iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 12 Issue: IV Month of publication: April 2024

DOI: https://doi.org/10.22214/ijraset.2024.60724

www.ijraset.com

Call: 08813907089 | E-mail ID: ijraset@gmail.com

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 12 Issue IV Apr 2024- Available at www.ijraset.com

PlantGuard: Leaf Disease Detecting and Suggests Remedy using Machine Learning

Shrutika D. Karale[1], Sanskruti D. Kulkarni[2], Pranali S. Jadhav[3], Firoj K. Sayyad[4], Prof. Sachin D. Pandhare[5]
[1, 2, 3, 4]*U.G. Student, Department of Computer Science & Engineering, SMSMPITR, Akluj, Maharashtra, India*
[5]*Professor, Department of Computer Science&Engineering, SMSMPITR, Akluj, Maharashtra, India*

Abstract: Plantguard is a leader in the fusion of artificial intelligence and agriculture, with a primary focus on transforming crop management via sophisticated leaf disease detection. The initiative provides quick and reliable plant disease identification from leaf photos by utilizing cutting-edge computer vision and machine learning algorithms, giving farmers the ability to take prompt action. Plantguard is dedicated to creating user-friendly interfaces that will allow precision agriculture to be smoothly incorporated into conventional agricultural methods. This will promote sustainable production, boost farmer productivity, and raise their financial stability. This novel strategy represents a significant step toward a future for global agriculture that is both resilient and more technologically advanced. Convolution neural network (CNN), transfer learning, deep learning, image processing, data augmentation, and agricultural applications are some of the index terms.

I. INTRODUCTION

At the intersection of artificial intelligence and agriculture, PlantGuard emerges as a ground-breaking initiative motivated by the need to transform crop management. PlantGuard takes on the issue of implementing cutting-edge technologies to strengthen agriculture, the foundation of our subsistence, in the face of growing global populations and the persistent threat of crop diseases. The main focus of the study is on leaf disease detection, a widespread problem that imperils crop productivity and global food security. Fundamentally, PlantGuard analyzes plant leaf photos with great care using cutting-edge computer vision and machine learning techniques. The goal is apparent: to quickly and precisely detect the early indicators of illnesses that frequently escape the unaided sight.

Through incorporatingthese technology developments into the agricultural environment, PlantGuard aims to provide farmers with a proactive tool that goes beyond customary methods. With the help of this tactical method, farmers may carry out focused interventions, lessening the impact of illnesses, decreasing crop losses, and eventually promoting a more efficient and sustainable farming ecosystem. PlantGuard's emphasis on user-friendly interfaces is a tribute to its devotion to practicality; it ensures accessibility for farmers across a variety of technical environments. The proposal imagines a time when traditional agricultural methods and precision agriculture coexist harmoniously in the future, combining technology and tradition in a pleasing way. Beyond short-term gains, PlantGuard's mission encompasses a wider revolution in agriculture around the world, encouraging resource optimization, resilience, and farmer economic empowerment. We explore the technological details, sociological effects, and wider ramifications that make PlantGuard a trailblazing force in influencing agriculture's future in the paragraphs that follow. With PlantGuard, improved leaf disease detection usingConvolutional Neural Networks (CNNs) is transforming crop management. PlantGuard's ability to identify tiny visual patterns that may indicate different plant illnesses is made possible by CNNs' innate potential for feature extraction and spatial hierarchy recognition

II. CONVOLUTIONAL NEURAL NETWORK

A Convolutional Neural Network (ConvNet/CNN) is a type of Deep Learning system that can recognize different objects and aspects ofan image, apply significance (i.e., learnable weights and biases), and process the image input. ConvNets require a great deal less pre- processing than other methods for categorization. When given enough training, ConvNets can learn these filters and properties, but simple methods require filter engineering by hand.

This area of Deep Learning deals with algorithms that, when used in real-time situations, aim to mimic human perception and decision-making processes. These algorithms are taught to evaluate circumstances from a variety of angles and settings, just like people do. Their integration aims to increase human labor efficiency through enhanced automation, spanning a variety of sectors from widely used mobile devices to highly performant supercomputers.

Three main layers are distinguished in the architecture of a Convolutional Neural Network (CNN).

