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CROP YIELD PREDICTION BASED ON AGRICULTURE RELATED DATA USING MACHINE LEARNING

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ABSTRACT

Agriculture is one among the main revenue producing sectors of India and a source of survival. Numerous seasonal, economic and biological patterns influence the crop production but unpredictable changes in these patterns cause an excellent loss to farmers. These risks are often reduced when suitable approaches are employed on data associated with soil type, temperature, air pressure , humidity and crop type. Whereas, crop and meteorology are often predicted by deriving useful insights from these agricultural data that aids farmers to make a decision on the crop they might wish to plant for the forthcoming year resulting in maximum profit. This paper presents a survey on the varied algorithms used for weather, crop yield, and crop cost prediction.

KEYWORDS: Agriculture, Crop yield prediction, Cost forecasting, Weather prediction.

I. INTRODUCTION

Agriculture is superior to citizenry , because it forms the idea for food security. Agriculture is that the main source of value for many developing countries [1]. However, for the developed countries, agriculture contributes a bigger percentage to their value . Agriculture is one among the main sectors to be impacted by different sources like climatic changes, soil attributes, seasonal changes etc., [2]. India is predominantly an agriculture based country, and agriculture is that the important occupation for many of the Indian families. In India, over 60.3% of acreage is agricultural land, it contributes about 17% to the entire Gross Domestic Product (GDP), one-tenth (10%) of total exports and offers employment to 60% of the population. India's agriculture consists of various crops, with the main crops of rice and wheat. Indian farmers growing pulses, sugarcane and also, non-food items like cotton, tea, coffee, then on [3], [4].This scenario mainly concentrates on meteorology , crop yield prediction and crop cost forecasting [5]. These factors help the farmers to cultivate the simplest food crops and lift the proper animals with accordance to environmental components. Also, the farmers can adapt to climate changes to a point by shifting planting dates, choosing varieties with different growth duration, or changing crop

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rotations. For experimental analysis, the statistical numeric data associated with agriculture is undertaken. Whereas, the clustering based techniques and supervised algorithms are utilized for managing the collected statistical data [6]. Additionally, the acceptable classification methods like Support Vector Machine (SVM), neural networks are employed for better classification outcome [7]. These techniques will help in predicting the rainfall, crop yield forecasting and price prediction of crops.

II. LITERATURE SURVEY

1. **G Rasul, Q. Z. Chaudhry, A. Mahmood, K. W. Hyder, "Effect of. 28–40Temperature Rise on Crop Growth & fertility", Pakistan Journal of Meteorology, vol. 8, no. 15, pp. 7-8, 2011.This considers an analysis. of ERS SAR imagery of agricultural crops in Flevoland, The Netherlands over a four-year period (1993 to 1996)**

To study the cohension of multitemporal radar indication from one year to the next. Direct comparisons of the multitemporal profiles of crop indication are made to derive limits on their stability and to examine the differences between them from one year to the next. Sharp rises (of several dB) in temporal crop indication are linked to variations in rainfall, freezing, and incident angle (due to elucidate passes from different orbit tracks). Model simulations confirm the plausibility of these mechanisms and emphasize their importance for calculable monitoring of agricultural crop development. The possibility of timing critical phases of the crop growth cycle is displayed using field-to-field variations with particular regard to the emergence and closure of sugar beet. The inter year comparison also enables generalized comments to be made regarding the performance of stability of crop classification algorithms from one year to another. Only summer months are constantly identified as helping to distinguish broad-leaved crops from cereals. There is some evidence that other times of the year assist in analyse specific crops, but this confirmation is not stable from one year to another.

