A Survey on Plant Disease Prediction

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Abstract- *Rice is the main crop for over 50% of the global population.generally known as rice. However, a number of illnesses frequently impact paddy farming, which can result in severe yield losses. We used a meta analysis methodology to create a review of the literature on different image processing methods required to forecast illnesses in paddy plants. In order to compare the systems that offer the highest accuracy in identifying different agricultural diseases, 25 journals from diverse sources were chosen to analyse the advantages and disadvantages of various algorithms. Based on this research, the most common diseases affecting paddy plants are bacterial leaf blight, brown spot disease, and leaf blast disease.. The 25 journals most frequently utilise neural networks and support vector machines as their categorization techniques. This study advises scientists to do cutting-edge research in this area to identify crop illnesses at an early stage and to decrease farmer suicides caused by low yields by creating a system that guarantees 100% accuracy in crop disease prediction.*

Keywords- SVM (Support Vector Machine), CNN (Convolutional Neural Network), Image processing methods, and Meta-analysis.

I. INTRODUCTION

Agriculture is India's economic backbone. In India, agriculture plays a significant role in supporting human life. Due to declining yields, more than three lakh farmers have committed suicide in the last 20 years. The one factor that influences the quality and quantity of high yield crops is accurate crop disease identification. The cost of detection through skilled observation with the unaided eye may be high, and it requires careful consideration and in-depth analysis. Leaf Blast Disease (LBD), Brown Spot Disease (BSD), The three main illnesses that affected paddy plants were identified as having bacterial blight disease (BBD). Due to the immensity of the paddy fields and the wide range of illnesses, including some that are not native but are caused by the nutrients and organisms in the environment, it is challenging to detect paddy diseases. Poor growth ratios and untrained farmers' manual problem-solving in paddy fields can result in a reduced capacity to combat such illnesses. Hence, there is a need for a fast and affordable technology for diagnosing crop diseases.. We are able to predict diseases at an early stage by employing image processing tools. Without image processing methods, farmers would have to personally inspect the paddy plants with their unaided eyes or send samples of the plants to experts for confirmation, which would be a great amount of labour given the size of paddy fields.

II. LITERATURE REVIEW

Table 1 offers an overview of research carried out over the past four years, categorized by the algorithm utilized in different image processing methods.

S.no	Year	Author	Proposed Algorithm	Pros	Cons
1	2019	Zaaba Ahmad, Nurnazihah Wahab, Nur Nabilah Abu Mangshor, Ahmad Firdaus Ahmad Fadzil, ShafafIbrahiim	Support vector Machine	This SVM model has been developed for the classification of the four most common diseases affecting paddy leaves: Brownspot, Bacterial Leaf Blight, Tungro Virus, and Leaf Scald. Its effectiveness was evaluated using 160 test images, resulting in an accuracy rate of 86.25%. This level of accuracy enables us to detect these diseases at an early stage and implement suitable preventive actions.	Inspite of better feature extraction in SVM its performance is very much lesser compared to globar filter Convolutional Neural Network and with this we can able to identify only limited no of diseases.
2	2019	S.Ramesh, D.Vydeki	Deep Neural Network With Jaya optimization Algorithm	During the post-processing phase at the port, a feedback mechanism is established to precisely evaluate the effectiveness of this method. The experimental results are analyzed and compared using Deep Neural Networks (DNN), Denoising Autoencoders (DAE), and Artificial Neural Networks (ANN). This approach achieved an accuracy of 95.78% for Bacterial Blight, 98.9% for Blast-affected cases, 92% for Sheath Rot, 90.57% for normal leaf images, and 94% for both Brown Spot and normal leaf images..	In the future, their recommendation is to employ advanced techniques to improve the detection and classification of plant diseases, aiming for optimal performance while reducing incorrect classifications. However, it's worth noting that this approach may not be universally applicable to all Deep Neural Networks (DNNs) or tasks..
3	2019	Amiya Kumar Rath,Nalini KantaBarpanda	K-means clustering, Multiclass SVM and Particle Optimization Technique	With a high accuracy of 97.91%, the research paper intends to detect and diagnose rice leaf illnesses, which can aid farmers in more efficiently identifying and controlling diseases. The study paper's usage of multiclass SVM enables accurate categorization of several rice leaf diseases. The PSO technique is used in the research paper to optimise the SVM classifier's parameters, which can increase the accuracy of spotting and classifying illnesses in rice leaves.	The relevance of the research paper to different types of crops or other disease detection tasks is limited because it is specifically concentrated on identifying diseases that impact rice leaves. The paper's utilization of SVM and PSO algorithms could pose challenges in understanding how the model arrives at its decisions. The presence of a small number of inappropriate and misclassified samples in the distinction between Bacterial Blight and Brown Spot is attributed to the intricate nature of the models used in the study, which could potentially lead to