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 12 Issue IV Apr 2024- Available at www.ijraset.com

1) *Input Layer:* This first layer is where the model starts, taking in data in the form of pictures most of the time. Every image is representedby an array of pixels, each of which has its value stored in a different network node. These nodes serve as the basis for all further CNN operations, including feature extraction and pattern recognition.
2) *Hidden Layer:* The majority of the CNN's computation is done by the hidden layer, which is positioned between the input and output layers. This is where intricate processes like feature extraction, data transformation, and data processing take place. The number of hidden layers, or the depth of this layer, is correlated with the architectural complexity of the network. The model gains the capacity to identifycomplex features from incoming data using advanced data processing methods, which speeds up inference and decision-making, especially in situations involving real-time data. Individual neurons' activity status is determined by activation functions incorporated inthe CNN, which take into account the input that each neuron receives.
3) *Output Layer:* The output layer, which is the last stage of the CNN, gathers and processes the hidden layer's signals. Usually, these outputs are flattened into a format that may be used for tasks involving regression or classification. The network's final inference or decision is the result of the output layer's transformation of these processed inputs into classes or predictions that make sense.

The elements that are taken out of the concealed layer are used in our research effort to identify and forecast the presence of illnesses that impact plants.

III. PROPOSED NEURAL NETWORK ARCHITECURE

PlantGuard's successful implementation primarily depends on a strong and effective neural network architecture designed especially for the detection of plant leaf diseases. The following proposed Neural Network Architecture seeks to ensure excellent accuracy and real-time performance while addressing the difficulties of this task.

1) *CNNs, or Convolutional Neural Networks:* Convolutional Neural Networks (CNNs), a deep learning architecture best suited for image classification applications, form the core of the proposed NNA. The convolutional, pooling, and fully connected layers that make up the CNN allow for the extraction of hierarchicalfeatures and the recognition of patterns from input images.
2) *Pre-trained Feature Extractor:* The suggested NNA includes a pre-trained feature extractor, such as VGG, ResNet, or MobileNet, to take use of transfer learning's advantages and reduce the need for training from scratch. These pre-trained models have learnt representations of different visual aspects because they were trained on extensive image datasets such as ImageNet. The NNA may take advantage of the pre-trained features' generalisation skills while adapting to the unique qualities of plant leaf photos by adjusting the parameters of the pre-trained model.
3) *Customised Classification Head:* The NNA comes with a specially designed classification head for the identification of plant leaf diseases in addition to the pre-trained feature extractor. The fully connected and softmax layers that make up this classification head's additional layers are in charge of assigning retrieved features to different illness classifications. The NNA can learn discriminative representations unique to the target task by fine-tuning the classification head's parameters during training, which increases classification accuracy.
4) *Data Augmentation and Regularisation:* The suggested NNA uses regularisation and augmentation methods for data during training to improve model generalisation and reduce overfitting. To increase the diversity of the training dataset, data augmentation entails randomly transforming input images using operations like rotation, scaling, and flipping. In order to improve generalisation to unknown data, regularisation techniques like dropout and weight decay are used to stop the model from learning noise and unimportant patterns.
5) *Optimised Training Process:* The suggested NNA's training process entails adjusting a number of hyperparameters, such as learningrate, batch size, and optimisation method (such as Adam or SGD). Furthermore, methods like early halting and learning rate schedulingcan be used to speed up convergence and avoid overfitting. In addition, the NNA is put through a thorough evaluation process to verifyits efficacy in detecting plant leaf diseases using common performance measures like accuracy, precision, recall, and F1-score.
6) *Real-time Deployment and Inference:* After training, the NNA can perform real-time inference, which enables prompt illness diagnosis from input leaf images. The implemented model can be combined with an intuitive user interface that farmers can access through web or mobile applications.

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 12 Issue IV Apr 2024- Available at www.ijraset.com

IV. LITERATURE SURVEY

Andrew J. 1 , Jennifer Eunice 2 , Daniela Elena Popescu 3 , M. Kalpana Chowdary 4,* and Jude Hemanth 2 they propose an Deep Learning-Based Leaf Disease Detection in Crops Using Images for Agricultural Applications in this paper, they utilized convolutional neural network (CNN)-based pre-trained models for efficient plant disease identification. They focused on fine tuning the hyper parameters of popular pre-trained models, such as DenseNet-121, ResNet-50, VGG-16, and Inception V4. The experiments were carried out using the popular Plant Village datasets, which has 54,305 image samples of different plant disease species in 38 classes. The performance of the model was evaluated through classification accuracy, sensitivity, specificity, and F1 score. A comparative analysis was also performed with similar state-of-the-art studies. The experiments proved that DenseNet-121 achieved 99.81% higher classification accuracy, which was superior to state-of-the-art models[1].