2. **AnupamaMahato, "Climate Change and its Impact on Agriculture", International Journal of Scientific and Research Publications, vol. 4, no. 4, pp. 4-5, April 2014, ISSN 2250-3153.**

Due to the complex climate types and various meteorological disasters in gansu province, with the background of climate change dominated by warming, the losses caused by meteorological disasters are increasing. The understanding of disaster risk characteristics and its response to climate change need to be solved urgently. In view of this, this study based on the data of the disaster situation of major meteorological stations in gansu province since 1961, constructed the disaster risk index-comprehensive loss rate, and systematically analyzed the space-time variation characteristics of drought, rainstorm and flood, wind and hail and low

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temperature disasters in gansu province, and discussed the impact of climate change on them. The results show that since 1961, the risk of agricultural drought disaster is the greatest, followed by wind hail and rainstorm flood, and the risk of cold disaster is relatively minimal. Among them, drought disaster, disaster and loss rate (25.2%, 14.1% and 2.2 %) were significantly higher than the national average (15.0%, 8.1 % and 1.7%), and the increase rate (0.16%/10a, 0.15%/10a and 0.05%/10a) was also higher than the national average. The comprehensive loss rates of storm hails, rainstorm and flood disasters and cold and cold disasters also showed an increasing trend, with the increase rates of 0.29%/10a, 0.45%/10 and 0.72%/10a, respectively. The characteristics of inter-decadal disaster risk change have obvious differences, and the drought disaster risk increases uniformly. After climate change, the risk of major meteorological disasters in gansu increased.

3. **Japneet Kaur, "Impact of Climate Change on Agricultural Productivity and Food Security Resulting in Poverty in India", Università Ca' FoscariVenezia, vol. 23, pp. 16-18, 2017.**

Secure food productivity is an important issue for the developing countries like India, where more than one third of the people is live in poverty. Season crop production estimations are vastly identified as an important input for investigating food balance sheets and production shortfalls. Crop production estimation and assessment is done worldwide on a regional basis to enable high production and cost reduction in crop yield estimation. The aim of this method is to the productivity of the crop, using various factors like soil type, season type, water availability and risk factor. In this scheme, Parallel Layer Regression (PLR) along with Deep Belief Network (DBN) strategy is proposed to perform crop productivity estimation. Here, DBN strategy is generated for top five growing crops in Karnataka namely, rice, ragi, and pulses. The proposed methodology forecasts each area in the applicable database into one of the five crops. Finally, the experimental results show that the method has strong potential for accurate crop productivity prediction in terms of accuracy (ACC), sensitivity (SEN) and specificity (SPE) and also this method performance has verified in real time data and people interactions.

4. **Pratap S. Birthal, Md. Tajuddin Khan, Digvijay S. Negi, Shaily Agarwal, "Impact of Climate Change on Yields of Major Food Crops in India: Implications for Food Security", Agricultural Economics Research Review, vol. 27, no. 2, pp. 145-155, July-December 2014.**

Crop productivity is a major treat all over the world to provide food security, resulting in the green revolution. It is noteworthy that the fertilizer implemented to farmland leads to more desirable cropping patterns. Utilization of agricultural land efficiently for the crop production requires the knowledge of the nutrient inconsistency. This paper has

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presented the power of geometics, to retrieve the synoptic and substantial changes in cropping pattern. Results and exposition lead to the evaluation of the contemporaneous cropping systems. After a major yield parameter study for crops (rice, wheat, sugarcane, and onion), the magnificent accelerations were suggested. Results indicate a correlation value of 0.834 with the estimated crop yield and normalized difference vegetation index. The rice similar Yield (ray) is highest at the range of 17-21 t/ha in the North, central and southern lower part, lowest at the western part ranging from 7-12 t/ha, with some part with 12-14 t/ha, while the most of the eastern part of the study site has shown the ray values ranging from 14 to 17 t/ha. The view information, such as pH, electrical conductivity, and organic carbon of the soil specimen, was used to examine the structural discrepancies of rice-based cropping system's productivity. Ultimately, the spatial temporal maps of fertilization pattern, yield parameters (e.g., N, F, and K), and relational ray observation were illustrated using spatial interpolation.

5. **J.P. Powell, S. Reinhard, "Measuring the effects of extreme weather events on yields" in Weather and Climate Extremes, Elsevier, vol. 12, pp. 69-79, 2016.**

Fiber optics is an stunning technology that allows our daily voice, video and data transmissions to occur with ever-increasing quality and lower costs. In this tutorial, you will learn how fiber optics welfare a variety of applications followed by a review of the cabling process and variations in cable. Next, will be a discussion of fiber optic splicing and fiber optic connectors. Next will be a review the many products designed for cable and fiber management and examine troubleshooting a fiber optic link. Finally, OTDR theory and operation will be reviewed. After completing this tutorial you should have an understanding of: Fiber Optic Applications; Fiber Optic Cable; Fiber Optic Knit; Fiber Optic Connectors; Patch Panels, Closures and Pedestals; Troubleshooting a fiber optic link; and OTDR Theory and Operation.