					overfitting and reduced generalization performance..
4	2019	A.Srinivasan, S.Sudha, D.Naraimhan, T.Gayathri Devi	Support vector Machine	Utilizing the SVM classifier, we can accurately categorize diseases such as leaf blast, brown spot, bacterial leaf blight, and fake smut in rice plants, achieving a classification accuracy of 98.38% in this context.	It is advised to enhance the dataset in order to further improve accuracy because in this system the primary focus was just on 4 paddy plant diseases.
5	2019	Usha Kiruthika,Kanagasuba Raja S, Jaichandran R, Priyadharshini C	AritificialNeural Network	Paddy plant diseases are identified using the Grey Level Co-occurrence Matrix technique, and the utilization of Artificial Neural Networks allows for the detection of these diseases with remarkable precision. ANNs exhibit resistance to noise and can effectively process images captured under various lighting conditions, camera angles, and other factors that may impact image quality.	This method only considers common paddy diseases, so expanding the dataset is important to raise the accuracy level.Because ANNs are notorious for being difficult to interpret, it can be challenging to comprehend the underlying mechanism and the outcomes..
6	2020	Muhammad Rashiduzzakman, Md.Touhidur Rahman, Md.IsmailJabiullah, Nargis Parven, Narsin Sultana	Support vector Machine	This suggested SVM can classify the majority of common paddy plant illnesses with greater accuracy of 94% when compared to other techniques like SVM, CNN, SVM, and K-NN. This method makes it possible to identify diseases at an early stage..	This model might only be able to identify and detect a small subset of diseases, which could limit how well it can identify any diseases that might impact the crop.SVM may not be as successful for multi-class classification jobs since it is typically employed for binary classification tasks.

