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Identification Of Crop Disease And Recommendation For Pesticides Using ML And DL

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Abstract: In agriculture, now-a-days farming is the main source of income in the country but there are many challenges in farming. The main problem is crop are being affected by various diseases.so the income of the farmers is dependent on crop cultivation. So, to overcome these problems we need to have use various methods to prevent crop diseases. This holds the potential to significantly impact global food security and contribute to the advancement of precision agriculture, fostering a more resilient and productive farming ecosystem. The solution is been built using deep learning models like CNN, and image segmentation models using ML. So, the pre-existing systems of disease prediction is having some limitations. In terms of accuracy and time needed to find the solution. Therefore, the system we are proposing is been built to not have any of these limitations.

***Index Terms* -** Recommender System, Machine Learning and Data Science, Disease prediction, Classification, YOLO, Image Classification, Image Segmentation, CNN

I. INTRODUCTION

India's primary industry is agriculture. The output of agriculture has a big effect on a country's economy.
particularly in a country like India where the agricultural sector employs roughly 60% of the workforce and generates 20% of the GDP of the country. India ranks second globally in terms of agricultural production. India is home to farmers who grow a diverse array of crops. A multitude of factors, such as the soil, the climate, various illnesses, etc., affect crop yield. Even now, these crops are grown according to scientific principles in order to yield the maximum yield and production requirements. Therefore, by applying technology, yield may be increased and quality can be improved. Plant illnesses are typically detected by visual observation, which can result in inaccurate disease diagnosis and unnecessary pesticide use. Resulting in the long-term development of disease resistance, lowering the crop's defence capacity. Many problems plague agriculture, such as poor farming practices, improper application of manure, compost, and fertilizers, lack of water, and disease-infected plants. Diseases have a detrimental effect on plants' health, which affects how quickly they develop. Numerous illnesses that affect plants result in a major loss of productivity, both in terms of quantity and quality. Diseased plants make up between 20 and 30 percent of all crop loss. As a result, the reputation of plant diseases will become

crucial to preventing significant losses in agricultural output quantity, performance, and production. It is possible to identify plant illnesses by examining the area on the afflicted plant's leaves. Our plant disease identification system uses a Convolutional Neural Network (CNN). The most popular method for automatically learning critical and discernible traits is to use deep learning-based approaches, primarily neural network architectures. Utilizing various convolutional layers, deep learning (DL) incorporates learning from the provided data. A deep learning model can be used to detect plant diseases. Because deep learning requires a large quantity of data to train the network, it also has several drawbacks. Performance will suffer if there are insufficient photos in the dataset that is currently accessible. Among the many advantages of transfer learning is that it requires less data to train the network. By applying prior information from a related task to a new task, transfer learning improves learning of a new task. Utilizing various convolutional layers, deep learning (DL) incorporates learning from the provided data. A deep learning model can be used to detect plant diseases. Because deep learning requires a large quantity of data to train the network, it also has several drawbacks. Performance will suffer if there are insufficient photos in the dataset that is currently accessible. Among the many advantages of transfer learning is that it requires less data to train the network. By applying prior information from a related task to a new task, transfer learning improves learning of a new task.

II. LITERATURE REVIEW

A. India's main industry for jobs and income is agriculture. The most frequent problem faced by Indian farmers is that they select the incorrect crop for their terrain. They will thus witness a significant decline in productivity. Farmers are using precision agriculture to assist them solve their difficulties. Precision agriculture is a modern farming method that advises farmers on the best crop for their particular site based on research data on soil kinds, characteristics, and crop production statistics. This raises productivity and decreases the frequency of incorrect crop selection [1].

B. Accurately forecasting crop yields far in advance of harvest can assist government organizations and farmers in making well-informed decisions regarding minimum support prices, import/export, storage, and other matters. A comprehensive analysis of vast amounts of data produced by numerous variables, including soil quality, pH, EC, N, P, K, and so on, is necessary to predict a crop. Given that crop prediction necessitates a huge number of datasets, this prediction approach is appropriate for data mining. One method for drawing knowledge out of massive amounts of data is data mining. This article discusses the many data mining techniques that have been applied to agricultural production estimation. The success of any crop production forecast system depends on how well classifiers are used and how accurately features are extracted. The accuracy and recommendations of several agricultural output forecast systems employed by different authors are summarized in this work [2].

