IJNRD.ORG ISSN : 2456-4184
INTERNATIONAL JOURNAL OF NOVEL RESEARCH AND DEVELOPMENT (IJNRD) | IJNRD.ORG
An International Open Access, Peer-reviewed, Refereed Journal

RICE LEAF DISEASES CLASSIFICATION USING IMAGE PROCESSING

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Abstract: Rice is deliberated one and very significant plants across world because it is main food for overall the world. Rice is subject to diseases that can distress the quantity and quality of produce as like other plants. It may produce crop loss production. Early days farmers were monitoring those plants and them well known about the disease of those plants so they can identify and cleared those diseases. Sometimes they can't monitor in daily basis if that land is very large. Finding disease detection making more spending more money and also costly to sell for customers. Machine learning algorithms are available for predicting rice leaf disease. In this paper, we proposed Enhanced Resnet50V2 Convolutional Neural Network method find the accurate detection and taxonomy of rice leaf disease. The revised approach includes a modified and Enhanced Resnet50V2 CNN model. The proposed modified system can accurately detect healthy, narrow brown spot, leaf scald, leaf blast, brown spot, and bacterial leaf blight. The proposed modified approach achieved considerably produce food result results rather than similar approaches.

Keywords: Enhanced Resnet50V2 convolutional neural networks; plant leaf disease detection; rice leaf disease detection;

1. INTRODUCTION

India is a largest processes of Agriculture as it the stage and crucial responsibility in our country so a group of the people is devoted to the agricultural industry. Major factors are Crop productions which are affecting domestic market conditions in our country. Agricultural firms began to explore new high-capitulate, commercial inventions as a consequence of growing population, unpredictable climatic changes and conditions, and biased volatility. The health of the plant/crop is critical for achieving food security and sustainability in agriculture. Nevertheless, the plants could be affected by the diseases rapidly, which can affect major social and economic problems, due to different factors. Diseases affected by the diseases have an affect of growth and development and also crop productivity and worth, it can make a main reason for productivity loss. To avoid some of the problems like contamination of soil, the infection should be detected at beginning of the stage and used certain pesticides on the same time. The conventional process of plant disease detection is continous eye monitoring process, for large crops which is hopeless and imprecise. The major goal of this paper is to research about leaf and their diseases, as well as to identify the disease's name so that proper safety measures can be followed. India is known for its agriculture as different types of crops are cultivated here. Rice is grown in nearly every state of India; with highest production of

our country are West Bengal, Uttar Pradesh and Tamil Nadu. India's more than three-fourth population depends on agriculture. Crop plant bad health or weather problems can carry undernourishment. India's economy also affects by horrible effects of illness. Hence detection of these leaf diseases at early stages is potential becomes very significant. At starting stages of disease prediction is manual examination other than that various various approaches are implemented. There are different major disadvantages of this method are, first, in accuracy, second, examining of every leaf is making difficulties, finally, It can take more time for prediction. With the help of science and technology, various approached are implemented for identifying those diseases in accurate way. Mainly two approaches such as image processing and deep learning. Image processing techniques are applied for prediction like filtering, clustering, histogram study damaged region detection, and various algorithms to find the diseases. Consideratin of deep learning neural networks are used to detect the illness of leaf. Rice diseases are classified into four major types: bacterial diseases, fungal diseases, viral diseases, and disorders. Bacterial infections include bacterial leaf streak, bacterial blight, grain rot, foot rot, and pecky rice. types of fungal diseases are brown spots, black horse riding, leaf blast, false smut, and some more types. few types of viral diseases are Rice tango, grassy rice stunt. Finally Cold injury, white tip, alkalinity, and bronze are also a few types of disorders in rice plants. There are two kinds of reasons for rice plant diseases are first fungal/bacterial attack and second unexpected climatic change.

