An analytical Survey on Predicting Crop Yield through Deep Learning techniques

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Abstract
Agricultural production is one of the most essential ethical considerations just because it produces a large amount of food. Currently, hundreds of countries are nevertheless starved as a result of food scarcity or a scarcity of supplies with an expanding economy. A country's prosperity is heavily reliant on agricultural products and the productivity of crops grown in that location. The dependency on agriculture has been critical for a nation's prosperity and progress, since a well-fed and fit and active population has a far stronger immune system and success than a community with subpar nutrition and health supply. Asia is primarily an agricultural economy, with farming accounting for a substantial portion of its trade. The agricultural process is a complicated activity that does not allow for exact prediction of crop production. Without proper production projections, the farmer cannot plan efficiently, that might also result in unanticipated damages. As a result, there is a demand for an effective technique for predicting agricultural yields using machine learning techniques. This literature survey study summarized and examined an effective collection of studies to reach our strategy, which will be detailed in the future research article on this issue.

Keywords— *Crop Yield Prediction, Linear Regression, Deep Belief Neural Network, Fuzzy Classification.*

I. INTRODUCTION

Agricultural production is amongst the most important societal considerations mostly because it produces a large quantities of food. Currently, hundreds of countries are still malnourished as a consequence of economic scarcity or a shortage of resources with an expanding population. The combined effects of increased population, extreme climate unpredictability, land erosion, and environment require procedures to assure timely and consistent agricultural growth and output. It is also necessary to participate to the expansion of agriculture output sustainably. These needs suggest that land evaluation, agricultural biotechnology, and growth and yield forecast are more important to global agriculture.

Crop cultivation is a substantial sector that employs a big majority of individuals on the Indian subcontinent. A wide range of jobs rely on agricultural production under certain manner for their development and implementation. Crops cultivated worldwide are highly dependent on a variety of conditions and traits. Enhanced agricultural output and an adequate result are essential to provide maximum economic growth.

It is crucial for the survival of the predominantly agricultural civilization since missed harvested lead to a loss of money. As a consequence, water scarcity may well be disastrous for a nation that is entirely reliant on agricultural goods and agronomic activities. As a conclusion, an appropriate measure for predicting crop yield is essential in particular to prepare for the oncoming arrival of starvation or beneficial conditions.

The various factors that influence crop yield are exceedingly complex, and any sort of forecasting necessitates a solid understanding of the agronomic viewpoint. Weather extremes over time, including the proper utilization of current data, might be crucial in establishing an acceptable and productive forecast system. Forecasting may be rather useful in recognizing situations that could have been terrible for producers in a large agriculture industry.

Thus, precise crop output forecast is required for the nation's policymakers to rely on in order to acquire simple export and import evaluations for boosting national food security. Consequently, crop production forecast is difficult owing to various complicated aspects. Fundamentally, agricultural production is determined by a variety of elements such as topography, growing conditions, insect infestations, heredity, groundwater availability and affordability, weather patterns, and harvesting planning, among others. Agricultural yield methods and techniques are time-dependent and essentially nonlinear.

These tactics are additionally difficult due to the inclusion of a wide variety of interconnected components that are specified and influenced by non-arbitration and extension services. Traditionally, producers relied on their own observations and reliable scientific data to anticipate crop yields and make important production judgements based on the projection. Nonetheless, the growth of new technology, such as crop modeling process and machine learning, has surfaced in current history to estimate yield increasingly accurately, as well as the capability to understand massive amounts of data employing high-performance computers.

Various researches are now demonstrating that the application of machine learning algorithms has an excellent capability than multivariate statistics. Machine learning is a branch of artificial intelligence in which computer systems may be programmed without the use of specific scripting. Such techniques, which ensure a significant forecasting performance, handle agricultural systems that are either non-linear or linear. The tactics are derived from the machine learning agriculture system's learning process. These approaches entail performing out a certain task using a train and learning information.

