A DEEP LEARNING APPROACH FOR DISEASE PREDICTION OF PLANTS AND CROP RECOMMENDATION SYSTEM

[1]D. Kumar Research Scholar, JNTUK, Kakinada.
[2]Dr. D.Bujjibabu, Professor of CSE, QISCET, Ongole.
[3]Dr. N.ramakrishnaiah, Professor of CSE, UCEK, JNT University, Kakinada.

Abstract: In this study, we provide a tool for farmers that makes use of Image Processing, Machine Learning, and Deep Learning techniques to improve their operations. Features like early detection of plant disease are included in our application and are achieved in a number of ways. The research showed that the Convolutional Neural Network was the most effective method for detecting plant diseases. It also helps farmers plan agricultural tasks like harvesting and plucking based on accurate weather predictions. Included is a crop-specific fertiliser calculator that can determine how much urea, diammonium phosphate, and muriate of potash should be applied to a certain region to minimize disease recurrence owing to soil mineral loss.

1. INTRODUCTION

Despite the fact that at least 200 million Indians go to bed hungry every night, a study by the Associated Chambers of Commerce and Industry of India estimates that agricultural losses due to pests and diseases amount to Rs.50,000 crore ($500 billion) annually [1]. Most people living in rural areas of developing nations find work in the agricultural industry. Unprecedented insect assaults and extreme weather that destroys crops are two of the biggest problems the industry has to deal with. Using a basic agro-android application system, technology may help enhance rural people's standard of living. Infectious plant diseases pose a serious threat to agricultural production. To aid farmers in solving this issue, we did a comprehensive literature analysis on the topic [5] and developed the Android app Agricultural Aid, which use machine learning to identify plant diseases. Android Studio and its APIs were used to construct and incorporate this identification into an app that delivers a variety of services, including a 7-day weather prediction, a fertiliser calculation, and language translation into up to four different languages. Image processing using machine learning and deep learning models were both used for illness classification.

The first method, known as Image Processing, involves a series of preprocessing steps to isolate the contaminated area, including filtering, colour space conversion, thresholding, and contouring. When used with Machine Learning principles, these methods allow for the identification and categorization of hotspots of infection. However, such approaches often have poor precision. In addition to these measures, the "GrabCut" Algorithm may be used to remove unwanted sounds in the background with little input from the user. In terms of background removal and categorization, it is more accurate than the present approach utilised in the application; nonetheless, it is not being employed at this time. With the second method, Deep Learning, a deep neural network is trained and evaluated using databases of leaf images to determine how best to categorise the condition. Results from several Deep Learning Models, including CNN, ResNet-152, and Inception v3, are compared throughout the article. Images of healthy and sick plant leaves are utilised to train and construct an automated plant disease system using our CNN Model, which is then employed in our agricultural help. In this study, we explored a number of potential methods for building an AI-powered plant disease detection system, with the ultimate goal of incorporating it into a wider agricultural support app. The application's functioning and architecture are described in detail using UML diagrams in Section 2. In Section 3, we discuss the dataset that was utilised for both training and testing. Then, the various experimental approaches, including image processing and deep learning models, are compared and contrasted, and the most accurate model is included into an android app to aid farmers. The presentation finishes with a general discussion and suggestions for more study that might be undertaken to further the intended use.

2. LITERATURE SURVEY

1. The use of AI and digital twins in promoting sustainable agriculture and forestry Agricultural and Forestry in Turkey, 2022, Turkish Journal Xuewei Chao, Yang Li, Jing Nie, and Yi Wang

Farmers and agricultural engineers have been focusing on sustainability in farming because of global economic constraints and diseases. Mechanization, automation, and artificial intelligence have all contributed to advancements in agricultural technology throughout the course of history. Today, artificial intelligence (AI) is the industry standard, driving sustainable farming forward. However, the massive amounts of data needed by AI technology and the expensive cost of data have resulted in individuals progressively considering the usage of digital twins (DT) in agriculture, thanks to the fast growth of virtualization technology. This study explores the current state, future prospects, and problems of smart agriculture via the lens of artificial intelligence and digital twin technologies. With the rising need for high-yield output from farmers throughout the globe, we found that digital twins have a great potential for success in sustainable agriculture, which is crucial to promoting smart agricultural solutions that accomplish low cost and high accuracy.

