers better manage their crops.
2) To increase economic growth in the country.
3) To save the people

III. RELATED WORKS

A. T.R. Sivaramakrishnan, S. Meganathan

Rainfall prediction is usually done for a region but spot quantitative precipitation forecast is required for individual township, harbours and stations with vital installation.. The method gives good result for the prediction of daily rainfall 24 hours ahead. There are three main parts in this work. First, the obtained raw data was filtered using discretization approach based on the best fit ranges. Then, association mining has been performed on dataset using Predictive Apriori algorithm

B. J.refonaa,m. Lakshmi, raza abbas, mohammad raziullha

Artificial intelligence is been widely used in all The applications and weather forecasting is not an exception. When it comes to weather forecasting, rainfall prediction is one Of the most widely used research areas as numerous lives and Property damages occur due to this. Intense rainfall has Abundant impacts onsociety and on our daily life from Cultivation to disaster.

C. K.Ishizaki & F.Yoshino,K. Takeuchi, A. Yoo

A short-term rainfall prediction model using the echo-tracking method was applied to a number of rainfall cases to determine the accuracy of the model, and the accuracy of one-hour prediction proved to be practical.

D. Adi Nugroho , Bistok Hasiholan Simanjuntak

Water is the main factor in determining the success of the activities of food crops, horticulture, and plantation. The main source of the water for agriculture and plantation comes from rainfall. This condition also occurs in regency of Semarang, Central Java, Indonesia. Therefore, rainfall prediction will play an important role in the success of the activities. Univariate time series model of ARMA (Autoregressive Moving Average) can be used to predict it in the future

E. Niravesh Srikalra, and Chularat Tanprasert

Thailand's main profession is agriculture and rainfall is one of the major factors that play an important role for its economy. With the rainfall data sets of each station around Chao Phraya River during the period of 2002 – 2005, recorded online every fifteen minutes all year round, rainfall prediction with neural networks

IV. PROPOSED SYSTEM

A. Existing System

Machine learning approach deals with predicting rainfall using machine learning approach. It finds the accuracy of the machine learning approach using two types of errors i.e. RE and RMSE. In these four major trends of machine learning are being used. The first one is called hybridization, which means multiple machine learning approaches are being used together and accordingly prediction is being done. The second one deals with improving the quality of dataset which is being used.

B. Proposed System

We have proposed ANN based rainfall prediction and forecasting system to efficiently predict the rainfall and to do forecasting for upcoming years.

Advantages: It provides the better accuracy comparing to the existing approach. It consumes less time for huge amount of data We prefer the deep learning approach for predicting the rainfall by using the Auto- encoder Neural network and multilayer perceptron. We are comparing the other state approaches with the present architecture.

The results have an opinion that in terms of RMSE and MSE, our recommended planning performs better than the other remaining methods.

The correctness of this can measured by RMSE and MSE, comparing with the other methods. With the conditions of the management and water resources, people's lives and the weather they own, predicting the precipitation is very important. We could face the wrong or unfinished estimation because of the precipitation measurement is affected by local and spatial climate changes, and some properties.

In this project we are going to provide a study on the various types of methodologies which are used for forecasting and predicting of rain and there might be many issues founded when we applied various Methods for rainfall forecasting. The following algorithms are used in this project

