IMPACT OF BIG DATA ANALYTICS IN MODERN AGRICULTURE

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Abstract

In our nation, most of the rural people rely depending on agriculture for a living. On the other hand, the yields of many agricultural goods in our country are very less because the existing farming practices are neither environmentally friendly nor prudent which is alarming. Being in a highly productive, competitive, and diverse agriculture industry accelerating rural, non-farm entrepreneurship and farming will be crucial for the nation in the near future. This study paper lists the negative effects of conventional farming methods and discusses how modern computer technology can be used to boost agricultural commodity yields. Additionally, it recognizes how crucial Big Data's computing and diagnostic capabilities are for processing massive amounts of transactional data in real-time scenarios. This study paper's goal is to outline changes in the agricultural industry and promote dialogue on how the government may support advances in analytics of Big Data to enhance the agricultural system in rural area.

Keywords:
Big Data Analytics, Electronic Farm Records, Precision Agriculture, Rural Agricultural System.

I INTRODUCTION

India is a strong nation with a population of over 1 billion people and one of the fastest-growing economies in the world. Out of the enormous population, 58.4% are creative agricultural groupings. Despite being outstanding, India's recent agricultural yield achievements still only account for farms can achieve 40 to 60 percent of the best agricultural yields possible in industrialized and other wealthy countries. India currently ranks second globally in agricultural output. In 2019, the agriculture and related sector contributed 13% of the overall GDP and employed roughly 40% of the workers [1]. Geographically, the major economic sector is agriculture, and it is essential to India's overall socioeconomic structure. However, the extended research claims that India's agriculture sector is still lagging behind. Agriculture's contribution to India's GDP is directly declining as the nation's economy expands.

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The term "precision agriculture" (PA) [2, 3] refers to an agricultural management strategy based on crop variability both within and between fields. Crop variability frequently has a spatial as well as a temporal component, making statistical/computational treatments highly complex. Some agricultural professionals have recognized the need for sensor data assimilation in agricultural systems and have developed strategies to get over the practical challenges related to governmental policies. By using this technology, agriculture professionals, data analysts, and data examiners plan out ways to achieve better results at cheaper prices. Big Data is a distinct in the domains of data science and information technology that was created as a result of the rapid evolution of data over the previous ten years. This brilliant technology [4] is gaining more and more attention as a solution to improve the efficiency of the agricultural system by fusing various systems into a platform for data and communications to reduce repeated crop failures, improve and hasten agricultural governance, and enable access to all strata of agricultural services for a variety of situations. It compiles all data about viable crops produced by electrical smart devices (such as electromagnetic sensors, optical sensors, and moisture sensors) for a certain region.

The phrase "big data" is used to denote the enormous volumes of data that these smart devices will produce as a result of record keeping, compliance, and regulatory needs. According to the explanation above, the data from e-agriculture services can be categorized as big data due to its, vast volume, variety and high-velocity flow of data[5]. The most popular modern technologies, such as HDFS, Map Reduce, Hadoop, STORM, etc., are some of the big data solutions for problems in the e-Agriculture service.

The following are the main factors that improve agricultural systems' performance and raise productivity:

1. To enhance the yield quality, measure, store, and evaluate data.
2. Control revenue costs by lowering the likelihood of crop failure.
3. Boost preventative healthcare and boost consumer and producer satisfaction.

Big data adoption in agriculture considerably reduces the likelihood of crop failure and farmers' top worries, and it is advised that soil [6] sensing and crop yield information be used as a result. The structure of this research work is as follows: II Section explains the current agricultural practices in our country; III Section describes Big Data in formally; Section IV concentrate on the issues with the current agricultural practices; Section V shows how big data analytics have been implemented in the agricultural system; and in section VI conclusion is given.

II RURAL INDIA'S CURRENT AGRICULTURAL SYSTEM

India carefully adjusts its agricultural systems to the best possible environments. In other words, crops are cultivated in accordance with the farm, the soil conditions in a certain place, or the land. The types of farming used in the various regions of India differ; few are based on agriculture, forestry, horticulture and other practices[7]. The geographical location of India results in varying climates in each region, which has a significant impact on agricultural productivity. In terms of global agricultural productivity, India is currently ranked second. More than 16 percent of India's GDP was made up of agriculture and other industries in 2019. Agriculture still contributes significantly to the nation despite a gradual decrease and is crucial to its socioeconomic development. It is also the second-largest producer of fruits and vegetables respectively, 8.6 and 10.0 percent of the total production. With 475 million animals, India is the country with the most livestock in the entire globe [8]. Serious agricultural fielding problems such erosion, water logging, aridity, acidity, salinity, and alkalinity affect about one-sixth of the land area. For an area of cultivation that is 80 mega hectares or larger, soil conservation measures are necessary. Within a few years of the use of irrigation techniques, salinity and water logging issues had emerged. Alkalinity and salinity, it appears, have an impact on 7 Mega Hectares of land. It is crucial to keep track of all the qualities of the soil quality because the crops that will be grown depend on the soil conditions of a certain farm area[9,10], including moisture content, humidity, the amount of nutrients present, etc.