C. In this work, we introduce RSF, a farmer recommendation system that can suggest which crops to grow in various environments. After determining a user's location, the system uses the Pearson co-relation similarity technique to calculate similarities among upazilas utilizing various agro-climatic and agro-ecological data. Next, the best-n equivalent upazilas are selected. Lastly, using seasonal data and crop production rates in comparable upazilas, it suggests top-fc crops to an upazila user. Using actual data, we tested the algorithm and found that it was reasonably accurate. The method can assist farmers in growing the right crops. They will be able to improve their quality of life and contribute more to society as a result [3].

D. Making decisions in agriculture is very challenging as so many factors affect the process as a whole. This program performs a backend computation and outputs a list of the most likely crops for that farm. The proposed decision support system may help farmers choose a crop for cultivation mapping by accounting for a number of variables, including temperature range, required water consumption, average weather needs, soil type, and PH value [4].

E. Agricultural intelligent decision systems can provide a scientific basis for agricultural research and are helpful in directing agricultural output. Big data analysis technologies can be advantageous when applied to intelligent decision systems. It is investigated how agricultural intelligent decision systems are developed and researched. [5].

F. The goal of this research is to employ data mining techniques to construct a crop production forecast system by analysing an agriculture dataset. The WEKA tool is used to compare the performance of several classifiers that are used for prediction. A lower error value means that the method will be more accurate. The outcome was obtained using a classifier comparison [6].

G. India places a lot of importance on agriculture. As farmers prosper, the nation prospers as well. As a result of our work, farmers will be able to plant the right seed depending on the characteristics of the soil, increasing the nation's output. [7].

H. The main industry in our nation and the foundation of the economy is agriculture. Farmers need to practice smart farming in order to be ready to handle modern issues including weather unpredictability, uncontrollable costs resulting from demand-supply mismatches, and water shortages. It is necessary to address low agricultural yields brought on by unanticipated climate change, inadequate irrigation infrastructure, declining soil fertility, and traditional farming practices. One such method for predicting crop yield in agriculture is machine learning. [8].

I. The needs and planning needed to build a precision farming software model are examined in this study. The authors begin with the basics of precision farming and then proceed to modeling and support development. This work offers a method for controlling diversity for each farmer and crop quality on small, open fields using the Precision Agriculture (PA) concept. The main objective of the model is to give even the smallest farmer precise instructions at the crop clip level. Among the most widely used technologies are email and SMS. Kerala, which has India's smallest average catch size, is the reason this model was created. This mode is now accessible as a result [9].

J. The Republic of India is built on agriculture, which is the most important industry on the globe. a suitable An essential component of crop forecasting is crop expansion forecasting. Such estimates will impair the federation industries' ability to support its workforce. A technique for extracting new models from massive data sets is machine learning. Regressive methods include, for example, linear regression and random forest. Two categories of meteorological data that are produced by necessary data are area and production. This study compares different machine learning ML regressions and computes the cumulative percentage improvement across multiple years to calculate the recommended agricultural yield. [10]

III. METHODOLOGY

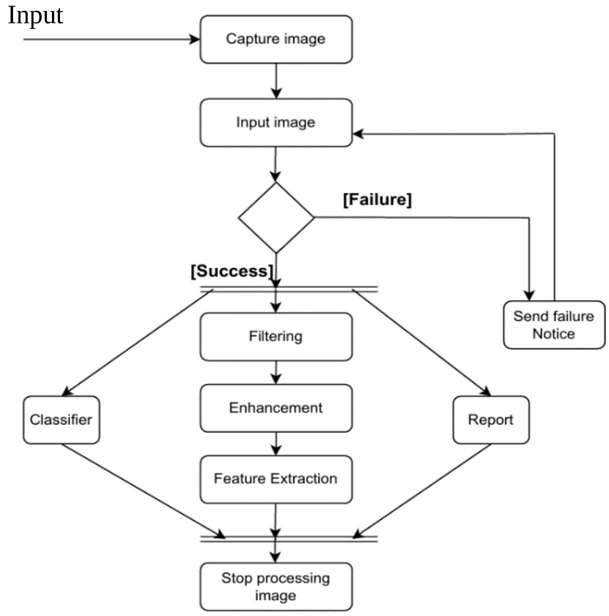

Fig.1. System Architecture

A. Data Preprocessing and Augmentation: To improve the quantity and quality of the training dataset, apply efficient data preprocessing techniques, such as data cleaning, normalization, and augmentation. Effective preprocessing of the data increases the robustness of the model and makes it better able to generalize to new data, which raises the overall accuracy of pest detection andpesticide recommendations.