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1) ANN

ANN (Artificial neural network) uses 2 deep learning methods which are the Auto-Encoders and Multilayer Perceptron. The Auto-Encoder extracts the all non-linear features, and then send it to Multilayer Perceptron (MLP), this helps the prediction much better. The neural network is neurons connected together with the output from one neuron becoming input to others until the final output is reached.
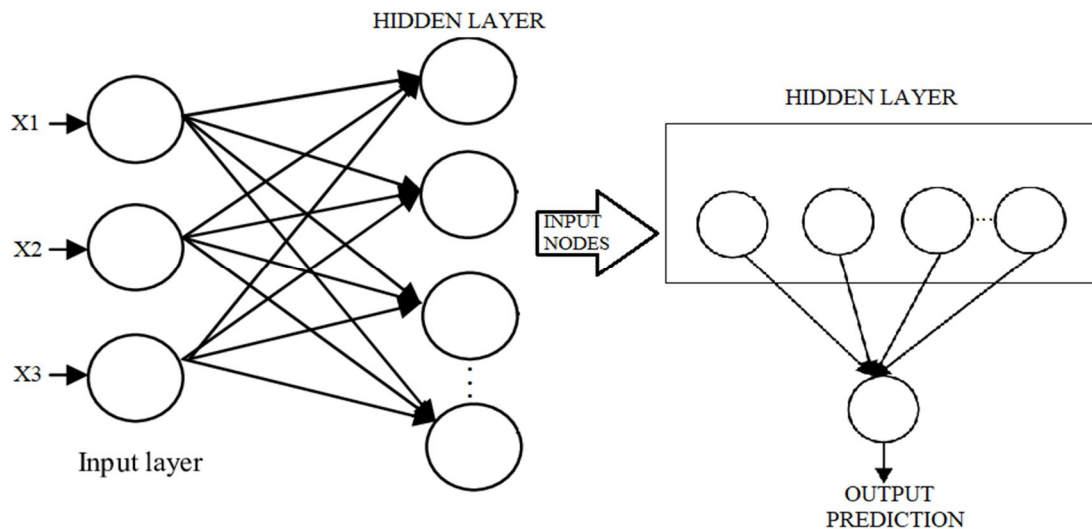
Fig 1.ANN

2) .Arima Model

(auto-regressive integrated moving average): The ARIMA model is mainly used for time series prediction, forecasting and analysis. It has 4 methods and is suggested by the Jenkins and Box, ARIMA model has 4 steps which are as follows.

a) Stage 1: In this stage recognizing series of the responses is been done. which are used for time series calculation and the autocorrelations by using the statement called IDENTIFY.

b) Stage 2: In this step, the variables which are already identified are estimated and also the evaluation of parameters are done by using statement called ESTIMATE.

c) Stage 3: In this stage the Diagnostics checking for above already collected parameters and variables is being done.

d) Stage 4: In this step, prediction of the time series values are being forecasted. which are the future values, by using the ARIMA model and also used the statement called FORECAST. In this model the parameters used are m,n,o which defines 'm' as number of the lag observations, 'n' as the differencing degree and 'o' as moving average order.
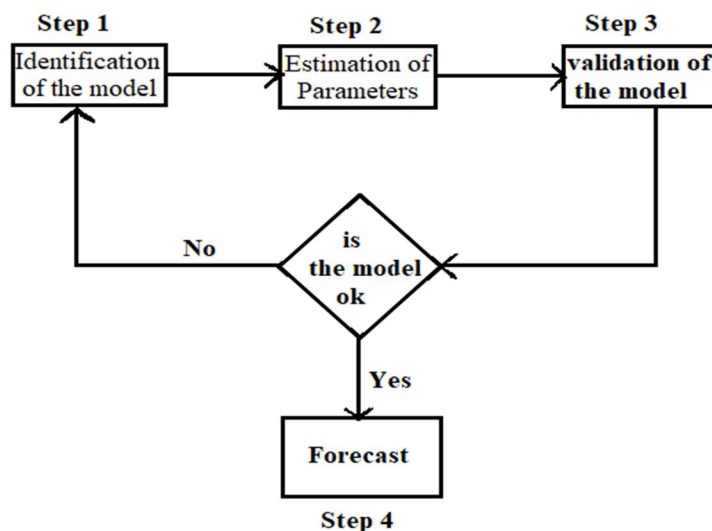