III BIG DATA DEFINITION IN GENERAL

Big data refers to any quantity of structured, semi-structured, and unstructured data that can potentially be mined for information, Big Data a term that is still developing. Big data is a collection of methodologies and tools that call for novel forms of integration in order to unearth significant hidden values from vast datasets that are diverse, intricate, and of an enormous scale.

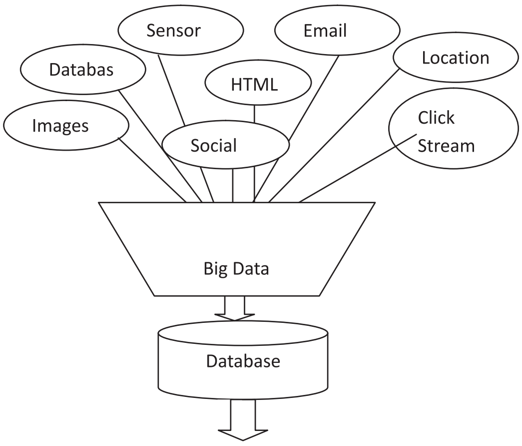

Fig.2. Big Data Methodologies and Tools

It is a laborious operation to process such data using typical database management software or traditional data processing apps. The production of big data is a constant byproduct of everything around us. It is sent through all social media interactions and all digital operations encompassing all digital devices, systems, sensors, and mobile devices in use. You need the best processing power, analytics capabilities, and talents to get value out of big data.

Business and IT leaders must work together in a new culture that big data is developing in order to gain value from all data. However, a new basic approach to design, tools, and practices is required in order to properly analyze this continuously expanding body of data. The extensive Indian agricultural system should comprehend a complicated mixture of data, including sensor data and electronic farm records, to utilize big data in agriculture. This makes it possible for agriculturists to access and analyze big data in agriculture to assess crop quality, identify at-risk crops, decide on optimal practices, and evaluate treatment options[11].

Big Data characteristics

Big Data is being controlled not just by the exponential growth of data but also by globalization and changing user behavior. As a result, many organizations are looking to analyze these models to improve how they operate.

The following are examples of big data's typical traits:

Volume: The amount of data produced by big data can be measured in terabytes, Exabyte's, or zettabytes. Upto 3.6 Exabyte of data are previously created and stored every day, and the volume has been growing dramatically. By the end of 2018, this is anticipated to quadruple.

Velocity: Big data is expanding swiftly, producing a bewildering amount of data that must be stored, transported, and processed quickly. In order to fulfill all challenges and demands that lie ahead on the route of development and growth, it refers to the speed at which data is generated or processed [12,13].

Variety: This describes the inconsistency that occasionally appears in the data. With the advent of cloud, web, and online computing, the heterogeneity and variety of data storage and sources have grown in Big Data.

Veracity: abnormality Biases, and noise in data are all examples of big data veracity. The Source data validity determines how accurate the analysis will be. The most difficult aspect of data analysis is truthfulness in contrast to the amount and pace of big data.

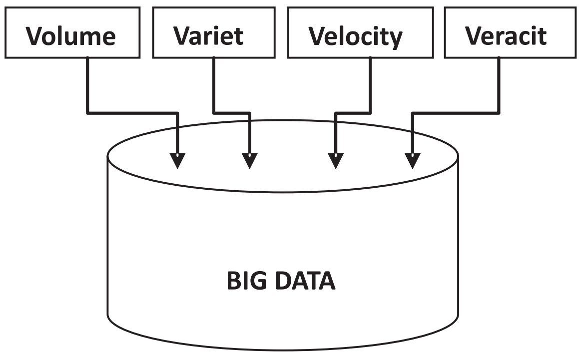

Fig.2. Big Data Characteristics

IV PROBLEMS IN THE INDIA'S CURRENT AGRICULTURAL SYSTEM

More than 68 percent of the people in India live in rural areas, and nearly three-fourths of those people depend on agriculture for their living. The problems that rural Indian agriculture is currently facing issues with irrigation and the Infrastructure for markets and transportation significantly raises the cost of farming. The absence of delivery mechanisms is another problem. There are several programmes designed to advance agriculture. In terms of boosting productivity, cutting costs, or raising price realization, we don't have efficient delivery systems that can transform things into efficient facilitation on the ground. Inadequate government assistance makes these problems worse. Failure of the government to provide assistance and facilitation is a serious issue in agriculture because of the significant risks involved.

