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DETECTING PLANT SPECIES HEALTH USING ARTIFICIAL INTELLIGENCE

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Abstract: A lot of study in computer vision and agriculture is done on using Convolutional Neural Networks (CNN) and the VGG16 architecture to find diseases in rice plants. One of the main goals is to make a model that can correctly tell the difference between pictures of different rice plant diseases. CNN is a deep learning method that is often used to recognize pictures. VGG16 is a type of CNN that is known for how well it does at classifying images.

To train the model, we need a set of pictures of both healthy and sick rice plants, with enough of each type of disease shown. The computer can then learn to tell the difference between the diseases. We use the VGG16 architecture to teach the CNN model once we have the information. The model learns to find patterns in pictures that show whether a plant is healthy or sick during training. We can use a different set of pictures to test the model and see how well it does after training. We use precision, memory, and the F1 score to measure how accurate it is.

This study could help farmers a lot by finding and treating diseases in rice plants early on. This could lead to higher crop output and more food security. One interesting way to use technology to help farmers is in this way. Deep Convolutional Neural Networks (DCNN) and transfer learning are used in the suggested method, which seems to be good at correctly identifying six types of diseases in rice plants. Farmers can keep an eye on their fields more efficiently by using IoT and drone technology. This cuts down on the need for costly manual checks.

The proposed method seems like it could be used in the real world because it is very accurate. It's interesting that this method works better than similar ones that have been used in previous studies. Overall, using this method could increase crop output and help ensure food security by making it easier to find and treat rice plant diseases early on.

Keywords: Machine learning; VGG-16; disease detection; convolutional networks; Plant Village; modern farming.

I.INTRODUCTION

Agriculture is an important part of India's economy; it employs more than half of the people and makes up 18–20% of the country's GDP. But farming has a lot of problems, such as using old techniques, chemicals in the wrong way, not having enough water, and plant diseases. Plant diseases can cause big losses in food production; they can cause up to 30% of the damage. Finding these diseases by hand takes a lot of time and isn't always correct, so we need new ways to do it. Thanks to progress in technology, we can now correctly find and name plant diseases, which means they can be treated better. Using convolutional neural networks (CNN) and other deep learning techniques, this system aims to find 14 different types of plant diseases. These include diseases that affect corn, grapes, oranges, peaches, peppers, potatoes, raspberries, soybeans, squash, strawberries, and tomatoes. A statistical model is used by the system to handle and sort the images that are sent to it.

In many places, especially in places with lots of people, like China, India, and Pakistan, rice is a main food. In the same family as wheat, corn, and barley, it is called Orza. People like rice because it is very healthy, which means that billions of people need it. But there are different kinds of rice and different ways to grow them. Before they are harvested, rice plants go through similar stages of growth. About 15% of farmland in the world is used for rice farming, with eastern India and Pakistan being the main production areas. Diseases like sheath blight, leaf blasts, and brown spots have made rice production go down in recent years. These diseases can have a big effect on grain quality and yield. Early detection is very important, but farmers can't check each plant individually on big farms, so it's hard to keep an eye on everything all the time. Farmers can't do regular checks because of the cost, size, risk of mistakes, and damage to plants. There are many things that go into diagnosing agricultural problems, such as the surroundings and conditions. However, advances in technology such as Artificial Intelligence (AI) and Machine Learning (ML) help farms find rice diseases early on. It is now easier to find infected crops and put diseases into groups thanks to progress in digital picture processing and recognition. Along with AI and ML, some experts want to use drone technology, the Internet of Things (IoT), and cloud computing. To boost output and quality while lowering costs for farmers and consumers, there needs to be a way to find rice diseases early on. Over three billion people around the world eat rice every day, so study in this area is very important. The purpose of this project is to create a system that can automatically find, classify, and identify diseases in rice plants using improved machine learning and deep learning methods.