G. Geetha1,* , S.Samundeswari2 , G.Saranya 3 ,K.Meenakshi 4 and M. Nithya5 they propose an PLANT LEAF DISEASE CLASSIFICATION AND DETECTION SYSTEM USING MACHINE LEARNING In this project, four consecutive stages are used todiscover the type of disease. The four stages include preprocessing, leaf segmentation, feature extraction and classification. To remove the noise we are doing the pre-processing and to part the affected or damages area of the leaf, image segmentation is used. The k-nearest neighbors (KNN) algorithm, which is a guided, supervised and advance machine learning algorithm, is implemented to find solutions for both the problems related to classification and regression[2].

Ms. Kiran R. Gavhale1 , Prof. Ujwalla Gawande2 they propose an An Overview of the Research on Plant Leaves Disease detection using Image Processing Techniques In this paper they review the need of simple plant leaves disease detection system that would facilitate advancements in agriculture. Early information on crop health and disease detection can facilitate the control of diseases through proper management strategies. This technique will improves productivity of crops. This paper also compares the benefits and limitations of these potential methods. It includes several steps viz. image acquisition, image pre-processing, features extraction and neural network based classification[3]

V. PROPOSED SYSTEM

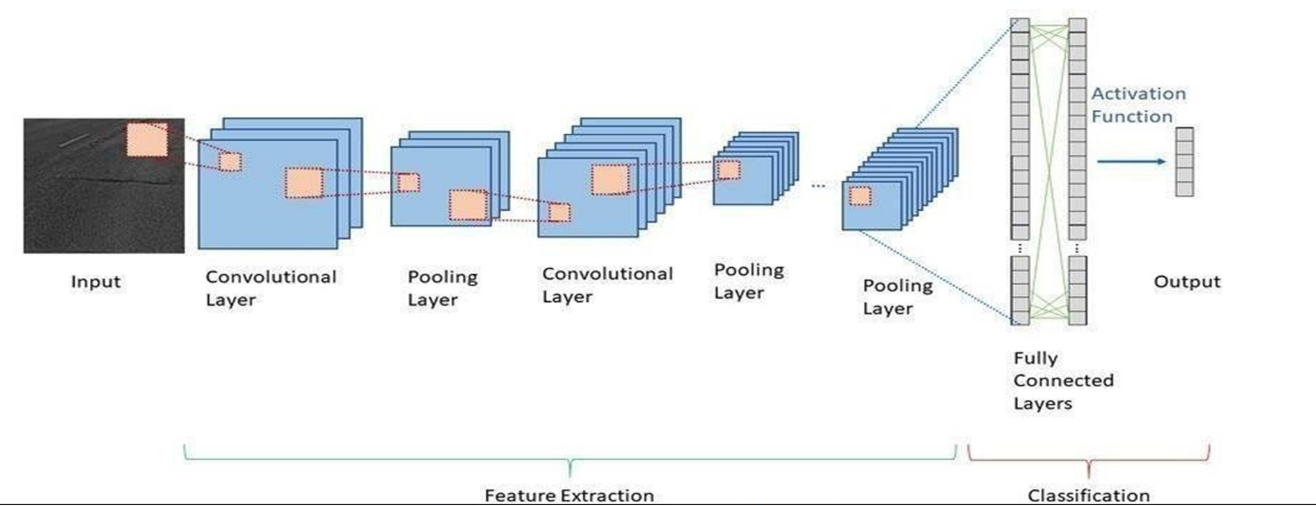
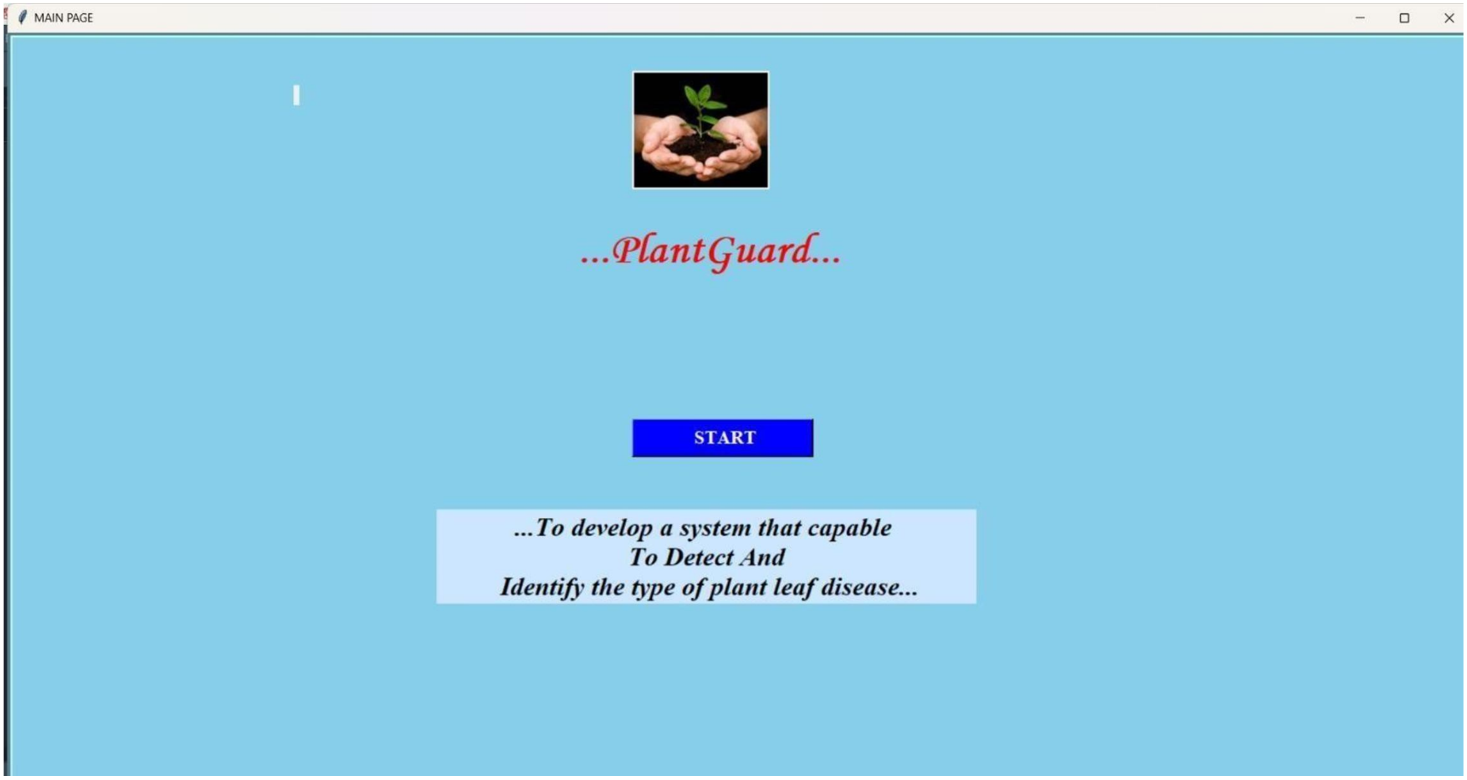
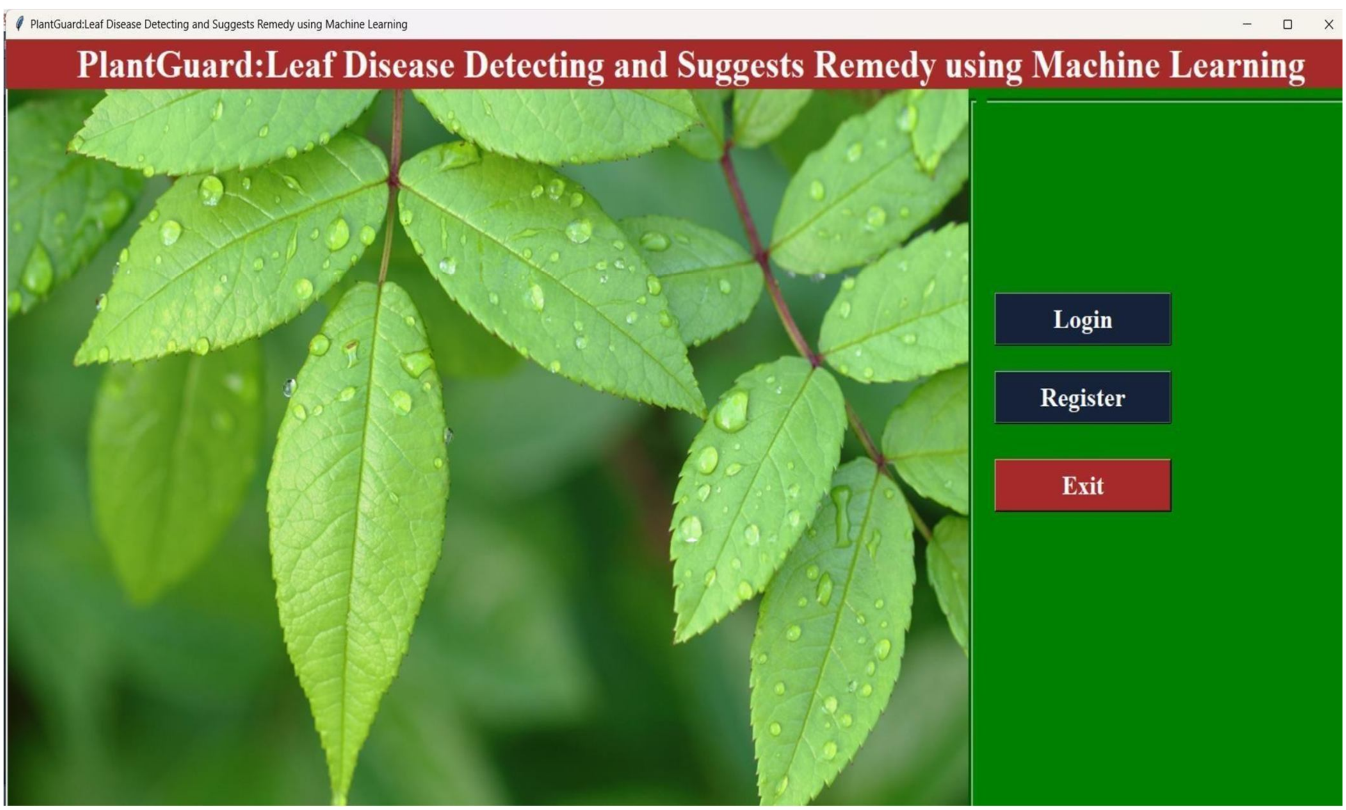