7	2020	Prasanta Kumar Sahoo, Sony Annem	Data Mining Technique	Numerous diseases in paddy plants, including Blast, Sheath Blight, False Smit, Foot Rot, and Rice Tungro, can be diagnosed very effectively by employing data mining algorithms.	We can infer from this that more changes are needed to increase the accuracy of this technique since the accuracy percentage of the suggested system is not provided, nor is the number of samples that were gathered for the data set. For businesses without the funding to engage in this technology, the cost of setting up and maintaining data mining models might be a deterrent.
8	2020	Nisarga M.A, Rachana M, Shashank S, Sahana Raj B.S, Prajwahal Gowda B.S.	Convolutional Neural Network	The two main paddy plant diseases may be accurately predicted using machine learning technology in a relatively short amount of time. This method is very economical, and it was used to collect dataset samples of 4,000 infected and 2,000 healthy plant photos. This approach is more user-friendly, reliable, and quick than the alternatives.	They recommended more development in the form of a mobile application, as well as the necessity to merge this model with others to help us detect other crop diseases. They also recommended increasing the number of dataset samples.
9	2020	Muhammad Aamir, Rosziati Ibrahim, N.S.A.M Taujuddin, W.H.N Wan Muda, NorhalinaSenan	Convolutional Neural Network	They collected 3,555 image samples from the dataset, including Hispa, Leaf Blast, Brown Spot, and healthy paddy photos. Unlike existing methods like SOM neural networks, Naive Bayes, Support Vector Machine, Radial Basis Network, Gaussian vector function, and optimized Deep Neural Networks, this new system stands out by achieving an impressive accuracy of 93.6%. Additionally, the inclusion of typical paddy images makes the single-layered convolution layer in this design outperform the multi-layered convolution layer.	To enhance the suggested model and facilitate a clear comparison with established models, further research efforts are required. Overfitting is a frequent issue in CNNs that can adversely impact generalization and performance with new data.
10	2020	Manjusha Pandey, Mahendra Kumar Gourisaria, Ritesh Sharma, Sujay Das, Siddharth Swarup Rautaray	Convolutional Neural Network	This model employs transfer learning, a robust technique in addressing deep learning challenges. It helps evaluate the probability of disease occurrence, assisting critical plant health decisions. Leveraging a sizable dataset is particularly beneficial in transfer learning, tapping into the model's past experience with	They have decided to work with good quality datasets going forward and to concentrate on how to improve accuracy using more sophisticated models because the model might not be able to detect new or unusual diseases that weren't present in the training data.

				various issues. In comparison to other CNN models, this one achieved a 94% accuracy rate.	
11	2020	PreetomSaha Arko, Mohammed Eunus Ali, Mohammad Ashik Iqbal Khan, Sajid Hasan Apon, Farzana Nowrin, Abu Wasif, Chowdhury Rafeed Rahman	Convolutional Neural Network	This system is designed to detect eight distinct rice diseases and boasts a 93.3% accuracy rate while maintaining a significantly smaller size. Its dataset contains 1,426 images, which is 99% smaller than the VGG 16 model's dataset..	They proposed certain changes for the future, such as merging the already suggested method with geographic, meteorological, and soil data to improve research on thorough and automated plant disease detection mechanisms.
12	2021	Leow Pei Ling and Goh Chi Yen	Random Forest Classifier	Using a random forest classifier, our proposed approach effectively identified three paddy plant diseases: rice blast, brown spot, and narrow brown spot disease, achieving an overall accuracy of 93%.	Even though this system had a 93.3% accuracy rate, it incorrectly identified the narrow Brown Spot condition in 13.33% of the cases, and it only had 15 photos for each condition in the dataset, thus more advancements are required to enhance the dataset size.
13	2021	N F Azhar, B Prihasto, S Mujahidin	Convolutional Neural Network	It has been discovered that CNN performs best when huge datasets are available. With smaller sets, it is unable to deliver good precision. Therefore, compared to ordinary CNN architecture, we can get good accuracy of 85,878% with the aid of CNN regularisation approaches.	Compared to traditional CNN approaches, the CNN regularisation has more sensitivity and specificity. Although there is some mistake in identifying paddy illnesses from photographs of rice.