Second, Using Image Processing Methods to Spot Leaf Diseases in Plants

Income from agriculture is substantial. In third world nations like India, agriculture is a major employer of rural residents. A recent poll found that approximately 70% of the Indian population relies on agriculture for their livelihood. Most Indian farmers still use inefficient manual farming methods like ploughing by hand. Most farmers don't know what kinds of crops do well on their soil. The spread of disease from plant to plant through the leaves has an economic effect on farming. Both the quality and amount of agricultural output have declined. Rapid plant development and greater agricultural yield are both dependent on leaves. It is challenging for both farmers and scientists to identify illnesses in plant leaves.

System for the semi-automatic diagnosis and categorization of soybean leaf diseases

Automatic disease detection and categorization systems are a major focus of precision agriculture research and development. Over the course of the previous several decades, scientists have examined how diverse societies make use of plants. Images of soybean leaves are utilised in a similar investigation. A semi-automatic method is developed using k-means ideas and rules to differentiate between healthy and unhealthy leaves. Downy mildew, frog eye, and Septoria leaf blight are the three main categories of infected leaves. Three models based on support vector machine classifiers are trained independently using colour characteristics, texture features, and a mix of the two for the experiments. The outcomes were derived from thousands of photos in the Plant Village collection. All of the stated average accuracy values are satisfactory, and all of the combinations represent improvements above the current state of the art. The optimal feature set for Soybean leaf disease identification is also the goal of this investigation. The system's ability to accurately assess illness severity has also been shown. Analysing samples of leaves visually illustrates the effectiveness of the suggested approach for detection, categorization, and severity assessment.

2. Detection Methods for Plant Diseases: A Systematic Review In 2020, the cast will include Radhika Chapaneri, Maithili Desai, Anmolika Goyal, S. Ghose, and Sheona Das.

Widespread crop failure due to plant diseases is a major danger to global food supply. This danger may be mitigated with an early detection strategy, which is unfortunately absent in many regions of the globe owing to inadequate healthcare delivery systems. In this article, we'll go through a number of different tests and methods for diagnosing plant diseases. There are benefits and drawbacks to every methodology, as well as variables that may be adjusted to fine-tune the outcomes. The goal of this article is to learn everything there is to know about the process of choosing an algorithm and the major obstacles standing in the way.

3. Fifth, crop recommendation systems use machine learning methods. Authors G. Chauhan and A. Chaudhary, Research Progress in..., 2021

Agriculture is vital to the Indian economy and the daily lives of most Indians since India is predominantly an agricultural nation. Soil, weather, humidity, rainfall, and other factors are considered when advising on crops to grow in order to maximise agricultural production. It's good for the economy generally and farmers specifically, and it helps keep food costs down. This study describes how machine learning techniques like Random Forest and Decision Tree may be used to analyse data and determine the optimal crop for a given soil type.

3. EXISTING SYSTEM

In order to identify plant diseases, it is typical to first process photos via a series of steps that result in processed, ROI-centric input images for further categorization. The input picture was processed using a number of picture Analysis methods to provide an output image that highlighted the diseased areas and provided a percentage of the total infected area in the leaf. The primary benefit of this approach was that the algorithm could be applied to images taken in real time, rather than requiring the leaf to be extracted and placed on a black backdrop. This approach successfully distinguished the infected leaf from the healthy leaves among a group of mixed crops, simulating a realistic situation.

DISADVANTAGES OF EXISTING SYSTEM

• This multi-step algorithm is not optimized and does not produce better background elimination results.

