International Journal of Research in Advanced Engineering and Technology
ISSN: 2455-0876; Impact Factor: RJIF 5.44
www.engineeringresearchjournal.com
Volume 1; Issue 3; December 2015; Page No. 54-56

Crop yield forecast using k-mean & fuzzy logic

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Abstract
We had used the latest technology like “Prediction using K-means” based on last several decades of data as well as “Rule based prediction using fuzzy logic”. We had also compared the result of both the process. There are number of algorithms for prediction purpose.
But, we used K-means algorithm for prediction because predicted rainfall is based on last several decades of data year by year. On using K-means algorithm we got the more accurate or actual or probable prediction.
Another prediction is done on the basis of rule base system using fuzzy logic by applying rule on land used for farming, rainfall and production with the help of inference engine.

Keywords: Fuzzy, K-MEANS, Matlab, Prediction, Rainfall, Crop yield prediction

1. Introduction

Agriculture in India has a significant history. Today, India is ranks second worldwide in farm output. Agriculture and allied sectors like forestry and fisheries accounted for 16.6% of the GDP, about 50% of the total workforce. The economic contribution of agriculture to India's GDP is steadily declining with the country's broad-based economic growth [1].
Agriculture activity is a type of business with risk. The production of Crops depends various factors like on climatic, geographical, biological, political and economic factors. Accurate information about the nature of historical yield of crop is important modeling input, which are helpful to farmers & Government organization for decision making process in establishing proper policies related to next production. The advances in computing and information storage have provided vast at most of data.
Rainfall and crops production is playing a most important role for countries economic growth and development. Farmers to Finance minister waiting and worshiping for good rainfall to their God and Goddess because farmers are anxious regarding their bread and butter while Finance ministry is anxious regarding GDP growth of the countries as well as revenue generation.
Finance ministry has also to plan and manage to store the yielded crops in better way and also to get ready to help farmers and their kin in bad situation with the help of disaster management like bad rainfall or heavy rainfall. Previously farmers predict the production on the basis of assumption of experience farmers without any help of computer as well as soft computing technology.
The challenge has been to extract knowledge from this raw data, Data mining that can bridge the knowledge of the data to the crop yield estimation. This research aimed to data mining techniques and apply them to the various variables consisting in the database to establish if meaningful relationships can be found and using fuzzy logic to find the condition of crops on various condition of rainfalls.
Fuzzy logic is a superset of Boolean (conventional) logic that handles the concept of partial truth, which is truth values between "completely true" and "completely false”. Fuzzy logic is multivalued. It deals with degrees of membership and degrees of truth. Fuzzy logic uses the continuum of logical values between 0 (completely false) and 1 (completely true)
The modeling of imprecise and qualitative knowledge, as well as the transmission and handling uncertainty of data at various stages are possible through the use of fuzzy sets [3].
Knowledge discovery in databases is mainly concerned with identifying interesting patterns and describing them in a concise and meaningful manner. Fuzzy sets depend on membership function which is mainly from human ideas so that decisions in agriculture can easily find by using fuzzy se.

1.1 Research work

For the prediction of rainfall data have been collected from different sources by different methods. The information gathering process is done with three government department like Indian Meteorological Department, Statistical Institution and Agricultural department.
Data collected here for this project is rainfall data of last several years’ and total crops production in year. Where area is in hectare, production is in tones [6] Rainfall data have been collected from different-different departments and crops data has been completed by official website of chittorgarh aggregation department [7].
The data has been download in excel format and of different crops i.e. Rabi crops and Kharif crops, but for this paper we have taken Kharif crops such as crops major crops because this research aims prediction of crops and major crops here is Jowar, Bajra, Maize and sugarcane. There are several applications of Data Mining techniques in the field of agriculture. Some of the data mining techniques are related to weather conditions and Short term forecasting of air pollution in the atmosphere [8]. Data mining techniques are applied to study sound recognition problems.