II.RELATED WORK

Using different machine learning techniques, different experts have come up with different ways to find and classify diseases on plant leaves. Hossain et al. [1] used the K-nearest neighbor (KNN) classifier to look at features in pictures of diseased leaves and got a classification accuracy of 96.76% for a number of common plant illnesses. A study by Sammy et al. [2] used a convolutional neural network (CNN) to accurately group nine types of leaf diseases from tomato, grape, corn, apple, and sugarcane plants. Kumari et al. [3] used K-means clustering and an artificial neural network (ANN) together to pull out different image features and sort them into four different disease categories. However, their method was not as accurate on average. In their study [4], Merecelin et al. used a CNN to find diseases on the leaves of apple and tomato plants. After training on a collection of 3663 images, the CNN was 87% accurate.

Using deep learning models to find diseases on tomato fruit and leaves has been the subject of several studies. Jiayue et al. [5] used the YOLOv2 CNN method to find sick tomato fruits and got a mean average accuracy (MAP) of about 97%. Robert G. et al. [6] created a CNN-based system to find different kinds of diseases on tomato leaves. The F-RCNN trained model had an 80% confidence score, while the Transfer Learning model had a 95.75% success rate. Halil et al. [7] used the Alex Net and Squeeze Net designs to build deep learning models that were accurate 95.6% of the time and 94.3% of the time. Sabrol et al. [8] suggested a simple way to sort the different diseases that show up on tomato leaves. They got very good results with a supervised learning method and decision trees, but they can become too good at what they do when they have confusing data. One big problem with Jiayue et al. [5] was that each picture had to be tuned differently. On the other hand, Ch Usha Kumari et al. [3] said that their system, which used K-Means clustering and Artificial Neural Network methods, wasn't very accurate.

III.PROPOSED SYSTEM

At the moment, farmers have to look inspect huge areas of farmland to find diseases in rice plants, which takes a long time and a lot of work. Also, you need to know a lot about diseases, which makes early evaluation hard and expensive. This can lead to big drops in production every year, anywhere from 20% to 40%. Using CNN and VGG16 algorithms, the proposed method provides a more accurate and cost-effective way to find diseases in rice plants. With the non-normalized expanded dataset, it has a higher accuracy rate of 96.08%. It also has accurate measures of precision, recall, specificity, and F1-score. The system is also made to work well with drones and the Internet of Things (IoT), which lets diseases be found in big farmlands in real time. This new way of doing things could save farmers time and money, which would lower the price of rice for everyone.

Key Technologies:

Here are some deep learning techniques that can be used with CNN and VGG16 to find diseases on rice plants:

Knowledge Transfer: This method, called transfer learning, uses a model that has already been trained to do a new job. We can make the current VGG16 model work better for our needs when it comes to finding diseases in rice plants.

Data Augmentation: Adding new training cases to an existing dataset is called data augmentation. It can be used to make more pictures of rice plants from different views, with different lighting and backgrounds.

Neuron Dropout: Dropout is a way to make deep learning stronger by stopping it from overfitting. It works by turning off neurons at random during training. This makes the neurons less dependent on each other and helps the network learn more general traits.

Batch Normalization: This method makes deep neural networks more stable and speeds up training by giving each layer's data a mean of zero and a standard deviation of one.

- Convolutional Neural Networks (CNNs): CNNs are a type of neural network architecture that works really well for jobs that need to recognize images. They use convolutional filters on the pictures they are given to pull out important features.
- Gradient Descent Optimization: This is a way to keep the loss function as low as possible during training. In deep learning, Adam algorithm is often used. It is a type of gradient descent.

Using CNN and VGG16, these deep learning methods can be put together and changed to fit the needs of finding diseases in rice plants.