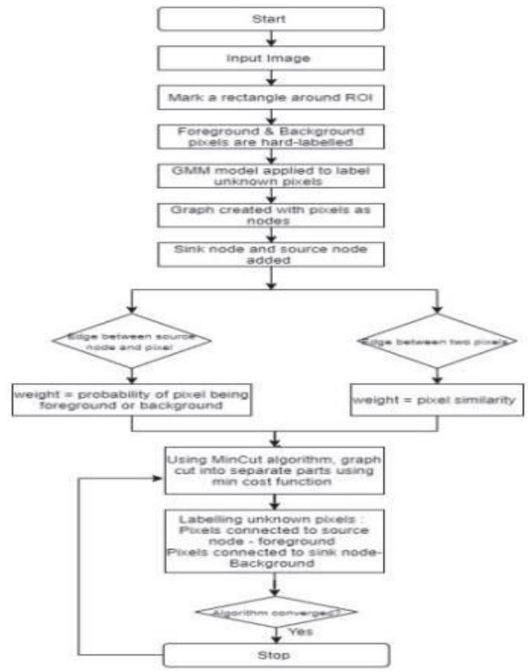
4. PROPOSED SYSTEM

We used a subset of the Plant Village dataset and the cotton dataset to train and test the CNN model as part of the Deep Learning Strategy. This model takes an image as input and was trained using 4200 photos from the Plant Village and Cotton Dataset and 1800 images from the validation set using a 70:30 training:validation split. A Convolutional Neural Network (CNN) is a kind of deep learning model that uses different characteristics to give weights to inputs. For image-based datasets, CNN is a popular neural network choice. A ReLU activation function, max pooling, and a dropout layer follow the four major convolutional layers in our CNN model. To determine which class has the greatest probability, we add a flatten layer, then a dense layer, and lastly a soft max activation function on top of the previous set of convolutional layers.

ADVANTAGES

- The CNN algorithm was used because it outperforms the prior multistep method in terms of background reduction and was shown to be optimal.

5. SYSTEM ARCHITECTURE



5. UML DIAGRAMS:

1. CLASS DIAGRAM

The cornerstone of event-driven data exploration is the class outline. Both broad practical verification of the application's precision and fine-grained demonstration of the model translation into software code rely on its availability. Class graphs are another data visualisation option.

The core components, application involvement, and class changes are all represented by comparable classes in the class diagram. Classes with three-participant boxes are referred to be "incorporated into the framework," and each class has three different locations:

• The techniques or actions that the class may use or reject are depicted at the bottom.

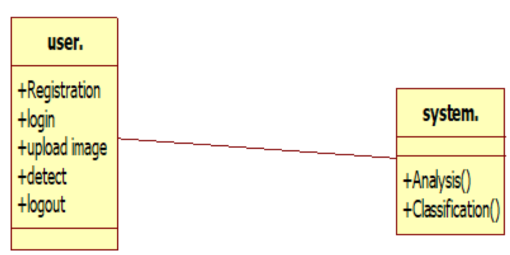


Fig 5.1 shows the class diagram of the project

2. USECASE DIAGRAM:

The use case structure represents the relationship between the needs of the client and the outcomes of the use case. The different sorts of users in a framework, as well as the methods in which they contribute, may be defined via a use case study. The stamping use case may be identified with this graph type, but it is also commonly combined with other graph types and layouts. Fig 3.4 below depicts a use case diagram for this activity.