Fig: Convolutional Neural Network

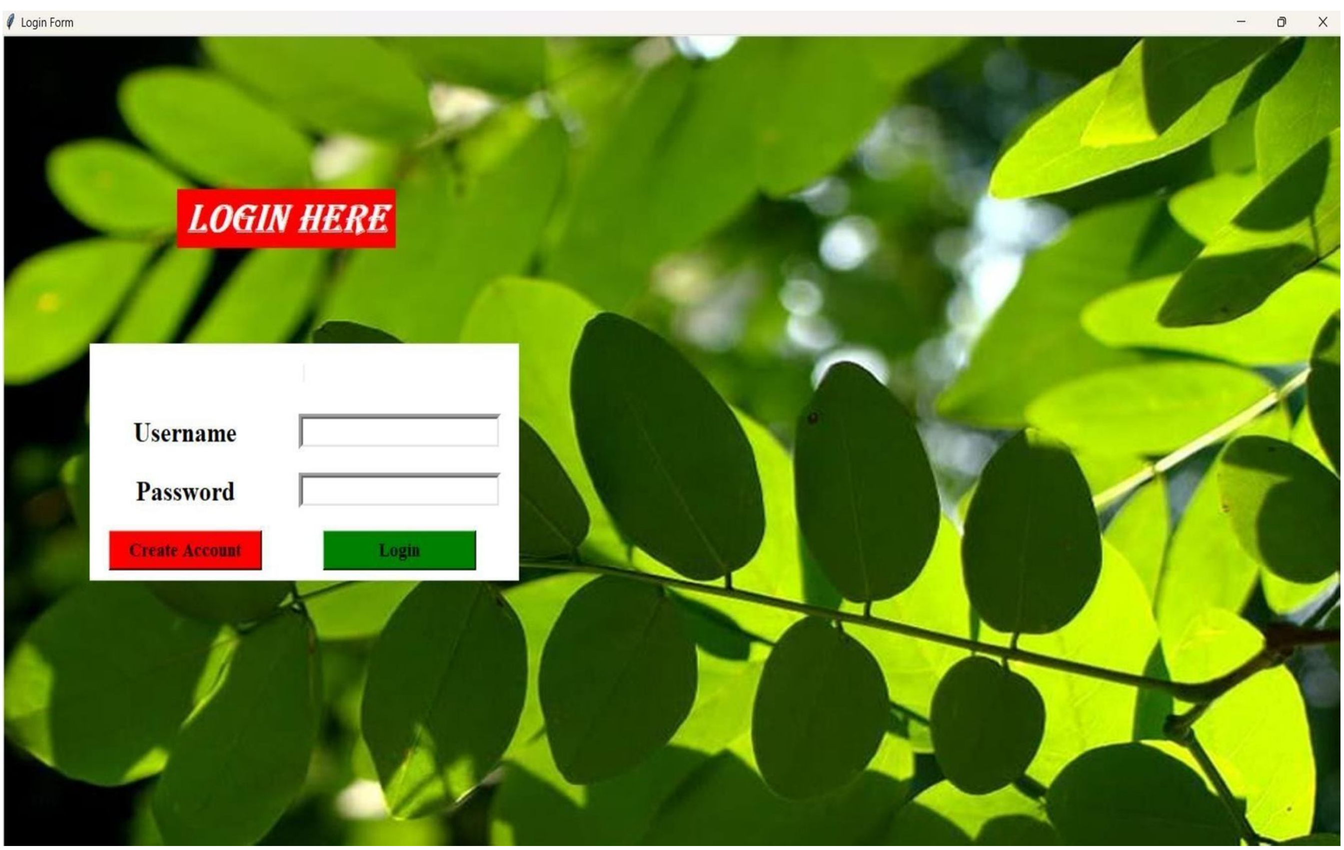
1) Have shown to be incredibly successful in tasks like object identification, image categorization, and image recognition. CNNs are especially useful for handling data that resembles a grid, like pictures. Convolutional layers are a tool used by CNNs to extract spatial feature hierarchies from input data.
2) The spatial dimensions of the convolutional layers are decreased by using pooling layers. Average and maximum pooling are two common pooling operations. A CNN typically ends with one or more fully linked layers, following a number of convolutional and pooling layers.
3) Assemble a varied collection of leaf photos that depict all kinds of diseases and crops. To improve the generalization of the model, resize, standardize, and augment the dataset. Create a CNN architecture that is appropriate for detecting leaf illness. If you want to capture hierarchical features, use multiple convolutional layers.