1.2 Analysis

(a) Open matlab in computer/laptop
(b) Open. m file of K-means code
(c) Run the. m file, after successful compilation GUI will appear like below.
(d) Choose name of crops for which prediction to be done from list of crops

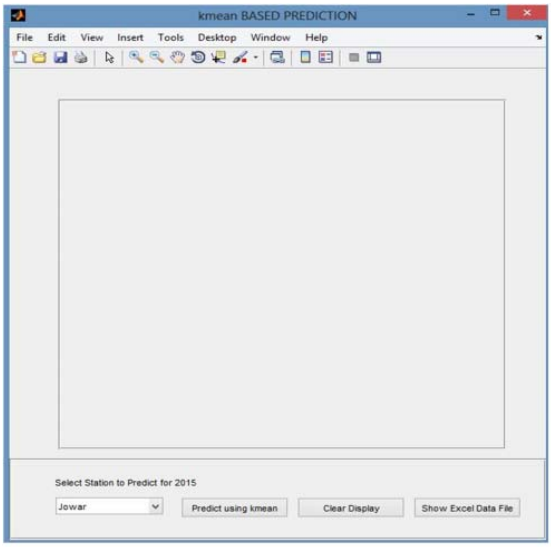

Fig 1

K is the value selected for year which values lie Between 1 to 15. Steps we have to do is open the matlab in your computer then import the data file (Ms-Excel) into workspace then import the. m file of GUI. Then run the code after successful compilation GUI will appear on screen then below select then select the station among which prediction is to be done, in GUI code data file is included in it, it is necessary to import data file so that prediction can be done from the previous data available in the data sheet. K-MEAN is applied for prediction of production [10].

In GUI click on prediction using K-means button and then mention the value of k from 1 to 15, then click on ok it will predict the production for next year.

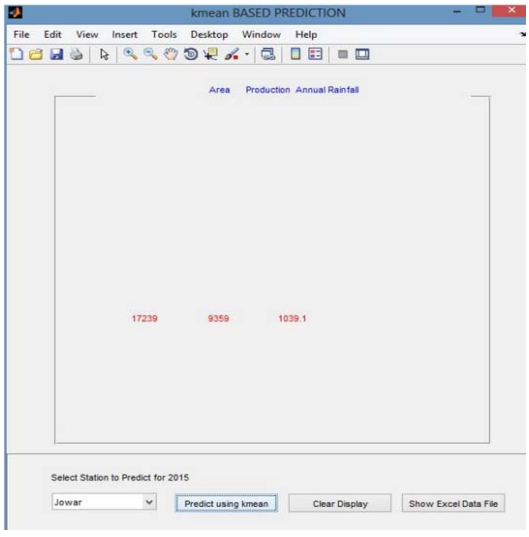

Fig 2

Implementing into fuzzy can be only done in matalb by using Mamdani or sugeno model, Mamdani is the basic and easy so for this paper Mamdani model is selected. Open FIS (Fuzzy Inference system) by fuzzy command in matlab.

Create the member function as much required and set the range of all member function. Fuzzy models can be said to represent a prudent and user-oriented sifting of data, qualitative observations and calibration of commonsense rules in an attempt to establish meaningful and useful relationships between system variables.

Overall output of this research depend upon the surface view of the fuzzy set and its membership function generated rule according to the requirement and condition, there can be multiple rules can be created in fuzzy system according to membership. Even there can be couple of FIS variable i.e. multiple input and multiple outputs. Other membership function can be added as shown in table.

Table 1

S. no	Variable Name	Terms Name	Range
1	Rainfall	Light rain	0 320
		Moderate rain	321 640
		Rather heavy	641 960
		Heavy	961 1281
		Very heavy	1281 1600
2	Area	Very less	0 4800
		Less	4801 9600
		Average	9601 14400
		Good	14401 19200
		Very good	19201 24000

2. Result

Table 2: Analysis for K-Mean

S. no	Year	Area	Rainfall	Production	Actual data
1	2015	16791.2	1015.06	8791.2	NIL
2	2014	16208.40	970.74	8457.40	9359
3	2013	14655	974.90	8904	6743
4	2012	15212.20	896.10	9691	8500
5	2011	15067.60	1036.90	8942.20	11600
6	2010	14609.80	990.70	9025	7754
7	2009	14325.20	1014.60	9147.80	7690
8	2008	15605.20	965.2	9141.80	8976

3. Conclusion

This research will help the farmers to know how much production will be done in next coming season and how much amount of rainfall will occur so that farmers can get awareness and they can manage themselves from their heavy loss. The tool used here can be used to predict crop production of any place simply uploading the data according to users.

3.1 Future work

With the improvement of computer technologies, especially those without any premises or humans subjective, fuzzy logic can be applied in many areas. In this paper some fuzzy logic were adopted in order to estimate crop production with existing data and their use in K-means & fuzzy logic.

Still there are some technique have not yet applied to agriculture problem, such as Actual weather condition for exact date to know farmers to harvest and yield or commencement of seeds and many more technologies to be employed for discovering important information from agricultural-related like soil identification, pest control and etc.

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