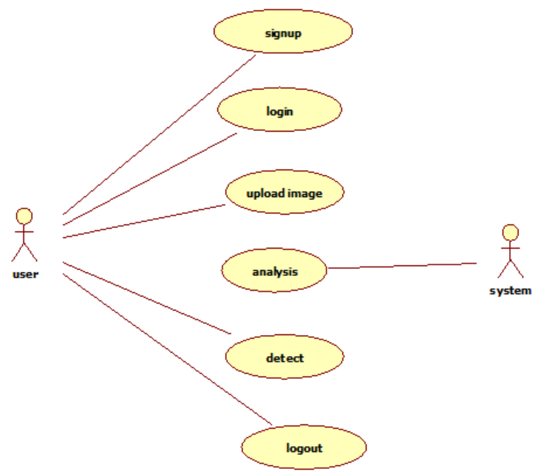


Fig 5.2 Shows the Use case Diagram

3. SEQUENCE DIAGRAM:

The sequence graph describes the interdependencies between the processes and the circumstances in which they operate. The planned progression of associations between entities is represented by a grouping graph. It shows the objects and classes that are relevant to the scenario or the set of signals sent across documents that are thought to make the whole thing suitable. Usage case recognition of a running function in the system's Functional View is often represented by a sequence diagram. Time charts, rare event graphs, and occasion graphs are all names for succession forms.

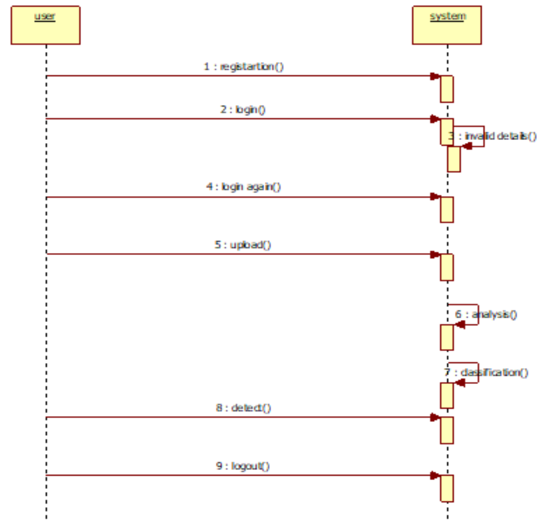
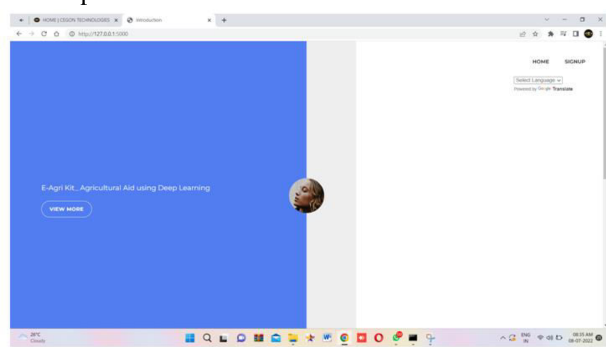


Fig 5.3 Shows the Sequence Diagram

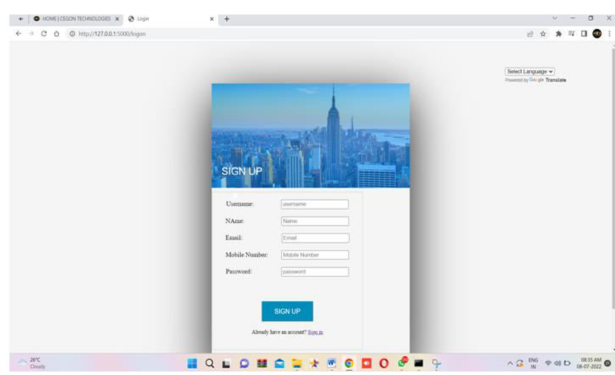
6. RESULTS

6.1 Output Screens



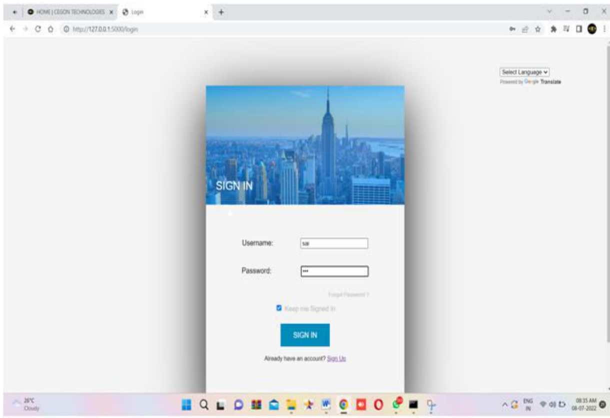
6.1 Login Page

In the below screen sign up the user details.