Fig 2 Arima model
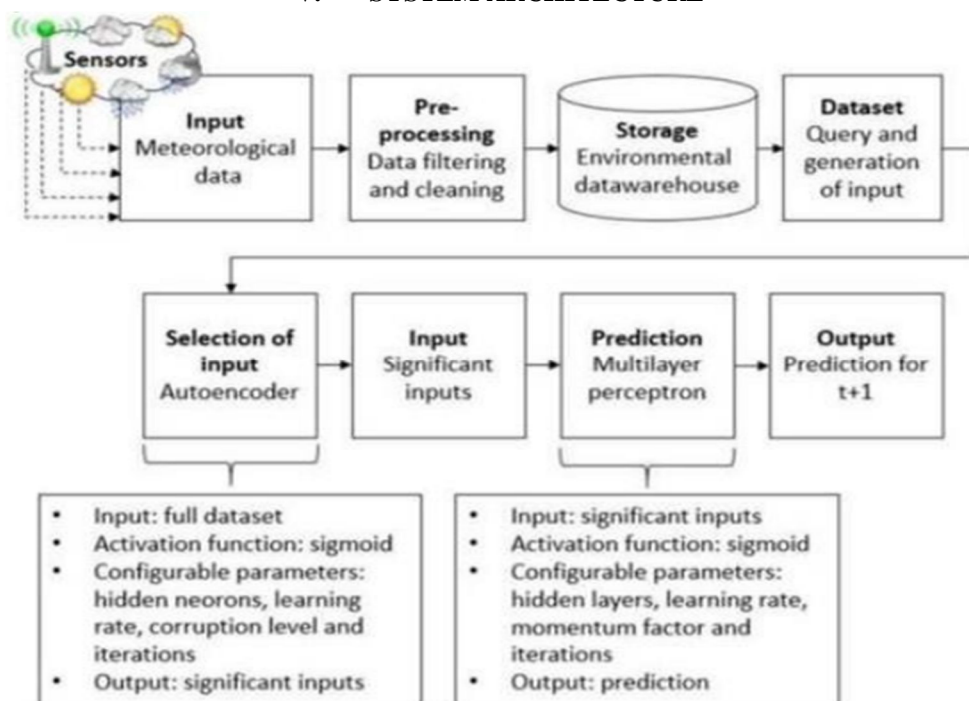
V. SYSTEM ARCHITECTURE