6. **G. P. Zang, "Time series predict using a mixture ARIMA and neutral network model", Neutro computing, vol. 50, pp. 159-175, 2013.**

Forecasting accuracy is the most important factor choosing any forecasting methods. Research for upgrading the accuracy of forecasting models has never been stopped. The plan in this paper is simple and old while the practice is simple using the software technology in use. We plan to filter out the residuals from a multivariate time series causality model by a univariate (residual term) time series model, then to remove any possible systematic component if left at all, by using an artificial neural networks. Doing so, we believe the blend method will take the advantages of each and all model in use. In this practice we have compared the ultimate residuals left out of

ARDL, ARIMA and ANNs linked, with that of ARDL, ARIMA and ANN, individually. The data set in our experiments consists of few macroeconomic variables such as consumer price index, interest rate, exchange rate and money volume, used to forecast the time series Tehran stock index, a very small and volatile market. Experimental results as imagine has specify that the hybrid model is a better forcaster for stock price compared to each of the ARDL, ARIMA and the Artificial Neural Networks.

7. **B. Dument, V. Leman, Salvador Ferrandis, Bernard Bodson, Jean-PerrieDestain, "Assessing the potential of an algorithm based on mean climatic data to predict wheat yield", Precision Agriculture, vol. 15, no. 3, pp. 255-272, June 2014.**

Bangladesh, a nation acclaimed for its rich productive coast and a population around 160 million, earns better of its living from agriculture. The fiber rich lands help us providing year-round crop yields that play a crucial role for the economy of Bangladesh. Thus, this is important to intentionally work on agricultural planning and prediction models to ensure economic prosperity. The advancement of crop yields is notably dependent on soil factors like Ph, nutrients and organic substances along with climatic factors like rainfall, temperature and humidity. Data of such factors are put down to serve the purpose of scientific and statistical analysis. With the help of applying different data mining techniques on them, we are able to determine effective parameters to predict crop yield from different locations. This paper mainly distinct on the analysis to predict Bangladesh's four better yielding crops; wheat, jute, T-Aman and mustard. To carry out the whole examination, we have analyzed soil properties of medium high land and high land from different sub districts of Bangladesh and also their respective climatic data and crop production of the last 6 years. For our analysis, we have applied different data mining ability such as K-means, PAM, CLARA and DBSCAN for clustering and four linear regression methods to predict crop yields.

8.B Basso, B Bodson, V. Leemans, B. Bodson, J-P Destain, M-F Destain, "A comparison of within season yield predictions algorithm based on crop model behavior analysis", Agricultural and Forest Meteorology, vol. 204, pp. 10-21, May 2015.

The behavior of crops can be accurately forcast when all the parameters of the crop model are well known, and assimilating data observed on crop status in the model is one way of estimating parameters. Nevertheless, the feature of the estimation depends on the sensitivity of model output variables to the parameters. In this paper, we quantify the link between the global reactivity analysis (GSA) of the soil parameters of the mechanistic crop model STICS, and the ability to retrieve the true values of these parameters. The Global sensitivity indices

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were computed by a variance based method (Extended FAST) and the quality of parameter estimation (RRMSE) was computed with an importance sampling method based on Bayes theory (GLUE). Criteria based on GSA were built to link GSA indices with the quality of parameters estimation. The result shows that the higher the criteria, the better the quality of parameters estimation and GSA appeared to be useful to interpret and predict the performance of the estimation parameters process.

9. Betty. J, Shem G Juma, Ever line. "On the Use of Regression Models to Predict Tea Crop Yield Response to Climate Diversity: A Case of Nandhi East Sub-County of Nandhi County Kenya", Assessing the Value of Systematic Cycling in a Polluted Urban Environment Climate, vol. 5, no. 3, pp. 5, July 2017.