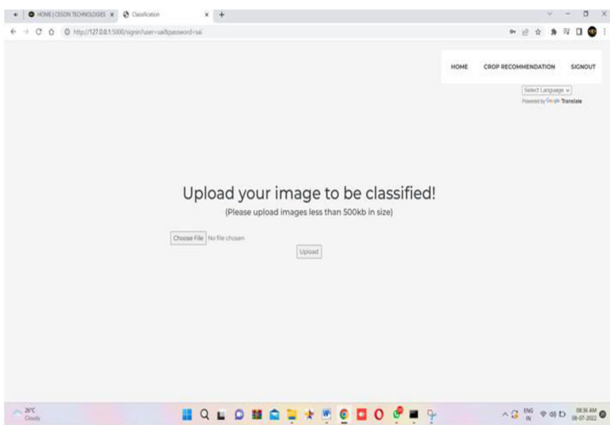
6.2 Signup Page

In the below screen to sign in into the application.



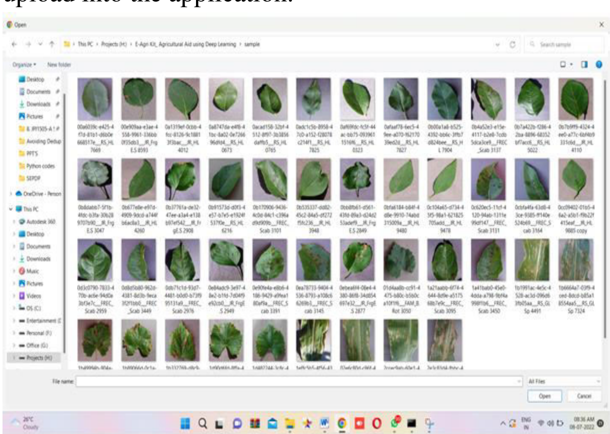
6.3 Sign Page

In the below screen to upload the plant image for classification.



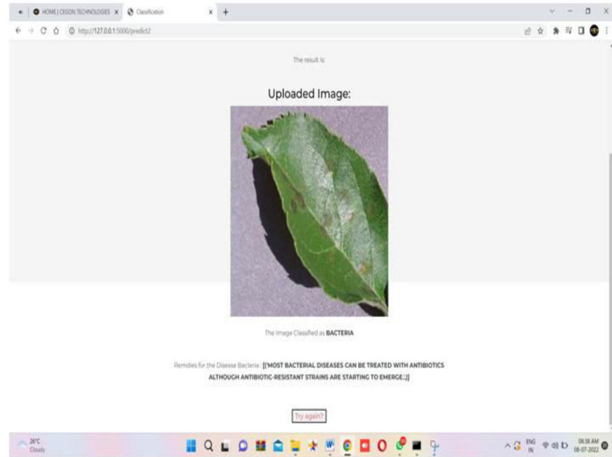
6.3 Uploading the Dataset File

In the below screen to select the plant leaf images and upload into the application.



