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Data Science in Agriculture: A review

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Abstract- Data analytics has already brought about a great deal of change in the world by bringing new ideas to improve decision-making, analyse patterns, and spot possibilities. The Internet of Things (IoT), artificial intelligence, and machine learning. The current situation of applying traditional approaches in practically all sectors is being revolutionised and changed by intelligence and big data. In India, agriculture employs about 42% of the labour force but only makes up 14% of the country's GDP (gross domestic product). The use of data analytics in agriculture has been the subject of extensive research.Nevertheless, integrating these technologies is not without its difficulties.

First off, farmers are not usually aware of these technologies, and secondly, there is a lot of variety in the data regarding weather changes, diseases, insect damage, harvest and production, etc.

1.Introduction

Globally, agriculture is a massive industry because of the rising demand for food. conventional farming techniques using current technology to manage the available resources and tasks in order to boost output and produce better results. The agricultural business is being significantly shaped by smart farming, which makes use of big data analytics and the Internet of Things. The network of physical objects or things that are equipped with sensors, software, and other technologies to connect and exchange data with other systems over the internet is referred to as the Internet of Things (IoT). A variety of sensors are employed by some machines to collect data about their surroundings, which is then used to control how the machines behave. Deep learning algorithms and relatively basic feedback systems are examples of this.

This is accomplished by Ag operations will become increasingly data-guided as sensors proliferate on farms and the volume of agricultural data increases. As an alternative,

Smart farming is being accelerated by the quick development of cloud computing and the Internet of Things (IoT). Precision agriculture only refers to site-specific applications; in contrast, smart farming takes real-time event-generated scenarios into account. These methods enable farmers to respond swiftly to unforeseen events, including disease outbreaks or weather event alerts. Typically, these capabilities include intelligent support for the use, upkeep, and installation of the technology. In order to assess soil moisture and crop projections for automated and error-free applications of water, fertilizer, pesticides, etc., artificial intelligence techniques like artificial neural networks have also been deployed.

2.Literature reivew

Ravesa Akter and Shabir Ahmad Sofi's study, "Precision Agriculture using IoT data analytics and Machine Learning," which was published in the journal designated King Saud University Journal in 2021. The adoption of IoT (sensors) and data analytics for apple scab prediction was covered by the writers in this research. A widespread apple disease called apple scab is brought on by the fungus Venturia inaequalis. Fruit and foliage are both afflicted by this fungus. As a result, a substantial quantity of Apples are thrown away. To understand the elements influencing the growth of apples, the writers examined and analysed the data. Moreover, phosphorus was crucial to the growth of crops. They created various prediction models based on this data, which may be used to determine whether or not the right circumstances existed for the illness to spread. They fed the linear regression model with real-time data. The necessary sensors were positioned around the crop and correctly

programmed. Analysis was completed following the acquisition of accurate data for data pre-processing. We can determine whether or not that area is safe based on the temperature and number of hours that the leaves are moist.

In 2020, the Journal of The Electrochemical Society released an article titled "Machine Learning in Wireless Sensor Network Based Precision Agriculture." As the Shekhar Bhansali, Lamar Burton, Arif Sarwat, Yemeserach Mekonnen, and Srikanth Namuduri are the authors. In order to monitor and manage factors crucial to crop growth, like soil conditions, environmental factors, and meteorological conditions, the authors of this research addressed Wireless Sensor Networks that were constructed utilising open-source hardware platforms, an Arduino-based micro-controller, and a ZigBee55 module. Using an IoT-based farm system, the main goal of this exploratory project was to learn more about the network of food, water, and energy. This could lead to the production of more food with less energy and water by using a basic self-operating system that is powered by solar panels.

