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A Review on Big Data Analytics in Agriculture

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Abstract

Big data is the complex process of examining large and varied data sets or big data to uncover information including hidden patterns, unknown correlations, market trends, and customer preferences that can help organizations make informed business decisions. Big data supports the public and private sectors in providing the knowledge patterns for future estimates. Data mining and statistical analysis are some practices in big data. Population growth is the key factor for the demand of agricultural and its products. Precision agriculture is a precise farm management technology. The data's collected are mapped with the management system using Geographical information system and advance sensor equipment's by doing these it which will make the most productivity of the crop with more income. The part of big data in Agriculture provides an opportunity to increase economic gain of the farmers by undertaking digital revolution in this aspect. This paper reviews the applications of big data to support agriculture.

Keywords: Agriculture, Big data Analytics, Farmers, Data-Driven

1. Introduction

Big data - statistics and improvements in data collection have given us tools to analyze big data and use them effectively. Data-driven farming is on course to reshape the entire agricultural economy. Forecasters at Markets and Markets project that the global agriculture analytics market will spike from $ 585 million in 2018 to $ 1.236 billion in 2023 – an increase of more than 110 percent. What's fueling the demand? As the precision agriculture market matures, more and more farmers will embrace data-driven solutions like artificial intelligence and machine learning for their ability to aggregate trends, track supplies, assess risk and reward, generate predictive models, and increase yields.

Big data is anticipated to deliver a huge impact on farming in the coming years. In this article, we'll be looking at some of the ways that agricultural businesses are using data to supercharge their operations [1].

Myanmar's farms are well diversified, with most farms producing rice paddy during the monsoon season and other crops such as beans, pulses, oilseeds and maize, during the cool and dry seasons. The study finds that agricultural productivity in Myanmar is low.

For example, to harvest rice, one day of work generates only 23 kg of paddy in Myanmar, compared to 62 kg in Cambodia, 429 kg in Vietnam, and 547 kg in Thailand. Farm practices are still largely labor intensive. In Ayeyarwady, farmers spend more than 100 days per hectare on monsoon rice paddy compared to 52 days in Cambodia, 22 days in Vietnam, and 11 days in Thailand. Myanmar's wages are still very low compared to international standards with daily wage at $2 in the Delta and Dry Zones. Myanmar has the lowest profits from rice production compared to those achieved by farmers in Asia's other rice bowls. In 2013-2014, the net margin/profit from producing monsoon rice paddy averaged $114/hectare.

Low productivity is a result of multiple factors, many of them associated with the undersupply of quality public services such as research and rural infrastructure. Many factors affecting farm production can be influenced by the government through service delivery and an enabling policy environment [2].

This paper intends to review of big data analytics in agriculture.

The paper is organized as follows: In Section 2, the big data transforming agriculture is presented. In Section 3, the impact of big data technology is described. Data-driven farming is presented in Section 4 and Section 5 explains dimensions of big data. The paper is concluded in Section 6, with the review of big data analytics in agriculture.

2. Big data for Agriculture

Big data has been disrupting almost every industry and surprisingly, it has not even left the Agriculture industry behind.

2.1 Big data transforming agriculture

Big data is helping farmers to grow plants in less time to increase their production. In India, agriculture is only industry responsible for the economy thus needs more support than any other industry.

The data analytics has helped the agriculture industry to meet the needs of a new era of farming. The agriculture industry is the only industry that can be affected by any technology, but big data is a powerful technology and has the potential to transform this industry.

Big data helps the scientists to make seeds that can grow in a harsh climate. Farmers are always in the search of finding techniques that can help them find the best crop and right procedure to grow the crop.

This is done by analyzing the soil, moisture content in it and leaves of the plant.

Famers are making big use of the data analytics for getting the crop information, qualities of the soil and extracting the useful data from it.

2.2 Ways of data analytics

Data-driven farming is on course to reshape the entire agricultural economy. As the precision agriculture market matures, more and more farmers will embrace data-driven solutions like artificial intelligence and machine learning for their ability to aggregate trends, track supplies, assess risk and reward, generate predictive models, and increase yields. There are four ways data analytics in transforming agriculture.

1. Boosting productivity and innovation

With global food demand set to surge almost twofold by 2050, it will be incumbent upon farmers and agricultural suppliers to harness data and innovation to improve productivity and feed a growing global population.