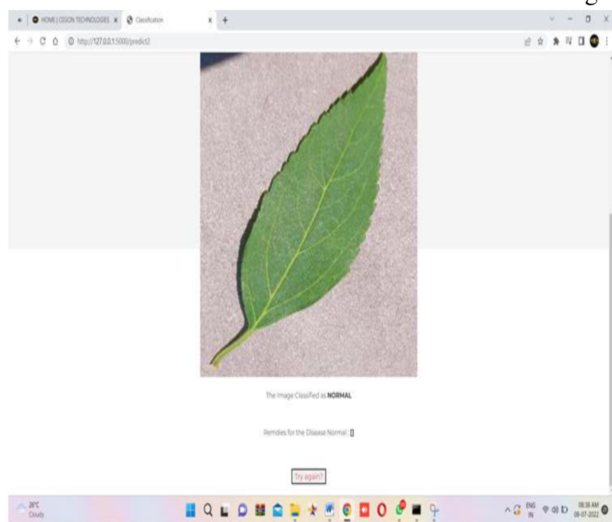
6.4 Uploading the Plant Leaf Image

In the below screen to detect the disease of the plant.



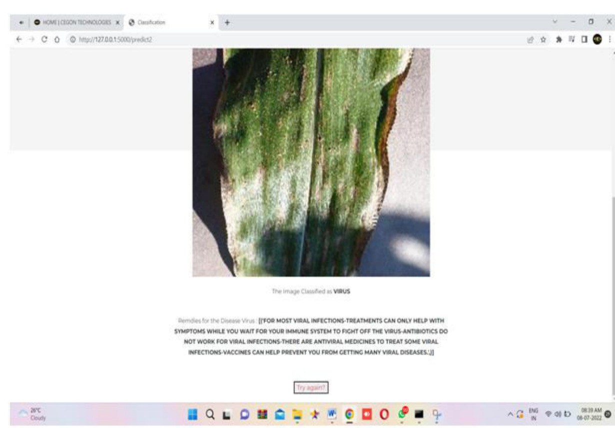
6.5 uploading the plant leaf image

In the below screen to detect the non infected leaf image.



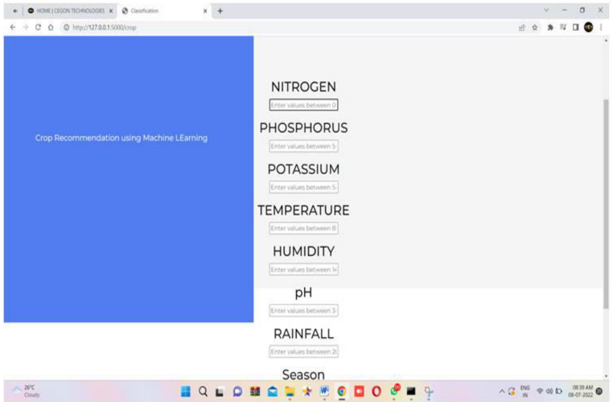
6.6 Uploading the plant leaf Image

In the below screen to detect the virus infected image

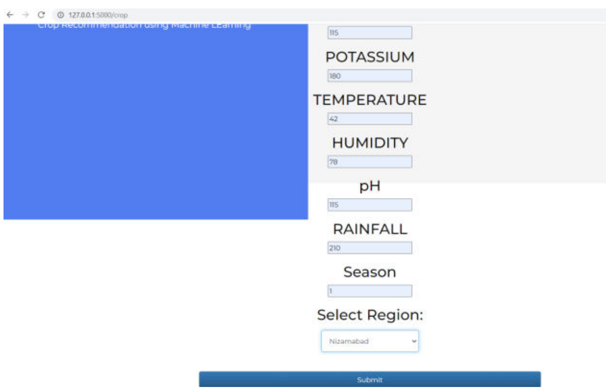


6.7 Uploading the virus infected image

In the below screen to get the result for crop recommendation.



6.8 Uploading the crop recommendation results



6.9 Uploading the crop parameters.

In the below screen to get the suitable crop for the given input parameters.

7. CONCLUSION AND FUTURE WORK

The importance of accurate plant disease diagnosis and classification algorithms and reliable ways of disease prevention was brought to light by our investigation. The ability of the detection system to adjust to new conditions and trends is crucial because of the wide variety of crops and illnesses. Because of this, we applied machine learning and deep learning techniques for this project to make sure the code learns to defend itself against the widest possible range of crops and illnesses.