Data mining is an emerging field of research in Information Technology as well as in agriculture. The present study focus on the operations of data mining techniques in tea plantations in the face of climatic diversity to help the farmer in taking decision for farming and achieving the expected economic return. This paper presents an analysis using data mining techniques for estimating the future yield prediction in tea harvest with climatic change trends observed in last 30 years (1977-2006). The patterns of crop production in response to the climatic (rainfall, temperature, relative humidity, evaporation and sunshine effect across the four tea growing division (South Bank, North Bank, Upper Assam and(Cachar) of Assam were developed using Multiple Linear Regression (MLR) technique. The tea production estimation equations developed for the regions were validated for the future yield prediction (2007, 2009 and 2010) and were found to be symbolic. Thus it is opinion that the planters/farmers could use the capability to predict the future crop productivity and therefore approve alternative adaptive measures to maximize yield if the predictions fall below expectations and commercial viability.

10. Christian Baron, Mathieu Varc, pettli. P, Sultan. B, "Are regional climate models relevant for crop yield prediction in West Africa?", Environmental Research Letters, vol. 6, pp. 2-6, 2011.

Precision agriculture is the technology directed approach for increase farm management in terms of inputs and outputs besides preserving resources. Towards this end many techniques came into existence. Data mining techniques are can be used towards precision agriculture. Numerous efforts have been made to exploit remote sensing data to build various indices for assessing productivity of crops. They include Temperature Condition Index (TCI), Vegetation Condition Index (VCI) and Normalized Difference Vegetation Index (NDVI). Crop yield prediction can help agriculture related departments and organizations to make strategic decisions. In

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this paper a novel framework named extensible Crop Yield Prediction Framework (XCYPF) is determined that is adjustable and extensible. It has provision for selection of crop, dependent and independent variables, datasets for crop yield prediction towards precision agriculture. The available indices are used along with rainfall data and surface temperature for crop yield prediction for rice and sugarcane crops.

III. PREPROCESSING METHODS

Preprocessing techniques play a vital role in text mining. Preprocessing is the beginning step in the text mining approach. Preprocessing is done in three steps namely Dataset and preprocessing, Feature exaction, classification.

IV. PROPOSED SYSTEM

This scheme mainly concentrates on weather forecasting, crop yield prediction and crop cost forecasting. These factors help the farmers to cultivate the best food crops and raise the right animals with accordance to environmental components. Also, the farmers can adapt to climate changes to some degree by shifting planting dates, choosing varieties with different growth duration, or changing crop rotations. For experimental analysis, the analytical numeric data related to agriculture is undertaken. Whereas, the clustering based techniques and supervised algorithms are utilized for managing the collected statistical data. Additionally, the suitable classification methods like Support Vector Machine (SVM), neural networks are employed for better classification outcome. Indians agriculture consists of numerous crops, with the major crops of rice and wheat Indian farmers growing pulses, sugarcane and also, non-food items like cotton, tea, coffee, and so on. These techniques will help in predicting the rainfall, crop yield forecasting and cost prediction of crops.

V. SYSTEM ARCHITECTURE

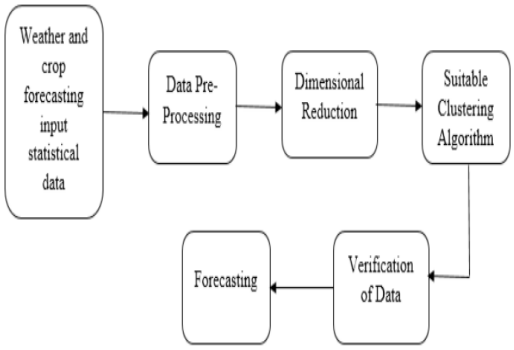
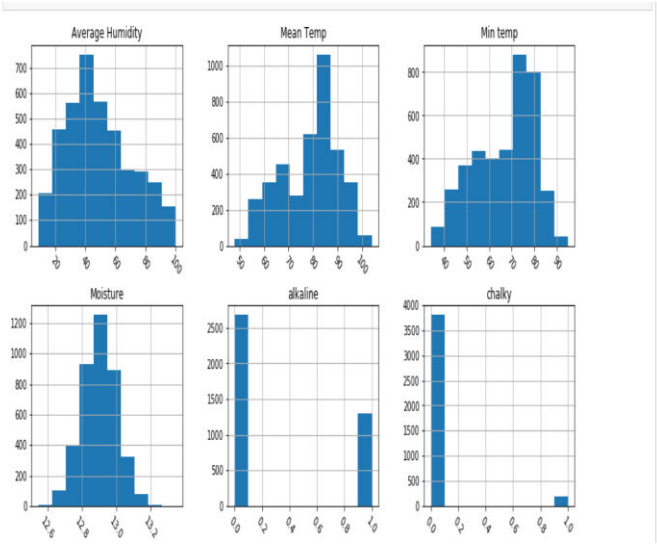