14	2021	Afrida Jahan, Ibne Farhan Ishrak, Md Naimul Islam Suvon, Sajan Mahmud Alvee, Shahnewaz Siddique, Fahim Mashoor	MASK Recurrent Convolutional Neural Network	High accuracy in tasks involving picture segmentation can deal with complex image features and vast amounts of data. It is capable of accurately detecting and segmenting things. It is applied to both picture segmentation and classification tasks. Multiple items in a single image can be detected and segmented using this technique. Four different paddy disease kinds are categorised using this. They achieved an accuracy of about 99% for the classification approach and 89% for the segmentation method.	Possibly not effective with noisy or poor-quality photos. The network's decision-making process can be challenging to grasp. The recurrent structure of the network may make training it more difficult. It might take longer and use more memory than alternative architectures.
15	2021	Shahnewaz Siddique, Sajan Mahmud Alvee, Md Naimul Islam Suvon, Ibne Farhan Ishrak, Afrida Jahan, Fahim Mashoor	Deep feature extraction with Vgg16 and Support vector Machine	Paddy fields may now be monitored in real-time thanks to deep learning algorithms and IoT technology, which can help farmers increase crop yields and cut costs. It can forecast agricultural growth patterns by analysing previous data, which can assist farmers in making better choices. The technology can automate processes like fertilisation and irrigation, helping farmers save time and labour. Farmers can remotely access the system to check on their fields from any location. They were able to identify four different types of paddy diseases using VGG16 and SVM, and they were able to forecast the nitrogen status with 79.86% and 84.88% accuracy.	A smart paddy field monitoring system might be expensive to implement, especially if new equipment needs to be installed. For some farmers, setting up and maintaining the system may need a certain level of technical competence. Because the system depends on technology to operate, it may be susceptible to network disruptions, power outages, and other technical problems.
16	2021	M.P. Gopinath and V. Malathi	Fine tuned ResNet-50 Deep Convolutional Neural Network Model	Fine-tuned ResNet-50 has proven to achieve high accuracy across various image classification tasks. This model's pre-trained weights can be customized, reducing the need for extensive labeled data. ResNet-50, a deep convolutional neural network, is designed to handle large datasets and complex features while maintaining robustness to noise and input variations. The refined ResNet-50 model achieved an improved accuracy of 95.012%.	A pre-trained model like ResNet-50 requires a lot of computing resources to fine-tune, making it less suited for systems with limited resources. ResNet-50's deep neural network architecture can be a drawback in some applications since it makes the model's decision-making process challenging to comprehend.

17	2021	Osim Kumar Pal	Supervised Neural Network	This suggested technique has a 96.27% accuracy rate and can quickly and cheaply identify five different kinds of paddy plant diseases.	They suggested maximising the dataset to further enhance the proposed system. They are prone to overfitting, particularly when there is a shortage of training data.
18	2021	NagappanKrishnaraj, ThangaiyanJayasankar	Deep Neural Network using a Crow search Algorithm	In this approach, the DNN model's weights and biases were fine-tuned using the Crow search algorithm to minimize classification errors. In experiments with multiple cross-validations, this proposed system outperforms the support vector machine by a substantial margin..	It is advised to use DNN-CSA performance rather than SVM classifier in the future.DNN helped the CSA reach a 96.69% accuracy rate. Compared to other optimisation methods like gradient descent or Adam, CSA might not be as effective. For some issues, CSA might not be able to identify the global best solution.
19	2021	NilamSachinpatil, E.Kannan	AdaBoost and Bagging	The suggested approach rapidly identifies paddy leaf diseases on Apple, Windows, and Android platforms, achieving an 86% accuracy when combining the Ad Boost and Bagging Classifier algorithms. These algorithms are utilized in tandem to build a strong classifier in the suggested system.	For this proposed system to be more accurate than the current models, additional study must be conducted. Gadabouts may react differently depending on the algorithm that is used to weight the classifiers. High-dimensional data or data with numerous attributes may not function well with bagging.
20	2021	V.Malathi, M.P.Gopinath	Deep Convolutional Neural Network	The current Deep Convolutional Neural Network in this proposed system gains an additional advantage. Developed with the ADAM optimizer and employing a dataset of 1,260 images featuring five distinct paddy diseases, this system provides the optimal solution, reducing the error rate and achieving a 94.08% accuracy rate.	In the future, they intend to broaden their research by collecting a vast array of paddy images in various languages and implementing transfer learning on a large dataset to enhance the system's capabilities. They also aim to further enhance the model for predicting weeds, pests, additional paddy diseases, and integrating it with Smart IoT for agricultural growth.
21	2021	Prabira Kumar Sethy, Santi Kumari	Deep Learning(Vgg16 and SVM) and IOT	The proposed system uses two techniques, transfer learning and deep feature extraction, for image recognition. In this context, the transfer learning method with VGG 16 and SVM achieves accuracy rates of 79.86% for detecting paddy leaf diseases and 84.88% for predicting nitrogen levels. On the other hand, the deep learning	Although transfer learning has many benefits, it may not be able to adapt to a new task if the two tasks are too different. Deep future extraction also has some drawbacks, such as the fact that it depends on the quality of the input data and needs a lot of data to train. If it is not well aligned with the information from the present, it