In section 2 of this research paper, relevant studies are discussed. The suggested approach is described in detail in section 3. In part 4, the experimental assessment is carried out, and section 5 closes this study piece with the potential for future improvement.

II. LITERATURE SURVEY

Mullangi Ramu [1] states that the agriculture sector has been one of the cornerstones of the economy in the developing countries such as India. The agriculture is a critical aspect of the country as there is an immense reliance on the farming activities that are being used for the purpose of feeding the growing population. The most important crop in the world can be considered as wheat, and this research article concentrates on the realization of the crop yield predictions based on the implementation of the Artificial Neural Networks and Random Forest algorithm. The approach has been compared to achieve the performance comparison between both the algorithms which has led to the authors considering the better performance of the Random Forest approach as best algorithm for the purpose of crop yield predictions.

Mamunur Rashid [2] demonstrates new agricultural technologies must be developed in order to feed the world's growing population. Aside from that, cultivators want a timely guidance that will help them to anticipate crop yields and design efficient tactics to optimize crop yields. By analyzing large amounts of data and evaluating the data, ML paradigms provide a comprehensive picture of the process. These capabilities are used to create models that describe the relationships between consumers and operations. Furthermore, the future responses in a particular circumstance may be forecasted using ML models. The current study demonstrates that the evaluated publications use a wide variety of qualities, with an emphasis on availability of data and study objectives.

Potnuru Sai Nishant [3] relates that In India, over a thousand crops have been grown across the nation. These harvests are classified for easier comprehension and representation. The data for this study was obtained from the Indian Government Repository. Our research found that everyone uses climatic factors like annual precipitation, natural light, and agrarian factors like soil conditions, nutrition attained by the soil, but the dilemma is that we do need to gather the information but then a foreign entity does this forecasting and then it will be clarified to the grower, which requires a huge amount of effort for the grower and he does not accept the science behind some of these considerations. To make it easy and immediately applicable to farmers, this study use simple parameters such as the farmer's local district, crop kind, and seasons.

Anıl Suat Terliksiz [4] argues that regression-based models imply crop production can be calculated using only a few factors that are independent of one another. Because of mistakes in these expectations, these models have several flaws. In comparison to regression-based approaches, simulation-based prototypes employ interactively coupled dynamics of photosynthesis, metabolism, dry mass generation, and crop phenotypic expression. As a consequence, simulation-based models may accurately simulate a genuine crop. These simulations require a high number of environmental and agricultural input parameters, limiting their use on small scales. Relatively simple models derived from empirical connections involving remote sensing vegetation indicators and in situ agricultural residues and yield can similarly estimate agriculture productivity. These models are simple to parametrize, but their use is confined to the research location and underlying dataset over which the correlations were constructed.

Ramesh Medar [5] explains that agriculture is an area that contributes to our country's economic progress. However, this lags behind in terms of utilizing emerging machine learning technology. As a result, our farmers must be aware of any new machine learning and other approaches. These approaches aid in increasing agricultural productivity. Numerous neural network models are used in agriculture to increase crop production rates. These strategies can aid in the resolution of agricultural issues. We can also determine yield accuracy by testing various approaches. As a result, researchers can increase performance by comparing the proportion of different harvests. Sensor technologies are being used in a variety of agricultural areas. This document assists in obtaining the highest crop production rate possible.

Ms Kavita [6] highlights how, as the population is increasing, production of food and the supply system have grown more difficult to manage. In recent years, academics have made significant attempts to forecast agricultural yield output in order to assist farmers. India is a land of producers and communities. Farmers can benefit from innovation by calculating crop production. This study use machine learning approaches to forecast agricultural productivity in India. So far, the prediction has indicated that the logistic regression works better with country-level data. As these strategies are related with the agricultural information, the study emphasizes the benefits of changing practices.

