

A Data Mining Method for Weather Change Impacts on Crop Yield

Ramachandra Reddy Avula¹, Dr. A. Rama Mohan Reddy²

¹*Research Scholar, Department of Computer Science and Engineering,
Sri Venkateswara University, Tirupati, Andhra Pradesh, (India)*

²*Professor, Department of Computer Science and Engineering,
Sri Venkateswara University, Tirupati, Andhra Pradesh, (India)*

Motivation

India is basically an agriculture dependant country. The agriculture is playing a very important role of development of economy of the country. Andhra Pradesh and Telangana states depends on Godavari and Krishna river basin for agriculture.. Till the formers of above states following the old methods to agricultural productivity. It impact to decrease the crop yield and benefits of production. It is necessary to understand the weather/climate changes to increase the crop yield.

ABSTRACT

Data Mining is an inter disciplinary field of study. The applications of data mining are Telecommunication, Bio technology, DNA, Spatial, Satellite, Agriculture and etc. The crop yield of certain agriculture region is depends on the weather and soil conditions of that region because weather can make huge impact on crop yield. Real time weather data can helps to attain the good crop management. This work surveys about the impact of weather changes in agriculture, agriculture vulnerability to weather and weather change vulnerability and so on. Also identified that how the data mining helps to analyze and predict the useful pattern from huge and dynamically changed weather data.

I INTRODUCTION

Data mining is a useful technique to find the useful pattern from the huge dataset. So it secured an important place in agriculture because the field agriculture contains the many data such as soil data, crop data, and weather data so on. Real time weather data is difficult to analyze and manage so various algorithms in data mining like K-Means clustering, Apriori algorithms and other statistical methods are used to analyze the agriculture data and provide the useful pattern. The weather create the great impact on the agriculture so the crop growth and crop yield level are depends on the weather. Real time weather data can helps to the farmers for planting a particular variety of crop because it gives high yield and also this real time data helps to alert the farmers for protecting their agriculture field from the weather disasters. Agro weather research centers and meteorological departments provide real time data to the farmers.

If the particular crop has planting on suitable weather it will provide the good yield so the economic level of our country can improve. So we need to predict the suitable weather for planting a crop because the weather vulnerability and agriculture vulnerability to weather can affect the yield level. Elicitation and analysis of

historical weather data and crop yield level of the particular region can help to predict the future weather condition of that particular region. Analysis is required for finding the future weather conditions of particular region where the data mining plays an important role for analyzing historical weather data and find the required solution.

II LITERATURE REVIEW

The following authors have analyzed about the geographic and weather data and their impact on crop growth by using data mining techniques.

Swati Hira et al (2015) suggested that generally the agriculture data is Spatio-Temporal data. These data has includes agriculture parameter, environmental attributes and geographic attributes. These data has to be analyzed by Multidimensional analysis, Statistical analysis and Data Mining Techniques (Association Rule Mining) for obtaining a useful pattern which helps to analyze the agriculture productivity. Multidimensional model has been constructed before the performing the multidimensional analysis. IDASM is a tool used to construct multidimensional model and perform the statistical and data mining techniques, which provide the correlation among the various agriculture parameters.

M. Das et al (2015) identified the weather zones in a huge region by using Multi Fractal Detrended Cross Correlation Analysis (MF-DXA) based on Spatio-Temporal data of particular place, which can be obtained by Multi Fractal Correlation. Weather zone among the large region (Eastern and North region of India) was accurately detected by the K- Mean Clustering. Two weather attributes such as land surface temperature and precipitation rate were taken into account.

Holz Kamper et al (2011) suggested that spatial and temporal variability in weather is one of the major events in agriculture productivity. This research examines the suitable weather for various crops based on Spatio-Temporal evaluation and weather analysis. Grain maize crop in the Switzerland was taken into account for investigating the weather suitability with respect to time and space. Very basic factors such as, Average solar radiation, Average minimum temperature, Average maximum temperature, Water deficit and Phase length were used to find the maize growth and yield. Non-linear Least Square Regression was applied on the above mentioned weather factors. These factors were observed on the different phases of maize growth. Based on this observation maize suitability was predicted. This approach can also be used to analyze the crop growth limitations of specific crop in the particular region.

Harlin D. Shannon (2015) inspected that the various weather and weather related natural disasters in the agricultural lands of North America, Central America and Caribbean. Recent history of weather and weather data helps the farmers for managing the agriculture risk. Weather risks in agriculture such as droughts, flood, hurricanes, extreme heat and freezes were discussed in this research. So the Decision Support System was used by the farmers for preparing the risk management event before the occurrence of disaster. Agro weather and agro meteorological department plays a major role in the agricultural based risk management activities.

H.Kremer et al identified that weather change variability over the time period is known as multivariate time series data. Novel Clustering and tracing methods are used for analyzing the multivariate time series data. Clustering was used to group the similar objects and tracing. Periodically trace the cluster and it to be analyzed, which used to map the similar clusters with respect to time for detecting the weather change over the time period.