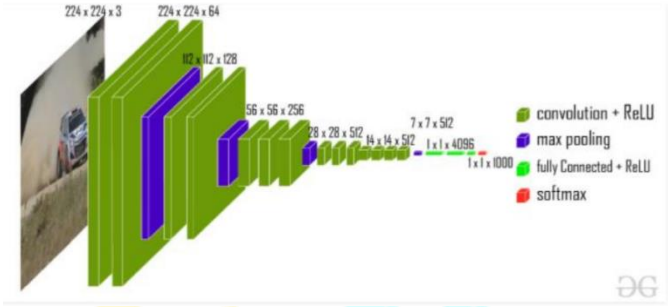

Fig1: VGG16 Model

IV.STEPS FOR PROPOSED MODEL

Here is a plan for using CNN and VGG16 algorithms to find diseases in rice plants:

Collecting Data: Put together a set of shots of both healthy and sick rice plants, with the disease type clearly marked on each one.

Data Preparation: Make the dataset ready by reducing images to the same size, normalizing pixel values, and rotating, flipping, and cropping images to make them more diverse.

Divide the dataset into three parts: training, validation, and testing. Each part should be 70% of the whole dataset, while the other three parts should be 15% each.

Model Choice: the VGG16 design should be used as the CNN's base model.

Fine-tuning: Make the VGG16 model better by fixing the first layers and adding custom layers on top for disease classification.

Training: Use the Adam optimizer and the categorical cross-entropy loss function to train the model on the training group. Make sure there are enough epochs to get the best results on the validation subset.

Model Assessment: Use measures like accuracy, precision, recall, and F1 score on the testing subset to judge how well the trained model worked.

Model Implementation: Put the learned model to use in the real world, for example by making an app that helps farmers quickly spot diseases on rice plants.

This suggested model starts with a VGG16 design that has already been trained. It then changes it to classify diseases in rice plants and tests how well it works on a separate set of plants. A model like this could help farmers find and treat rice plant problems more quickly, which could increase crop yields and make sure there is enough food for everyone.