Fig 3 System Architecture

The model takes sequence of daily rainfall intensities and geographical parameters, namely latitude and longitude as input. After initial pre-processing, input goes to a deep network, which is a ANN, and a wide network consists of convolutions. The model is trained using joint training approach, considering outputs from deep and wide networks simultaneously.
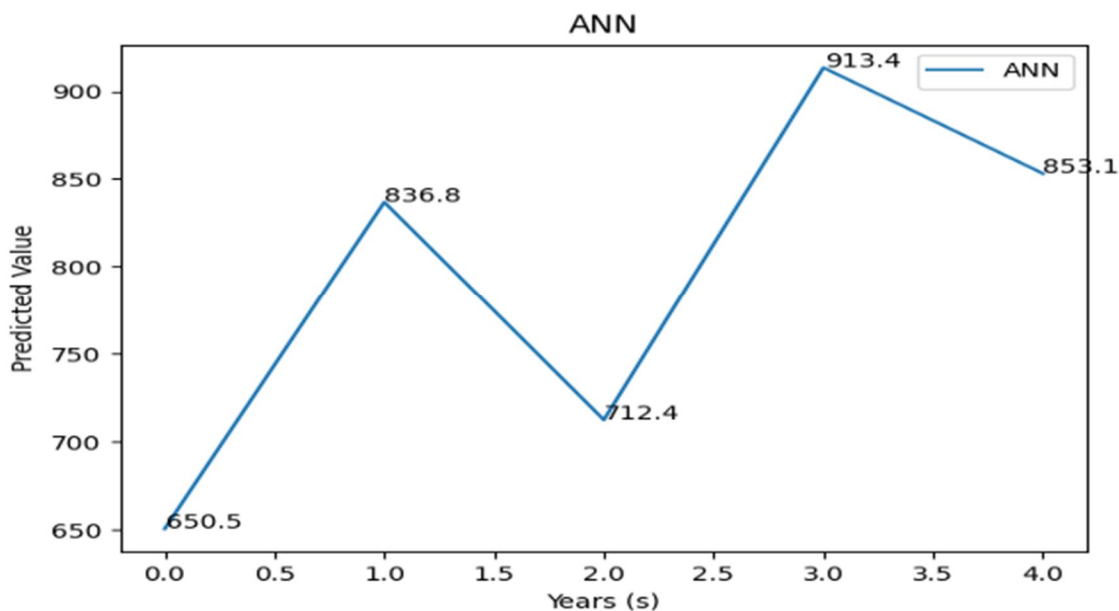
VI. EXPERIMENTAL RESULTS
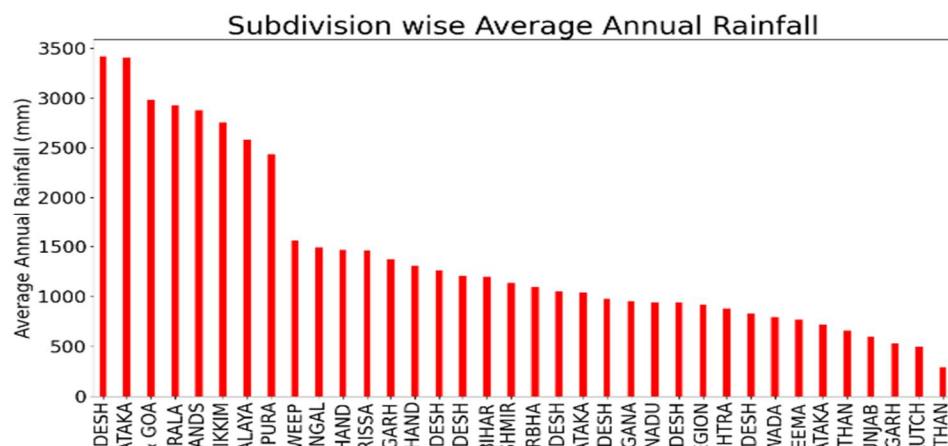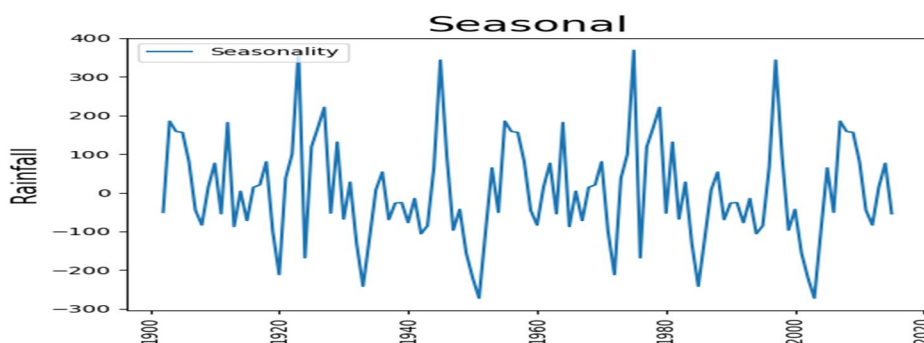

Fig 4 Ann forecast

Fig 5 Annual Rainfall

Fig 6 Seasonality

VII. CONCLUSION

We are developing an desktop application which uses the python language where system automatically predicts the rainfall information in the given region. In this project we represented an deep learning approach to predict the rainfall by using Auto encoder neural network and Multilayer perceptron. By comparing other state approaches with current architecture. The outcomes for this project aim that in the terms of RMSE and MSE, our planned architecture better performs the remaining methods. The accurateness of the project outcomes can measure by RMSE and MSE by relating the results with other methods. By including the conditions of the water resources and the management, people's valuable lives and climate they own, to predict the precipitation is of more important. Incorrect or the aborted precipitation is been influenced by the spatial, the local change and the property.

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