Mallari et al (2016) predicted that vulnerability assessment is a helpful method for increasing an agriculture sector adaption to weather change. Method can improve the decision making process of farmers, which may increase the resilience of agriculture systems during the hazard events. The Mabalact city was considered for this research for evaluating vulnerability by using following methods: 1.Index method and 2.Geographic Information Systems (GIS). In Index method three types of vulnerability indicators were chosen such as Sensitivity indicators, Exposure indicators and Adaptive capacity indicators. GIS helps to predict the location with high vulnerability to weather change. Finally the index map was generated, which helps to the farmers to access the efficient cropping pattern.

Shengcai Tao et al (2011) predicted that weather change vulnerability is one of the huge phenomenon's which create great impact on the agricultural management system. Weather changes also produce the agriculture vulnerability. Problems in evaluation of agriculture vulnerability were encountered. Capacity of adaption, analysis and evaluation are the problems in the weather change vulnerability assessment. An Indicator System is a method used for evaluation of agriculture vulnerability. Learning about weather context can helps to assess the future agriculture vulnerability to weather change.

Pedro Valverde et al (2015) suggested that soil water balance model framework was used to quantify the crop yield. Particularly the herbaceous crop yield was examined by the ISAREG model. Water balance approach and spread shed based model used to estimate the yield level of rain fed woody crops which derived for the future (2011-2040) and (2041-2070) by using Weather Change Scenario (CSS). The crops in the Guadiana river basin was considered for evaluate the weather change and the yield level. Winter wheat, Sunflower, Grain legumes, Pastures, Olive, Grapevine and almond are the crops used in this research. This research has been concluded as Herbaceous crops provide good yield level under rain fed condition and the future crops yield level may depends on the crop specific management.

V. Vagh (2012) constructed a visual data mining framework for analysis agriculture based geographic data (Soil and weather data of Australia) which was made by Digital Elevation Model (DEM). Soil variability of the selected area was identified by the monthly rainfall. Finally this system used to analyze the soil and rainfall of the agriculture lands in Western Australia.

Alvaro Calzadilla et al (2014) assessed that impact of weather change in agriculture in South Africa by using CSIRO (Common Wealth Scientific and industrial research organization) and MIROC (Medium resolution General Circulation Model). GTAP-W model was used for the data analysis which shows the difference between the rain fed and irrigated agriculture. Two main factors such as weather change and the yield change were identified by using CSIRO and MIROC model.

Table-1: Software and Techniques used for constructing visual data mining framework

Software and Techniques used	Purpose
ArcGis, Quantum GIS and Microsoft access database	For data preprocessing
GRASS software package	For generating the map
Viasual data mining	For predicting the pattern of agricultural land soil type
WEKA of Microsoft Excel	For used to analyze the data.

Table-2: Summary of the Analysis

Researchers	Particulars		
	Methods and software used	Crop taken for experiment	Considered regions
Swati Hira et al	Multidimensional analysis, Statistical analysis and Data Mining Techniques (Association Rule Mining)	-	Eastern and North region of India
M. Das et al	Multi Fractal Detrended Cross Correlation Analysis (MF-DXA), K-Mean clustering	-	-
A. Holz Kamper et al	Non-linear Least Square Regression	-	-
Harln D et al	Decision Support System	-	North America, Central America and Caribbean
H.Kremer et al	Novel Clustering	-	-
Mallari et al	Index method and Geographic Information Systems (GIS)	-	Mabalact city
Shengcai Tao et al	Indicator System	-	-
Pedro Valverde et al	ISAREG model. Water balance approach, spread shed based model	Winter wheat, Sunflower, Grain legumes, Pastures, Olive, Grapevine and almond and herbaceous crop	Guadiana river
V. Vagh et al	DEM, ArcGis, Quantum GIS, Microsoft access database, GRASS software package, Viasual data mining, WEKA of Microsoft Excel		Western Australia
Alvaro Calzadilla et al	CSIRO, MIROC, GTAP-W model	-	South Africa

III CONCLUSIONS

This analysis provides the good decision support to the farmers for planting the crop and also helps to alerts the farmers for protecting their field from disaster. The various clustering algorithms such as Multidimensional analysis, Statistical analysis, Association rule mining, Novel Clustering, Multi Fractal Detrended Cross Correlation Analysis (MF-DXA), K-Mean clustering and Non-linear Least Square Regression were identified. Weather parameters such as Average solar radiation, Average minimum temperature, Average maximum temperature, Water deficit and Phase length were encountered in this survey.

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AUTHORS

Mr. RAMACHANDRA REDDY AVULA, Research scholar, Department of Computer Science and Engineering, University College of Engineering, Sri Venkateswara University, Tirupati, Andhra Pradesh, India.	
Dr. A. RAMAMOCHAN REDDY, Professor, Department of Computer Science and Engineering, University College of Engineering, Sri Venkateswara University, Tirupati, Andhra Pradesh, India.	