An Android app with built-in illness detection, language translation, weather forecasts, and fertiliser calculation is included in the research. By developing this tool, we seek to facilitate groundbreaking agricultural endeavours and guarantee a robust crop. We conducted an extensive literature research and implemented a number of different methods before settling on CNN, which achieved an accuracy of 97.94% after 20 iterations of training. To confirm our model does not overfit and functions well in the actual world, we also did real-time analysis on a sick tomato crop and tested it on a cotton dataset.

FUTUREENHANCEMENTS

The system will be able to respond to changing circumstances in real time and give extensive coverage if our dataset is expanded to include additional varieties of crops and illnesses.

9.REFERENCES

[1]. Crop Life International (May 2015). India's farmers fighting pests.

[2]. Retrieved from: https://croplife.org/news/keeping-indias-pests-in-line/

[3].Economic Times (Sept 2018). India sets record farm output target for 2018-19.Retrieved from: https://economictimes.indiatimes.com/news/economy/agriculture/india-sets-record-farm-output-target-for-2018-19/articleshow/65858058.cms

[4]. Sharada P. Mohanty David P. Hughes and Marcel Salathé."Using Deep Learning for Image-Based Plant Disease Detection."Front.
Plant Sci., 22 September 2016

[5]. Carsten Rother, Vladimir Kolmogorov, and Andrew Blake. 2004. "GrabCut": interactive foreground extraction using iterated graph cuts. In ACM SIGGRAPH 2004 Papers (SIGGRAPH '04). Association for Computing Machinery, New York, NY, USA, 309–314.

[6]. R. Chapaneri, M. Desai, A. Goyal, S. Ghose and S. Das, "Plant Disease Detection: A Comprehensive Survey," 2020 3rd International Conference on

Communication System, Computing and IT Applications (CSCITA),Mumbai, India, 2020, pp. 220-225,doi: 10.1109/CSCITA47329.2020.9137779

[7]. Raghavendra, B. K. (2019, March). Diseases Detection of Various Plant Leaf Using Image Processing Techniques: A Review. In 2019 5th International Conference on Advanced Computing &Communication Systems (ICACCS), (pp. 313-316). IEEE.

[8]. Malathi, M., Aruli, K., Nizar, S. M., & Selvaraj, A. S. (2015). A Survey on Plant Leaf Disease Detection Using Image Processing Techniques. International Research Journal of Engineering andTechnology (IRJET), 2(09)

[9]. Kaur, S., Pandey, S., & Goel, S. (2018). Semi-automatic leaf disease detection and classification system for soybean culture. IET Image Processing, 12(6), 1038-1048.

[10]. Patil, S., & Chandavale, A. (2015). A survey on methods of plant disease detection. International journal of Science and Research (IJSR), 4(2), 1392-1396.

[11]. Rathod, A. N., Tanawala, B. A., & Shah, V. H. (2014). Leaf disease detection using image processing and neural network.

International Journal of Advance Engineering and ResearchDevelopment (IJAERD), 1(6).

[12]. "Computational Vision and Bio-Inspired Computing", SpringerScience and Business, Media LLC, 2020. [13]. Agarap, A.F. (2018), “Deep Learning using Rectified Linear Units (ReLU),” ArXiv, abs/1803.08375.

[14]. Glorot, Xavier & Bordes, Antoine & Bengio, Y. (2010), “Deep Sparse Rectifier Neural Networks,” Journal of Machine Learning Research. 15.

[15]. K. He, X. Zhang, S. Ren and J. Sun, "Deep Residual Learning for Image Recognition," 2016 IEEE Conference on Computer Vision and Pattern Recognition (CVPR), Las Vegas, NV, 2016, pp. 770-778, doi: 10.1109/CVPR.2016.90.

[16]. Szegedy, Christian et al. “Going deeper with convolutions.” 2015 IEEE Conference on Computer Vision and Pattern Recognition (CVPR) (2015): 1-9.