V.RESULT AND DISCUSSION

Fig2: Registration Page

Fig3: Upload Dataset

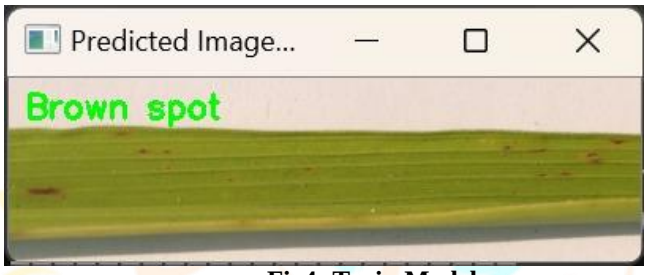

Fig4: Train Model

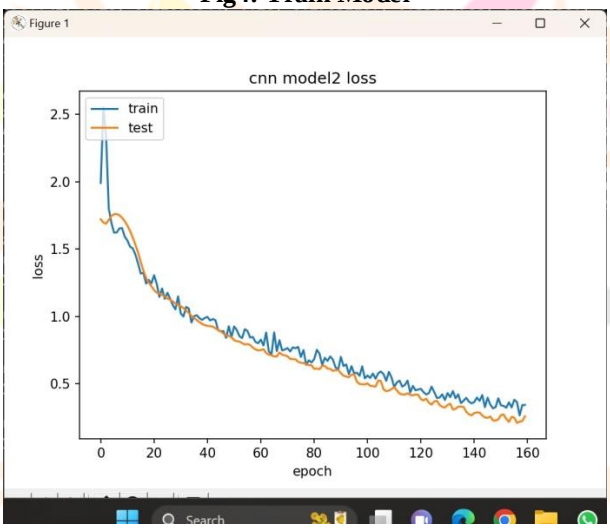

Fig5: CNN Model

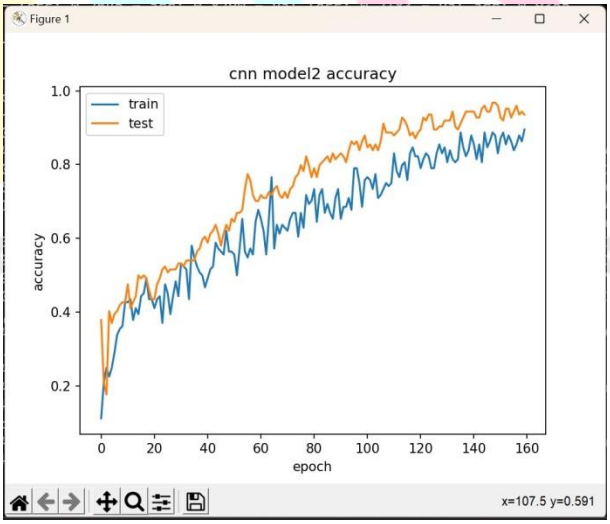

Fig6: CNN Model accuracy.

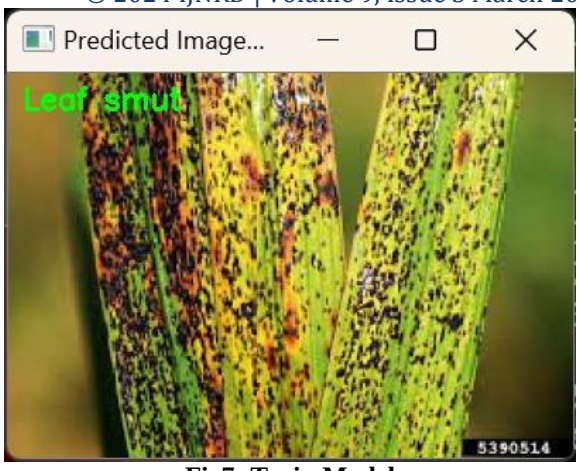

Fig7: Train Model

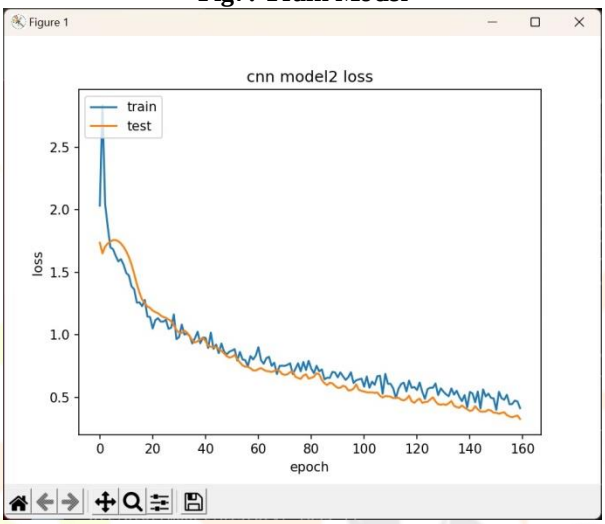

Fig8: CNN Model

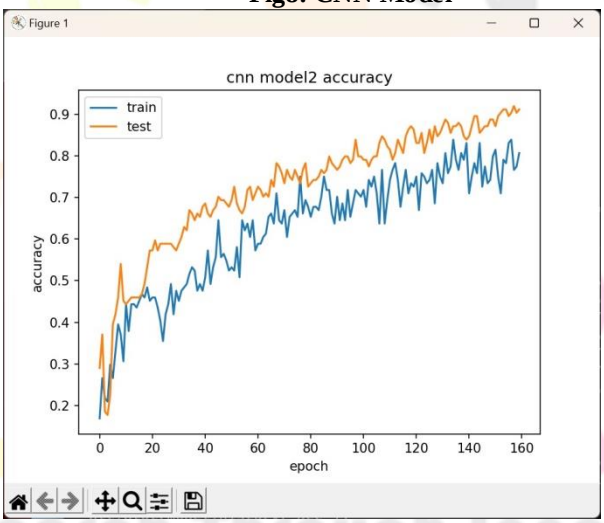

Fig9: CNN Model accuracy.