B. Model Selection and Optimization: Convolutional neural networks (CNNs) are one example of a model that may be used for image recognition. The system's efficiency and accuracy can be increased by tweaking the CNNs' hyperparameters. When implemented in resource-constrained contexts, methods like transfer learning and model compression can assist lower computational complexity and enhance the system's real-time performance.

In deep learning, convolutional neural networks with popular topologies—like EfficientNet—are used for computer vision tasks like object recognition and picture classification.

EfficientNetB0:

The goal of the EfficientNet family of neural network architectures is to strike a compromise between computational efficiency and model accuracy. The baseline model in this family is called EfficientNetB0. Its design concept is cantered on three main elements:

Compound Scaling:

To scale the depth, width, and resolution of the network to be seen, EffectiveNet employs compound scaling. the ideal ratio of performance to model size. As a result, the model is effective and efficient. As a result, an efficient and effective model is produced.

Mobile Building Blocks:

It uses inverted residual blocks and depth-wise separable convolutions, among other mobile-friendly building blocks. These building elements preserve the network's expressive capacity while lowering the number of parameters.

Efficient Use of Resources:

To make effective use of computational resources, EfficientNet combines a number of strategies, including squeezing and-excitation blocks, regularization, and attention mechanisms. Users can select the model that best suits their needs from the B0 (small and efficient) to B7 (bigger and more accurate) models in the EfficientNet family.

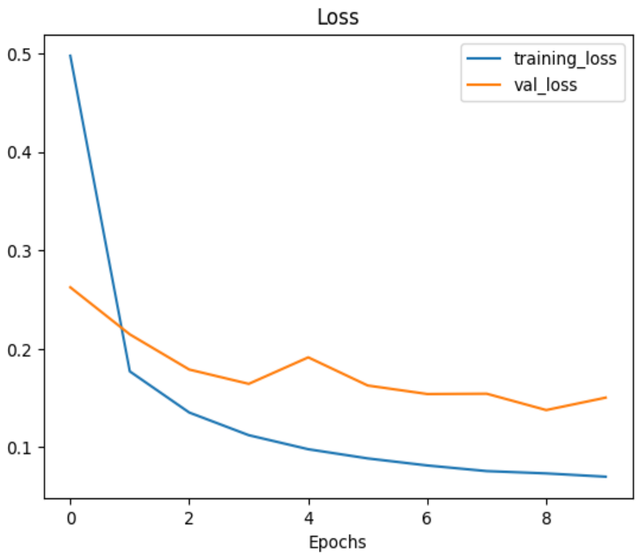

Fig.2. Loss

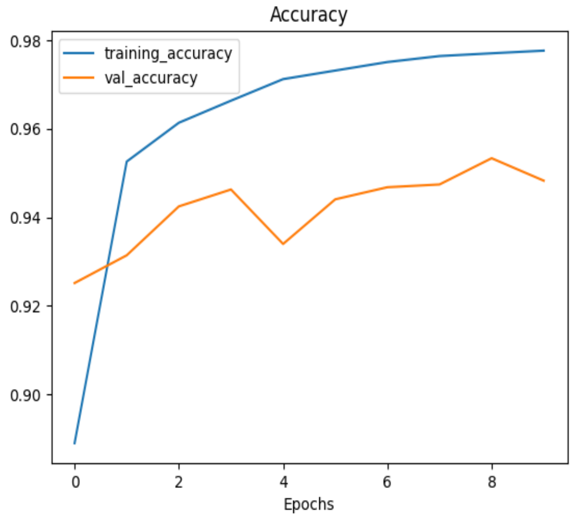

Fig.3. Accuracy

C. Dimensionality reduction and feature engineering: dimensionality reduction techniques are used to lower the computational complexity of the model and feature engineering is carried out to extract meaningful features from the input data. The efficiency of the system can be increased by utilizing methods like principal component analysis (PCA) or t-distributed stochastic neighbour embedding (t-SNE), which can assist in keeping the important information while lowering the computational load.