Aruvansh Nigam [7] showed multiple machine learning techniques for estimating agricultural production based on temperature, rainfall, season, and region Research using Indian government datasets revealed that the Random Forest Regressor offers the greatest yield forecast accuracy. The sequential model, which is a Simple Recurrent Neural Network, outperforms the LSTM in terms of modelling and forecasting. A yield projection for a certain district may be created by considering precipitation, humidity, and other data such as season and area. Once all characteristics are pooled, the results show that Random Forest is the preferred model.

Jeevan Nagendra Kumar [8] outlines a technique for predicting agricultural production based on historical data. Crop production is forecasted using data mining algorithms. In this case, the Random Forest method is used to estimate the best crop production as an output. Crop yield forecasting is typically accurate in the agricultural area. The greater the improvement in precision, the greater the benefit to crop output. The proposed method assists farmers in gaining an understanding of crop demand and pricing. It assists farmers in deciding which crop to produce in the field. The greater the improvement in precision, the greater the benefit to crop output. This task is used to obtain knowledge about the crop that may be used to produce an appropriate and beneficial harvesting.

Shivam Bang [9] argues that the occurrence of rainfall is an essential aspect in crop output forecast but is difficult to determine exactly. Additional characteristics that may impact rainfall forecast may cause weather patterns to vary. Furthermore, the suggested study use fuzzy logic to anticipate crop yield, because operates on a specified range but instead of categorical variables; hence, errors in anticipated annual rainfall do not prove to be problematic as soon as the discrepancy among actual and expected values is not significant. Whenever the preceding year's precipitation and temperature parameters are available, the suggested model may correctly estimate crop production for that year.

Meeradevi [10] expresses that the concept of farming is one of the most central aspects of the Indian subcontinent. The economy of the country is based on the agriculture as farming supports the increasing population and their nutrition needs as well as improves the economy of the country through the exports. Therefore, the prediction of crop yield is one of the most useful mechanism that can be helpful in determination of the state of the crop as well as it can be effective in reducing the ambiguity related to the yield. This can also help the farmer effectively assess the returns of his investment for this purpose an interactive mobile application has been designed which implements machine learning approaches to achieve accurate prediction.

A Suresh [11] K-Means and Modified KNN were used to estimate key crop outputs in Tamil Nadu. The analysis was done on three optimization algorithms: fuzzy, KNN, and Improved KNN, with Customized KNN proving to be the pick of the bunch. In the future, we want to investigate the many bioinspired approaches and conduct a comparison analysis validate the effectiveness of each methodology. The WEKA platform is being utilized to help with the deployment of K Means and modified KNN for crop yield prediction. The findings show that the proposed technique was deployed effectively and accurately, yielding very accurate results.

Jigisha Patel [12] says that agricultural analyses would assist rural bodies in assisting ranchers in making essential and beneficial decisions. In this investigation, models were kept and accomplished in Python in the quickest possible way, and they were performed under close programming and gear situations to assure suitable connections. The misstep metric is being used to describe the extent of model integration during implementation. The screw up indicator is evaluated using the residuals acquired during the evaluations, which are the discrepancy between the legitimate and predicted features. By the conclusion of the day, the accuracy, as well as the sustainability of the model, is determined by the magnitude of the anticipatory dispersion. In terms of and manageability, the suggested substantial assistance model appears to outperform the LSTM-RNN with q-learning major learning approaches.

III CONCLUSION AND FUTURE SCOPE

Agriculture is probably of the very prevalent occupations in the nation. Various agricultural enterprises generate major financial benefits for the government. As a consequence, it is regarded as one of the most adaptable investment approach. India is mostly an agriculture based country. Agrarian nations are those whose major source of revenue is agricultural cultivation and other farm goods. Attempting to sustain a community is a massive effort that should only be completed via effective farming. India has by far the most farmable farmland. The overwhelming majority of inhabitants dependent on agriculture for a livelihood also because nation is largely agrarian. As a result, is there a need for more powerful approach for predicting agricultural yields using machine learning techniques. This literature survey study summarized and examined an effective collection of studies to reach our strategy, which will be detailed in the future research article on this issue.

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