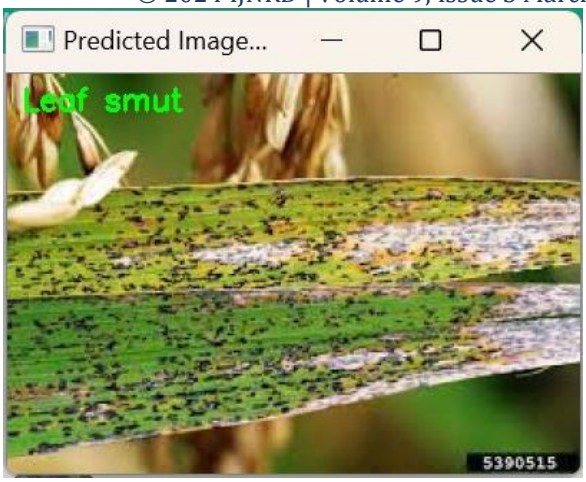

Fig10: Train Model

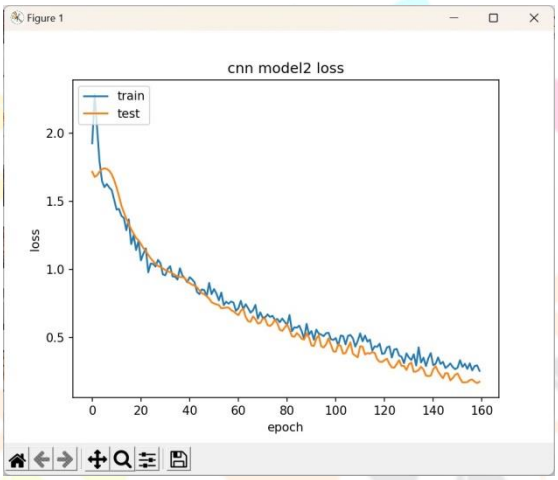

Fig11: CNN Model

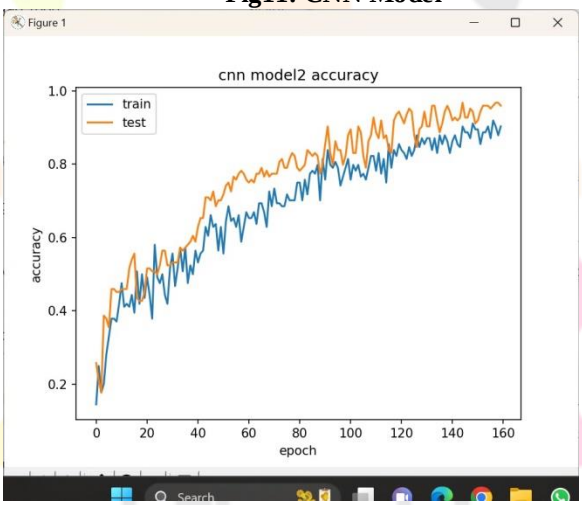

Fig12: CNN Model accuracy.