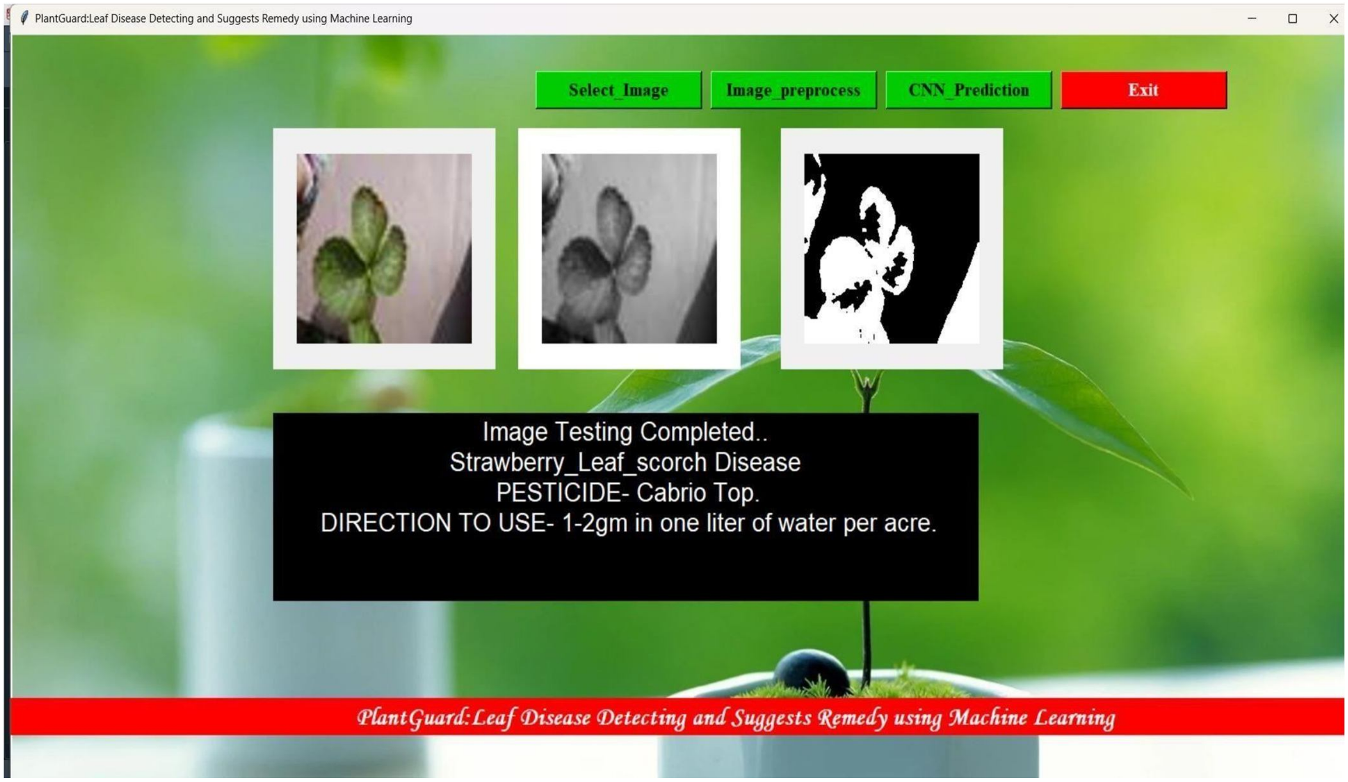
VI. RESULT


MAIN PAGE
...PlantGuard...
START
...To develop a system that capable
To Detect And
Identify the type of plant leaf disease...


PlantGuard:Leaf Disease Detecting and Suggests Remedy using Machine Learning
PlantGuard:Leaf Disease Detecting and Suggests Remedy using Machine Learning
Login
Register
Exit

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 12 Issue IV Apr 2024- Available at www.ijraset.com





VII. CONCLUSION

In conclusion, the PlantGuard project is a paradigm change in agriculture since it uses Convolutional Neural Networks (CNNs), a type of artificial intelligence, to tackle the long-standing problem of leaf diseases in crops. PlantGuard provides farmers with fast and accurate information through the introduction of a sophisticated early disease detection technology, hence enabling proactive treatments and avoiding crop losses. The incorporation of CNNs guarantees a high degree of accuracy in identifying minor visual cues associated with different plant diseases because of their exceptional capacity for feature extraction and spatial hierarchy identification. This improves crop health and also helps to boost yields, farmers' financial stability, and, ultimately, global food security. Furthermore, PlantGuard's dedication to creating user-friendly interfaces takes into account the various technical environments that farmers work in, guaranteeing usability and accessibility in various locales. In the future, the project might potentially undergo significant development, with potential avenues for growth including the incorporation of drone technology, Internet of Things devices, and further machine learning enhancements. PlantGuard's scalability and ability to adapt to a variety of agricultural settings make it a flexible solutionthat has the potential to have a big global impact.

REFERENCES

[1] Andrew J. 1 , Jennifer Eunice 2 , Daniela Elena Popescu 3 , M. Kalpana Chowdary 4,* and Jude Hemanth 2 Deep Learning-Based Leaf Disease Detection in CropsUsing Images for Agricultural Applications
[2] G.Geetha1,* , S.Samundeswari2 , G.Saranya 3 ,K.Meenakshi 4 and M. Nithya5 they propose an PLANT LEAF DISEASE CLASSIFICATION AND DETECTION SYSTEM USING MACHINE LEARNING
[3] Ms. Kiran R. Gavhale1 , Prof. Ujwalla Gawande2 An Overview of the Research on Plant Leaves Disease detection using Image Processing Techniques
[4] Pranesh Kulkarni1 , Atharva Karwande1 , Tejas Kolhe1 , Soham Kamble1 , Akshay Joshi1 , Medha Wyawahare1 Plant Disease Detection Using Image Processingand Machine Learning [5]https://www.frontiersin.org/articles/10.3389/fpls.2023.1158933