Due to the variable nature of the components involved, agriculture, like other commercial enterprises, is exposed to high risks. For example, weather is frequently an issue – you have droughts one year and big rain the next. Farmers lose out in both scenarios; therefore they must search for a typical time to generate income. As a result, the government must play a significant part in assisting farmers [14,15]. This is true everywhere in the world, and there is seldom a nation where there isn't some form of government intervention. Of course, there may be variances in the level of intervention, but if you look at the situation in the majority of nations or areas, including industrialized nations like European Union, Canada and US, we will observe significant government interference in agricultural development.

V BIG DATA ANALYTICS IN AGRICULTURAL SYSTEMS IMPLEMENTATION

The era of big data has come to pass. Big data offers a platform for gathering, analyzing and storing data to reveal previously unknown facts. We could create new visions by carefully employing the ever-growing amount of data available by reevaluating the data or combining it with other information already available. For agriculture research, continuous examination of data streams produced for and by the defined area at every time instant, in agricultural maps, diagnostic reports, etc. In addition to helping rural residents boost the yield of their crops, this paper's main goal is to help agricultural systems address issues including the use of dangerous pesticides, excessive fertilizer use, the lack of adequate irrigation facilities, and the control of agricultural fraud. His idea enables staff, analysts of big-data, and agriculturists based on their individual duties, to have access to data on electronic farm records. The term "big data" in agriculture primarily refers to Electronic Farm Records (EFR), which contain information about past crop cultivation, insurance, and yield, as well as social media posts like tweets, blogs, new feeds, and agricultural articles. EFR also includes data and precipitation data and maps, soil temperature data and maps, electrical conductivity data and maps, moisture content and pH level data, and past cultivation records. The role of a big data scientist is to properly diagnose the numerous components in order to mine the big data, find relationships, identify patterns, and trends in order to enhance agricultural systems, boost crop productivity, and reduce associated expenses. Annually, databases that create pre-processed reports in relationships are used for majority of agricultural data analytics. Data analysis needs to happen right away. Furthermore, data vivification must be done right now, not in a year or a month. Using different types of sensors and a Global Positioning System (GPS) to instantly operate machinery that uses variable rates, it is feasible to produce field maps of certain soil attributes.

For the agricultural sector to better serve the public, innovation and change must be ongoing. Precision agriculture can employ the data produced through big data analysis in a variety of ways.

- The information gathered from a variety of systems (or sensors) can be assessed in real-time to signal the critical values that are crucial to the choice-making process in production.

- The geographical maps produced in this way have very high resolution and show variations in soil moisture. It would suggest using irrigation strategically. The use of detailed pictures of insect damage in the field will also enable the precise targeting of controls.

These big data applications can be quickly tested, improved, and scaled out, and they will fundamentally alter agricultural delivery and research. In order to deliver improved agricultural services, big data analytics in agriculture is necessary. It offers historical data analysis to unearth secret facts. Data heterogeneity and incompleteness, scalability, timeliness, privacy, and human collaboration are some of the difficulties associated with big data analytics. Future research will focus on overcoming challenges to apply big data analytics in agriculture to reveal competence from unstructured raw data.

VI CONCLUSION

A new understanding of how to improve outcomes from these vast data sets is emerging as a result of the development of big data analytics in the agricultural industry. The agricultural system is now far less expensive, more efficient and produces greater quality than before because to soil and crop sensing. In the meantime, a lot of entrepreneurs are creating satellite- and terrestrial-based sensors, hastening the shift to linked agriculture. We will make progress in releasing farmers from the restrictions of unpredictable weather as smart sensors proliferate and large data are effectively analyzed. The usage and adoption of big data in government processes is advantageous and promotes cost, productivity, and innovation efficiencies. But in order to get the intended result, this data analysis frequently necessitates coordination between numerous government agencies and the development of fresh, cutting-edge procedures. The information contained in the massive agriculture data sets could be uncovered by implementing this work using Hadoop, HDFS, and Map Reduce.

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