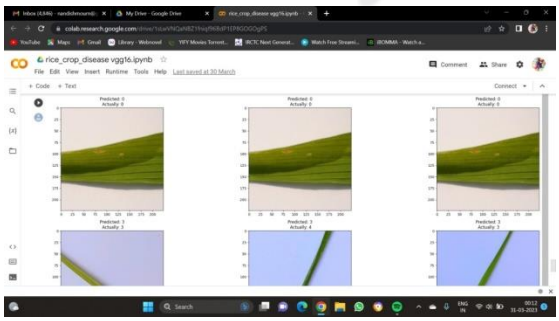

Fig13 VGG16 Model Prediction & Actuality

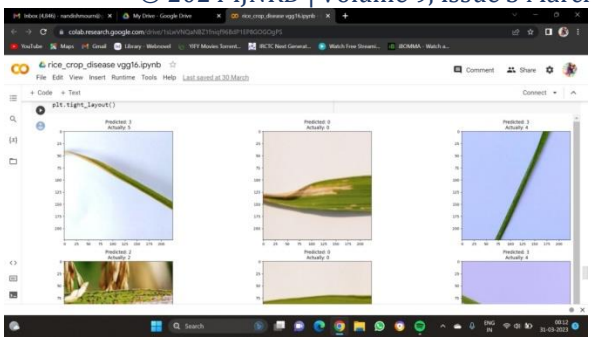

Fig14 VGG16 Model Prediction & Actuality

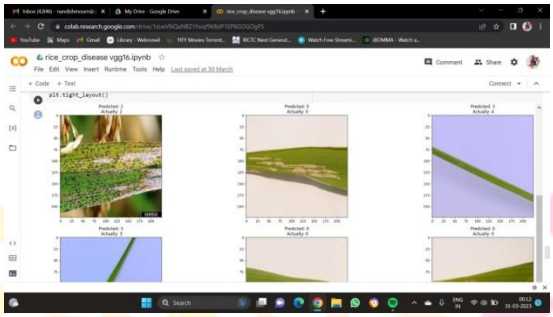

Fig15 VGG16 Model Prediction & Actuality

VI.CONCLUSION

Diseases that affect rice leaves often cause big drops in output, but finding them by hand is hard and takes a lot of time. As computer vision gets better, automated ways may be able to find and diagnose rice leaf diseases more accurately. This research uses a better deep learning transfer method and gets an amazing 96.08% accuracy rate on a sample with healthy leaves and five common diseases. The system also works with drones and the internet of things (IoT), which lets doctors make diagnoses in real time in the field. In the future, efforts will be made to expand the system so that it can identify more rice diseases and look into how it can be used in similar ways with other important crops.

The CNN and VGG16 algorithms are used in this project to create a custom deep learning-based transfer learning method for accurately finding and diagnosing diseases in rice plants. The method is very good at telling the difference between six types of diseases that affect rice plants: narrow brown spot, leaf scald, leaf blast, brown spot, and bacterial leaf blight. The proposed system is much more accurate than similar methods that have been used before; it gets a peak average accuracy of 96.08% when using the non-normalized augmented dataset.

Using drones and the internet of things together makes it easier to diagnose diseases in rice plants in real time. This could allow early action, which would cut down on production losses and improve food security. In the future, work will focus on creating a complete IoT system based on drones that can be tested in real life and expanding the technology's use to include other important plant leaf illnesses. Basically, this project shows how deep learning-based methods can be used in agriculture, especially to find and diagnose plant problems early on, which could have big positive effects on both the economy and society.

REFERENCES

1. Eftekhar Hossain, Md. Farhad Hossain, Mohammad Anisur Rahaman, “A Color and Texture Based Approach for the Detection and Classification of Plant Leaf Disease Using KNN Classifier”, Proceeding of the International Conference on Electrical, Computer and Communication Engineering (ECCE), Cox’s Bazaar, Bangladesh, 2019.
2. Sammy V. Militante, Bobby D. Gerardo, Nanette V. Dionisio, “Plant Leaf Detection and Disease Recognition using Deep Learning” Proceeding of the IEEE Eurasia Conference on IOT, Communication and Engineering (ECICE), Yunlin, Taiwan, 2019, pp 579-582
3. Ch. Usha Kumari, S. Jeevan Prasad, G. Mounika, “Leaf Disease Detection: Feature Extraction with K-means clustering and Classification with ANN “Proceedings of the 3rd International Conference on Computing Methodologies and Communication (ICCMC)”, Erode, India, 2019, pp 1095-1098
4. Mercelin Francis, C. Deisy, “Disease Detection and Classification in Agricultural Plants Using Convolutional Neural Networks — A Visual Understanding”, Proceeding of the 6 th International Conference on Signal processing and Integrated network, Noida, India, 2019, pp 1063-1068.
5. Jiayue Zhao, Jianhua Qu, “A Detection Method for Tomato Fruit Common Physiological Diseases Based on YOLOv2 “Proceeding of the 10th International Conference on Information Technology in Medicine and Education”, Qingdao, China, China, 2019