BIOGRAPHY

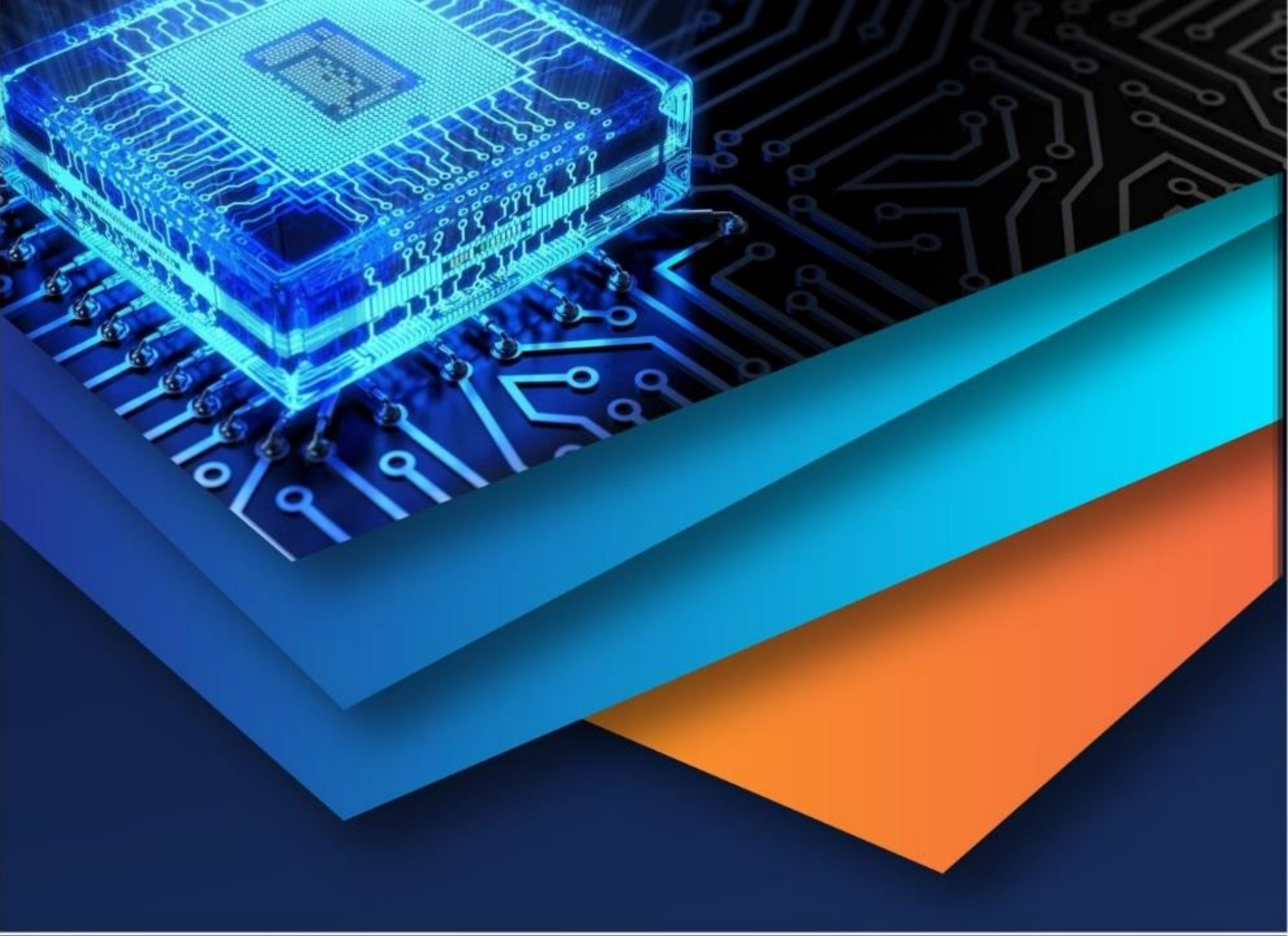
Ms. Shrutika Damodar Karale. Student, Dept. of Computer Science & Engineering, SMSMPITR, Akluj, Maharashtra-413118

Ms. Sanskruti Dinesh Kulkarni Student, Dept. of Computer Science & Engineering, SMSMPITR, Akluj, Maharashtra-413118

Ms. Pranali Sanjaykumar Jadhav Student, Dept. of Computer Science & Engineering, SMSMPITR, Akluj, Maharashtra-413118

Mr. Firoj Khudbuddin Sayyad Student, Dept. of Computer Science & Engineering, SMSMPITR, Akluj, Maharashtra-413118

Prof. Sachin Dadaso Pandhare. HOD, Dept. of Computer Science & Engineering, SMSMPITR Akluj, Maharashtra - 413118



10.22214/IJRASET

INDEX COPERNICUS 45.98

IMPACT FACTOR: 7.129

IMPACT FACTOR: 7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Call : 08813907089 (24*7 Support on Whatsapp)