Armed with data from soil sensors, GPS-equipped tractors, and external sources such as local weather channels, farmers who implement precision agriculture are gaining unprecedented visibility into their operations [Figure 1]. This enables them to better manage key resources including seed, fertilizer, and pesticides, while increasing productivity [3].

Figure 1. Armed with data from soil sensors, GPS-equipped tractors, and external sources

2. Environmental challenges

Climate change and other environmental challenges rank amongst the biggest threats to agricultural productivity, but data-driven farming can help make it easier for farmers to navigate shifts in environmental conditions, helping to combat climate change by enabling smarter resource management.

With precision farming, farmers can continuously monitor crop health and other natural events, and predictive analytics can even alert farmers to likely problems with pests or disease. Utilizing data on crop inputs and resource management, farmers can adapt accordingly to head off adverse events and mitigate damage to productivity.

3. Cost savings and business opportunities

The agriculture industry and the broader global economy stand to gain big from data-driven farming. According to scholars at Tufts University, smarter farming practices could generate $2.3 trillion in cost savings and business opportunities annually – and $ 250 billion of those yearly savings could come from AI and data analytics alone. Those serious savings can help farmers better manage risk and cushion themselves against the vagaries of domestic and global markets.

4. Better supply chain management

The agricultural supply chain is slated to see some of the most transformative impacts of precision agriculture technologies like data analytics. Farmers will have an easier time tracing their products throughout the supply chain, while retailers, distributors, and other key stakeholders will be better equipped to tailor their product offerings and services according to the needs of the agricultural market, thanks to the growing availability of rich data and actionable insights.

3. Impact of big data technology

3.1 Ways of impact with big data analytics

Big data analytics can lead to some serious environmental issues if the data is not interpreted correctly. There's a list of ways big data technology is impacting the agriculture industry.

1. Crop predictions

Data analytics and computer algorithms helped the farmers to predict the accurate crop productions before even planting the seeds. Big data is also used to analyze the centuries of crop data, weather and soil condition. This data helps the framers to maximize the crop production in the minimum time.

2. High-quality seeds

Growing crops in an unfavorable climate can lead to starvation which can affect the whole population of that area. Scientists and engineers are making seeds that can grow quickly at any temperature. This might sound scary but those crops are completely healthy to consume, all thanks to this new technology. These seeds can thus put an end to global starvation.

3. Precision farming

Precision farming is not a new concept and farmers are looking for ways to automate the agricultural processes. Big data analytics helps in separating the commercial agriculturalists. With the help of data analytics, the automation has reached to the new heights. Farmers are using drones to extract information about the crops and make a list of things that need improvement [4].

3.2 Application areas for impact of big data technology

There are some application areas with the impact of big data technology. Precision farming requires some important aspects like Mapping, Remote sensing, Geographical Information system, Investigation during the field operation during big data analytics.

Soil is the main asset of farming, mapping will measure and control spatial variability. This mapping process can be done by utilizing Remote sensing, Satellite Navigation system and Geographical Information system which is recorded during field operation.

The remote sensing is to monitor the visible and invisible areas of land cultivated, it will convert these data into spatial information which is rather and is sent to GIS the generated images will allow mapping.

GIS is used to integrate spatial data collected from various sources it is used to develop decision environment and makes weed control, pest control, and fertilizer application rather than it gives information regarding drought, yield information and weather forecasting as a whole it is integrated with GPS for location tracking.

4. Data-Driven farming

Data-driven farming is gathering thanks to the use of technology like soil sensors, drones and livestock monitoring gadgets to produce reams of priceless information. The end goal is to help agricultural businesses make better, more informed decisions, allowing them to tap into a range of advantages. Key to realizing its potential lies within the part in the middle; the applications and practices which make sense and use of all this information, creating a new era of 'smart farming' for the world to behold.

4.1 Usage of big data

Big data has no lack of uses within farming. Some of the more prominent include:

1. Yield prediction

Yield prediction sees the use of mathematical models to analyze data around yield, weather, chemicals, leaf and biomass index among others, with machine learning used to crunch the stats and power the making of decisions. Predicting yields in this way can allow a farmer to extract insight on what to plant as well as where and when to plant it. The use of sensors for collecting data means that only a small amount of manual work is required to hand each business an instruction manual on how to guarantee the best return from their crops. According to the International Journal of Computer & Mathematical Sciences, predicting yields in this way should improve the production of crops in countries like India, where population increases represent a very real concern.