				approach with VGG 16 and SVM achieves higher accuracy rates of 97.31% and 99.2% for the same tasks. Additionally, apart from disease identification, the system can also monitor and detect temperature, humidity, and nitrogen levels.	can also be unable to forecast the future.
22	2021	Md. Nymur Rahman Shuvo , Muhammad Shamsojjaman	Deep Convolutional Neural Network	In order to identify four different paddy diseases, deep learning CNN models such VGG16, Inception-ResNetV2, ResNet-10, and Xception are utilised. This model outperformed Inception-ResNet V2 by 92.68%. The detection procedure can become more objective and less prone to human error by utilising CNNs.	They stated that in order to improve accuracy and speed up identification, they plan to incorporate more varieties of paddy leaf diseases as well as integrate this model with other CNN models. They also recommended changing the model to recognise either in challenging or complex scenarios.
23	2021	Bifta Sama Bari, Md Nahidul Islam,	Faster R-Convolutional Neural Network	To overcome challenges like the lack of real field data, complex image backgrounds, unclear symptoms, and variations in weather during image collection, a faster R-CNN approach was employed. This method improved the model's robustness by using publicly available web data and real-world field data. The proposed approach achieved high accuracy, specifically 98.09%, 98.85%, and 99.17%, in identifying and detecting rice leaf diseases such as rice Blast, Brown Spot, and Hispa. Notably, it achieved an impressive 99.25% accuracy in identifying healthy rice leaves.	This system concentrates on the entire image, not only one area at a time, but progressively on a portion of the image, leading to misclassification due to comparable geometrical features across the diseases. Rice leaf conditions alter in real time according on the temperature, humidity, and illumination..
24	2022	Petchiammal A Murugan .D	Convolution Neural Network-ResNet34 model	The model was created utilising focus transfer learning-based models (VGG16, Mobile net, Xception, and ResNet34) and convolution neural network samples from this big dataset of 16,225 paddy leaf images across 13 classes.The results of the experiment revealed that Resnet 34 had the highest F1 score (97.05%), and this dataset was made available as replicable code in the open source for usage by the public.	It was suggested that they increase the size of this paddy disease dataset by gathering fine-grained information about paddy diseases and pests, such as infrared and hyper spectral images, and benchmarking them using additional deep learning models. Because ResNet34 is a pretrained model, its performance may suffer if the dataset used to test it differs significantly from the one used to train it.

25	2022	RutujaR.Patil, Sumit Kumar	Convolutional Neural Network And Multi-Layer Perceptron	While CNN models may have limited accuracy in real-time image analysis, they excel in image segmentation. An innovative approach combines agricultural IoT and CNN models to detect rice diseases, referred to as Rice Fusion. This method achieves a testing accuracy of 95.31%, outperforming the 82.03% and 91.25% testing accuracies of other single-mode frameworks based on CNN and multi-layer perceptron architectures, respectively. Experimental results demonstrate that Rice's multimodal data fusion approach is superior to single-mode frameworks.	The proposed method may misclassify diseases with similar geometric characteristics, and unbalanced datasets remain a problem due to geographical and climatic challenges. Overfitting issues are expected during training due to a lack of diverse images covering various ages and weather conditions.

III. CONCLUSION

Analyzation of various journal papers in detecting the pros and cons of various image processing techniques is the main purpose of this proposed work. This investigation will be very much helpful for the beginners and new researchers to make a new revolution in Image processing technique

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