Applications of Remote Sensing in Precision Agriculture" article was published in the year 2020 by Rajendra P. Sishodia , Ram L. Ray, and Sudhir K. Singh. This paper was published in the Remote Sensing Journal. In this paper, the authors talk about Advancing technologies, such as remote sensing, global positioning systems (GPS), geographic information systems (GIS), Internet of Things (IoT), Big Data analysis, and artificial intelligence (AI). These are the encouraging tools being imposed to enhance agricultural performance and inputs directed to strengthen production and reduce inputs and yield losses. Remote sensing systems, using computerized information technologies, usually bring about a large capacity of data due to the high structural resolutions needed for various applications. Growing data processing procedures such as Big Data analysis, artificial intelligence, and machine learning have been operated to obtain convenient information from a big data volume. Cloud computing systems have also been used to store, process, and distribute such a huge amount of data. All these modern data additions and processing techniques have been practiced globally, to assist the managing process for field crops, horticulture, viticulture, pasture, and livestock. The authors also talk about using satellite images to monitor high-resolution images for disease and crop water stress detection.

3. Satellite imagery and precision agriculture

Precision Agriculture (PA) has been defined as "an industrial technique to farming management," according to one description that recognises, quantifies, and evaluates the requirements of distinct fields and crops. To put it simply, predictive farming is farming that gathers and utilises map data to manage and improve crop productivity. Using predictive farming is like using medication to treat a sickness. Production is closely watched, from choosing the right crop for a plot to only using herbicides in designated areas. The cost of production and waste are reduced by using precision farming. Using technological devices and systematic software is how precision farming is done.A vast quantity of data is gathered.

The profitability of Sentinel-2 multi-temporal data for crop-type monitoring is very crucial as it reaches up to 91%–95% overall accuracies in various crop classifications while single-date images show insubstantial results. Besides the reanalyzed time, the higher geographical and spectral resolution also upgrades area detection and evaluations. Regarding classification techniques, object-based and pixel-based have shown to be accurate classification approaches using Sentinel-2 imagery. The object-based dynamic time distortion was demonstrated to be more systematic in classifying crops than the pixel-based approach when using multi temporal Sentinel-2 imagery, nonetheless, the random forest algorithm seems to be more coherent for crop type classification when crop spectral irregularity is high. In common terms, the consolidation of Sentinel-2 imagery and various algorithmic methodologies, like the random forest algorithm, k-nearest neighbor, and support vector machines have also shown suitable classification accuracy, resulting in over 90% of overall accuracy for several approaches. Understanding the conditions of the crop, namely crop type attributes and surface expansions, is central to accurately making classification method conclusions when using Sentinel-2 imagery 4.

4.Using Techniques for Remote Sensing

For effective management, researchers have long recognised that soil and land databases need to be surveyed of natural resources at the municipal, state, and federal levels.

Drafting and carrying out crop management procedures (irrigation, drainage, nutrient, and other) requires an awareness of the physical,

biological, and chemical characteristics of the soil. These processes are crucial components of Precision Agriculture. Before 1958, there was a traditional method for applying remote sensing techniques to agriculture. It was at this point that the term "remote sensing" was originally proposed. For example, aerial In the US, soils, land, and crop patterns were observed by photography in the 1930s and 1940s.

But these conventional methods of handling soil and land

The process of mapping usage classification usually entails extensive fieldwork and laboratory inquiry, both of which are costly and time-consuming. Global land use mapping became more efficient in the years that followed with the advent of satellite remote sensing. Remote sensing is the technology that allows one to identify, measure, and analyse necessary things, places, or phenomena' properties without having to come into direct contact with them in order to make informed decisions. Images captured by remote sensing can be used to detect diseases, plant populations, insect damage, wind damage, herbicide damage, weed infections, and water shortages or surpluses.

5. Conclusion

Thus, this research helped us to first understand how important it is to apply data science to the agricultural sector. It'srequired to accurately identify independent problems in order to identify the best solutions for them. Global agriculture is a vital industry that will influence global trends in the future. We must make use of current state-of-the-art technologies in order to obtain higher quality, better quantity, and more verified results. Even though there are many uses for modern technologies like data science, analytics, artificial intelligence, remote sensing, etc., our planet is still in its infancy as far as technology is concerned. Accurate data insights and pattern detection using different models are essential for the proper use of the resources that are now available. Additionally, it is crucial to empower small.

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