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Machine Learning-Based Decision Support System for Effective Quality Farming

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ABSTRACT

Although Big data analytics, machine learning and cloud technologies have been acknowledged as better enablers in revolutionizing the quality of agricultural systems, in most of the developing nations like India there is no able system to effectively survey the real grocery needs of the society and accordingly educate the farmers to grow and supply the crops. Due to lack of such process, there is no synchronization between demand and supply of food crops, and hence, most of the time farmers suffer with loss and consumers suffer from high varied prices. In order to address this problem, data about the demand, supply, and price variation of various crops of different seasons of the year have been collected and analysed. The analysis results have shown a huge gap between demand and supply of crops. Hence, this work proposes novel machine learning-based data analytics system that forecasts the demand for different food crops and regulates the supply accordingly by assisting the farmers in growing the crops based on the demand. Implementation results have shown 92% reduction in the gap.

KEYWORDS

Agriculture, Big Data Analytics, Cloud, Decision, Demand, Machine Learning, Supply

1. INTRODUCTION

Agriculture is one of the fields which contribute major portion to the economy of developing countries. For instance, in India over 58 percent of the rural households depend on agriculture as their main means of income, and farming is one of the major contributors to the GDP of the country (Ramesh, 2017). However, the agricultural system in the developing countries is lagging with ineffective use of advanced technologies available, and hence facing many hurdles. Advanced technologies have been acknowledged as the best enabler to support consumerism in the digital world where information could be made available with just a click. An attempt should be made to integrate advanced technologies and information systems that support many business processes, including communication, operations, supply, marketing, customer service, quality assurance, management. Agricultural system is no exception. Innovation drives the pursuit of the reduced gap, price variation, loss and improved quality of the Agricultural system. Technological innovation offers immense opportunities for process innovation. According to Omachonu & Einspruch(Omachonu, 2010), "process innovation involves

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the implementation of a new or significantly improved production or delivery method and includes significant changes in techniques, equipment and/or software".

It is widely accepted that the population of the world stands at around 7.3 billion and that this will increase to 9.5 to 10.0 billion by 2050(Agree, 2017). This increase will be comparatively greater in developing countries than in developed countries. To keep up with rising populations and income growth, global food production must also increase by 70 present in order to be able to feed the world (Alexandratos & Bruinsma, 2012; Department of Economic and Social Affairs, 2012). So, managing the supply of food production to match the demand is very much essential.

It has been observed that, in recent days there is a huge price variation of food crops in the market. This market price disparity for various food crops is mainly because of deficit in the management of supply and demand of food products in the field of agricultural system. Hence, there is a need to reduce the incompatibility in supply and demand of food commodities efficiently. To reduce the gap between the supply and demand of food crops, the demand for various foods produces needs to be estimated and assist the farmers in growing the crops having a demand. So, there is a need for a system that could predict the demand for various food commodities and assist the farmers in choosing and growing the crops to satisfy the actual need of the society. This could reduce the breach amongst the consumer's demand and producer's supply and helps in reducing the loss for both consumers and farmers.

This paper is proposing a Cloud, Machine Learning and Data Analytics based decision support system that (i) collect huge historical data about the demand, supply and price variation of various crops of different seasons of the year for analysis, (ii) forecasts the demand of various food commodities (ii), suggests the best crop to grow based on the land details and forecasted demand (iii)reduce the gap between demand and supply of food crops (iv)avoid the loss for farmers (v) reduce the price variation in the market.

The proposed system also provides security by avoiding the unauthorized access to the system by allowing only legitimate farmers to get registered with the system using their Aadhaar ID (Aadhaar is a 12-digit unique identification number issued by the Indian government to every individual resident of India).

To analyse the variations in demand, supply and price values, huge data sets about the demand, supply and price variation of different crops are collected from various sources (AgmarkNet, data.gov.in, Ministry of Horticulture) and also the elaborated market survey has been made for the years 2005-2016 for the state Karnataka. The analysis was made with this collected big data values for the crop Tomato and the results have shown a huge gap between a demand and supply and a price variation for the same. The gap observed for the crop Tomato during the years 2012 - 2017 for the state of Karnataka, India is plotted on using visualization tool and is shown in Figure 1.

The remaining portion of the paper is organized as follows; section 2 presents the motivation for the research problem. The related works are discussed in section 3. Methodologies used in this work are given in section 4. Section 5 discusses the system architecture of the proposed work. Section 6 illustrates the implementation of the proposed system with different modules. Section 7 and gives the results and discussion, the system evaluation is given in section 8. The section 9 concludes the work.

2. MOTIVATION

According to National Crime Records Bureau's latest farmer-suicides data, over 6867 farmers had committed suicide across the country India in 2015-16(NCRB ADSI annual Reports, 2016). According to the survey, this is primarily because of their inability in paying back loans raised from banks and microfinance institutions.

In order to overcome such situation and help farmers, researchers worked towards improving the yield and production of the crop but without bothering about the actual demand for same. There is a myth in the agriculture that, more yields gives more profit in crop business. With the lack of actual

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