D. Algorithmic Efficiency and Parallel Processing: To speed up calculation and cut down on processing time overall, parallel processing should be used along with model optimization for algorithmic efficiency. The system's computational efficiency can be greatly increased by utilizing hardware accelerators like GPUs or TPUs and distributed computing frameworks. This will allow for faster and more dependable insect identification and pesticide recommendation operations.

E. Continuous Model Monitoring and Improvement: By incorporating feedback loops and putting retraining techniques into practice, a framework for continuous model monitoring and improvement is established. In order to keep the model current and effective in providing precise pest identification and timely pesticide recommendations, the system can be made more adaptable to changing pest patterns by implementing strategies such as online learning and active learning.

F. Scalability and Deployment Optimization: Considering these factors during system design can help it integrate more easily into a variety of agricultural contexts. Using cloud computing services and containerization technologies like

Docker or Kubernetes can improve the system's scalability and guarantee effective deployment, allowing for widespread access and use in the agricultural community.

IV. CONCLUSION

Crop disease identification is a critical component of modern agriculture, harnessing technology and data-driven approaches to enhance crop management, increase agricultural productivity, and reduce environmental impact. By providing early warnings and actionable insights, crop disease identification systems empower farmers and agricultural professionals to make informed decisions and take preventive measures to protect their crops.

V. REFERENCES

[1] Li, L., Zhang, S. and Wang, B., 2021. Plant disease detection and classification by deep learning—a review. IEEE Access, 9, pp.56683-56698.

[2] Venkatasaichandrakanth, P. and Iyapparaja, M., 2023. Pest Detection and Classification in Peanut Crops Using CNN, MFO, and EViTA Algorithms. IEEE Access.

[3] Rashid, M., Bari, B.S., Yusup, Y., Kamaruddin, M.A. and Khan, N., 2021. A comprehensive review of crop yield prediction using machine learning approaches with special emphasis on palm oil yield prediction. IEEE access, 9, pp.63406-63439.

[4] Sharma, A., Jain, A., Gupta, P. and Chowdary, V., 2021. Machine learning applications for precision agriculture: A comprehensive review. IEEE Access, 9, pp.4843-4873.

[5] Reyana, A., Kautish, S., Karthik, P.S., Al-Baltah, I.A., Jasser, M.B. and Mohamed, A.W., 2023. Accelerating Crop Yield: Multisensor Data Fusion and Machine Learning for Agriculture Text Classification. IEEE Access, 11, pp.20795-20805.

[6] Kumar, M., Kumar, A. and Palaparthy, V.S., 2020. Soil sensors-based prediction system for plant diseases using exploratory data analysis and machine learning. IEEE Sensors Journal, 21(16), pp.17455-17468.

[7] Kumar, R. and Shukla, N., 2022, March. Plant Disease Detection and Crop Recommendation Using CNN and Machine Learning. In 2022 International Mobile and Embedded Technology Conference (MECON) (pp. 168-172). IEEE.

[8] Bhansali, S., Shah, P., Shah, J., Vyas, P. and Thakre, P., 2022, April. Healthy Harvest: Crop Prediction And Disease Detection System. In 2022 IEEE 7th International conference for Convergence in Technology (I2CT) (pp. 1-5). IEEE.

[9] Saranya, K., Dhayalan, D., Prasanth, R. and Sathish, M., 2022, March. Agriculture Based Recommendation System with Image Processing. In 2022 International Conference on Communication, Computing and Internet of Things (IC3IoT) (pp. 1-6). IEEE.

[10] Chauhan, G. and Chaudhary, A., 2021, December. Crop recommendation system using machine learning algorithms. In 2021 10th International Conference on System Modeling & Advancement in Research Trends (SMART) (pp. 109-112). IEEE.