2. Risk management

One area that is becoming all the more influenced by connected devices and algorithms is risk management. It's now possible for farmers to leverage a web of big data with a view to evaluating the chances of events like crop failure, and even improve feed efficiency within the production of livestock. The area of risk management created headlines in 2014 as advice from data scientists to Colombian rice farmers was said to have saved millions in damages caused by shifting weather patterns.

3. Food safety and decay prevention

The collection of data around things like humidity, temperature and chemicals will paint a picture of health around smart agricultural businesses. That level of insight should be of interest to organic farmers in the US, whose issues with GMO contamination between 2011- 2014 was said to have caused damages of $66,395 per affected business.

4. Operation management

The role of big data aids various aspects of the everyday running of an agricultural business. Equipment manufacturers have already made a good start with their fitting of sensors around vehicles to aid their providing of data.

Farmers can then log into special portals to manage their fleet and maintenance of equipment in order to reduce downtime and keep everything productive. As more companies provide solutions to aid areas of equipment management and supply chain optimization, we can expect a much smoother delivery of crops to the market.

5. Dimensions of Big Data

Four dimensions (Figure 2) often are described the big data phenomenon: volume, velocity, variety and veracity. Each dimension presents both challenges for data management and opportunities to advance agri-business decision-making. These four dimensions focus on the nature of data.

Volume:

In recent years, statements similar to IBM's observation and its emphasis on volume of data have become increasingly more common. The volume dimension of big data is not defined in specific quantitative terms. Rather, big data refers to datasets whose size is beyond the ability of typical database software tools to capture, store, manage, and analyze. This definition is intentionally subjective; with no single standard of how big a dataset needs to be to be

considered big—and that standard can vary between industries and applications.

Velocity:

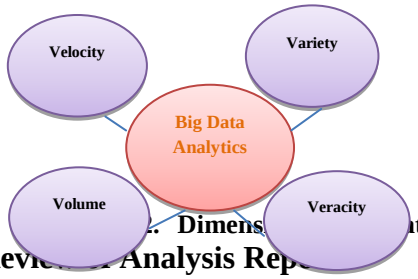
The velocity dimension refers to the capability of understanding and responding to events as they occur. Sometimes it's not enough just to know what's happened; rather we want to know what's happening. For example, applications like Google Maps provide real-time traffic information at our fingertips. Google Maps provides live traffic information by analyzing the speed of phones using the Google Maps app on the road (Barth 2009). Based on the changing traffic status and extensive analysis of factors that affect congestion, Google Map scan suggest alternative routes in real-time to ensure a faster and smoother drive.

Variety:

As a dimension of big data, variety may be the most novel and intriguing. For many of us, data refers to numbers meaningfully arranged in rows and columns. For big data, the reality of "what is data" is wildly expanding. For example, the movement of someone eyes as they read this text could be captured and employed as data.

Veracity:

Big Data Veracity refers to the biases, noise and abnormality in data. Accuracy of analysis depends on the veracity of the source data. In comparison to Big Data's volume and velocity, veracity is the most challenging characteristic in data analysis [5].



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6. Revi Analysis Rep

This section presents the review concerned with big data technology in agriculture. The role of big data analytics are explored in the field of agriculture. Agriculture will face reasonable challenges to provide sufficient nutrients. We have reviewed the facts of big data technology which will afford to increase the productivity of crops. In addition big data covers a major role by introducing Precision Agriculture techniques which is already initiated in many developing countries which makes the farmers to integrate traditional farming methods.

7. Conclusion

In this paper, we conclude that the review of big data analytics in agriculture. All farmers have a goal for their job. They want to get cultivating profitability and efficiency, reducing the cost of a job, or increasing product value. To reach each goal, farmers must do well decisions and change beyond the use of general knowledge from research experiments. Through big data and connected devices, every one of the goals around profitability, efficiency and cost management are not only achievable but completely realistic. This review exposes that several chances are available for utilizing big data in agriculture; however, there are still many issues and challenges to be addressed to achieve better utilization of this technology. In future track of Agriculture will provide technical support to the farmers to implement advanced simulations. People plan to work on precision agriculture techniques.

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