Figure 1. General forecasting block diagram

GRAPHS OF DATASET:



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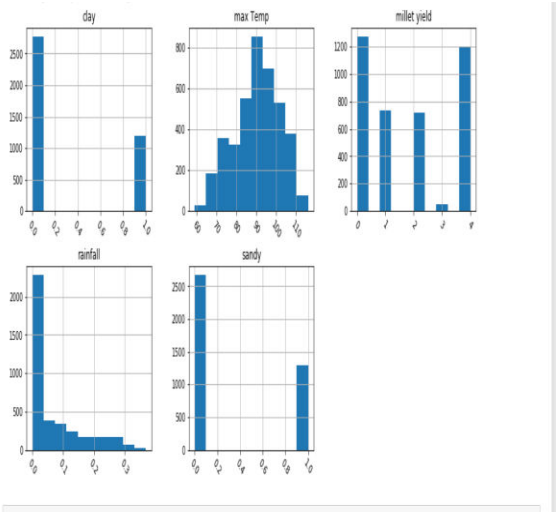
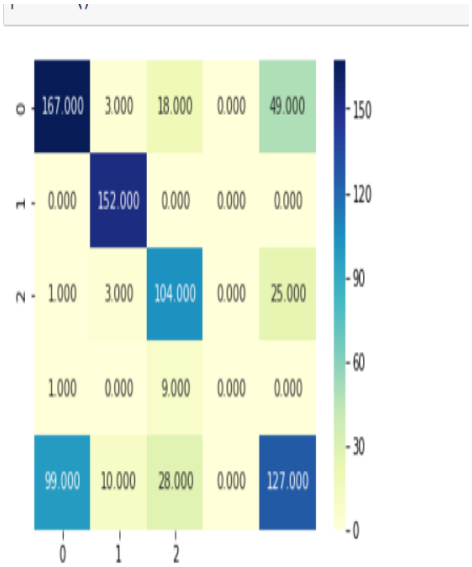
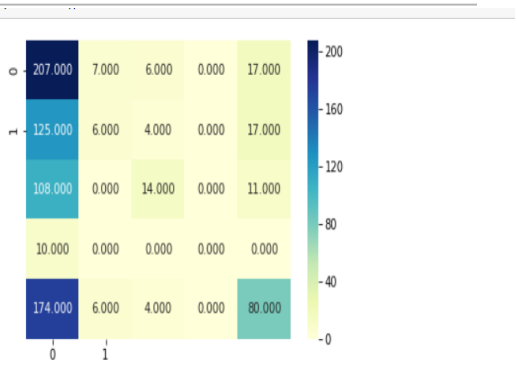


DEEP NEURAL NETWORKS:





VI. CONCLUSION:

Our proposed work presents various classification , mining and pre-processed techniques There are numerous systems that utilize various methodologies to manipulate data, to derive insights and help indecision making for farmers. But the major concern is that they focus either on one crop prediction or forecast anyone parameter like either yield or price. This scheme is employed to forecast the weather, yield and price of major crops of Karnataka based on historical data. Especially, for Mysore region, because they are the largest producer of coffee, ragi, and coarse cereals and also the largest rice producing district in Karnataka. The statistical data and predicted output are accessible for the farmers through a stand-alone user friendly application. This aids farmer to decide on the crop they would like to plant for the forthcoming year, which helps them to obtain maximum price for their products.

VII. FUTURE WORK

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