6. Robert G. de Luna, Elmer P. Dadios, Argel A. Bandala, “Automated Image Capturing System for Deep Learning-based Tomato Plant Leaf Disease Detection and Recognition” Proceeding of the IEEE Region 10 Conference, Jeju, South Korea, 2018, pp 1414-1419.
7. Halil Durmus, Ece Olcay Gunes, “Disease detection on the leaves of the tomatoplants by using deep learning” Proceeding of the 6 th International Conference oftheAgro-Geoinformatics, 2016, Fairfax, VA, USA
8. H. Sabrol , K. Satish, “Tomato plant disease classification in digital images using classification tree” Proceeding of the Internati onal conference on communication and signal processing, Melmaruvathur, India, 2016 pp 1242-1246
9. Usama Mokhtar, Mona A.S. Ali, Hesham Henfy, “Tomato leaves diseases detection approach based on support vector machines” Proceeding of the 11th International Computer Engineering Conference, Cairo, Egypt, 2015 pp 246-250
10. Suma V.R Amog Shetty, Rishab F Tated, Sunku Rohan, Triveni S Pujar, “CNNbased Leaf Disease Identification and Remedy Recommendation System “, Proceedings of the Third International Conference on Electronics Communication and Aerospace Technology, Coimbatore, India, 2019 pp 395-399.
11. Akshay K, Vani M, “Image Based Tomato Leaf Disease Detection”, Proceedings of the 10th International Conference on Computing, Communication andNetworking Technology, Kanpur, India, 2019.
12. Sharada P Mohanty, David P Hughes, and Marcel Salath, “Using deep learning for image-based plant disease detection”. In: Frontiers in plant science 7 (2016), p. 1419.
13. S. D. Khirade and A. B. Patil. “Plant Disease Detection Using Image Processing”, Proceeding of the International Conference on Computing Communication Control and Automation. Feb. 2015, pp. 768–771.
14. M. Brahimi, K. Boukhalfa, and A. Moussaoui, “Deep Learning for Tomato Diseases: Classification and Symptoms Visualization”, vol. 31, no. 4, pp. 299–315, 2017.
15. Alex Krizhevsky, Ilya Sutskever, and Geoffrey E Hinton. “Imagenet classification with deep convolutional neural networks”. Proceeding of the Advances in neural information processing systems, 2012, pp. 1097–1105.
16. K. Elangovan and S. Nalini, “Plant disease classification using image segmentation and SVM techniques”, International Journal of Computational Intelligence Research, vol. 13(7), pp. 1821-1828, 2017.
17. Y. Dandawate and R. Kokare, “An automated approach for classification of plant diseases towards development of futuristic decision support system in indian perspective,” Proceedings of the International Conference Advances in Computing, Communications and Informatics (ICACCI), 2015, pp. 794-799.
18. Mohanaiah, P., P. Sathyanarayana, and L. GuruKumar. ”Image texture feature extraction using GLCM approach.” International journal of scientific and research publications 3, no. 5 (2013)
19. Monika Jhuria, Ashwani Kumar, and Rushikesh Borse. ”Image processingfor smart farming: Detection of disease and fruit grading.” In 2013 IEEE Second International Conference on Image Information Processing (ICIIP-2013), pp. 521-526. IEEE, 2013.
20. Husin, Zulkifli Bin, Ali Yeon Bin Md Shakaff, Abdul Hallis Bin Abdul Aziz, and Rohani Binti S. Mohamed Farook. ”Feasibility study on plant chili disease detection using image processing techniques.” In 2012 Third International Conference on Intelligent Systems Modelling and Simulation, pp. 291-296. IEEE, 2012.
21. Mrunalini R. Badnakhe, Prashant R. Deshmukh, Infected Leaf Analysis and Comparison by Otsu Threshold and k-Means Clustering, International Journal of Advanced Research in Computer Science and Software Engineering.