2. LITERATURE REVIEW

A novel rice blast recognition method based on CNN used a dataset with the positive samples of 2906 and negative samples of 2902 are reputable at training and testing the CNN model. In addition, we qualitative and quantitatively analysis were performed by conduct comparative experiments, in our evaluation of that comparative experiments helped to examine the effectiveness of the proposed method. The evaluation results demonstrate that the sophisticated features extracted by CNN are more discriminative and successful than traditional hand-crafted features including local binary patterns histograms (LBPH) and Haar-WT (Wavelet Transform). Furthermore, indication of that CNN with Softmax and CNN with support vector machine (SVM) encompass related performances by the result of quantitative evaluation, with higher accuracy, larger area under curve (AUC), and better receiver operating characteristic (ROC) curves than both LBPH plus an SVM as the classifier and Haar-WT plus an SVM as the classifier. Hence, our CNN model is a highly successful method for rice blast disease recognition and can be probable process in practical applications

An automated Development system recognizes and categorizes different diseases of the infected plants is an emerging research in precision agriculture. Disease detection is the key to avoid loss of qualitative and quantitative agricultural yields. Rice (Oryza Sative) is one of the essential crops in our country and losses are heavy due to the diseases and produce bad impact on the economy. Image processing techniques will help in accurate and timely detection of the diseases and overcome the limitations of the human vision. Various techniques are analyzed and a new technique is implemented to diagnose and classify the rice diseases in this paper. Some of diseases namely rice bacterial blight, rice blast; rice brown spot have been predicted and classified. Different features like shape, the color of a diseased portion of the leaf have been extracted by our new algorithm. Extracted features have been collected and combined for applying classification algorithms and then diseases have been classified using Minimum Distance Classifier (MDC) and k-Nearest Neighbor classifier (k-NN).

The diseases in plants cause a overwhelming problem on implementing protection in the production of food and they can chance to reduce in the capacity and feature of agricultural harvest. In many of the

time, plant diseases happened to reduce production rate. Thus, an automatic diagnosis of plant disease is highly recommended for determining agricultural information. Several techniques are implemented by the using of deep learning is preferred because of its accurate performance. Novel deep learning is obtainable to spot disease from rice leaf images. Here, the rice plant image undergoes pre-processing to remove clatter and unwanted artifacts available in the image. Then, the Segmentation Network (SegNet) is performed segmentation process and produce new segments. Statistical features convolution neural network (CNN) features and texture features were extracted further from the segments. These features are employed for leaf disease detection then the deep recurrent neural network (Deep RNN) is used. In that proposed Deep RNN is training is implemented by RideSpider Water Wave (RSW) algorithm. Then proposed RSW is formulating by integrating RWW in Spider monkey optimization. This proposed RWS-based Deep RNN involved very good performance with the highest accuracy of 90.5%, maximal sensitivity of 84.9% and maximal specificity of 95.2%.

An attention-based depth wise separable neural network with Bayesian optimization (ADSNN-BO) is proposed to identify and classify rice disease from rice leaf images. It can produce Rice diseases often result in 20 to 40 % crop production loss in yield and are highly related to the economy of global. There was critical problem to plan treatment promptly and reduce the crop losses in continous disease monitoring process. Rice disease diagnosis is on time still problem. To achieve AI assisted rapid and accurate disease detection, we proposed the ADSNN-BO model based on Mobile Net structure and augmented attention mechanism and also Bayesian optimization algorithms were applied to enhance the hyper-parameters of the ADSNN-BO Method. It can take public rice disease dataset with four categories in total then Cross-validated classification experiments were conducted based on that dataset. The ADSNN-BO experimental results reveal that our mobile compatible model and achieves accuracy rate of 94.65%, which outperforms all of the state-of-the-art models tested.

The proposed GLCM method is used to extracting statistical texture features of the images. From different three quantized versions of the original image in different distances and directions the GLCMs matrices are extracted. Further analysis of feature extraction new multi-inputs 1D CNN with deep neural network is implemented to extract very accurate features from GLCMs matrices and also PCA technique used to reducing its dimensions. Three datasets are used to evaluate in this proposed method that includes SARS-CoV-2 CTscan, COVID-CT, and DLAI3 Hackathon COVID-19 Chest X-Ray datasets. The proposed system produce a Classification improvement in terms of precision, F1 score, and AUC metrics compared with other methods and exceeds 98%, 89%, and 93% for three datasets, respectively.

3. BACKGROUND STUDY

PROBLEMS IN PRESENT SYSTEM

In this system we propose a novel model for the classification of rice leaf disease. The proposed work will be capable to distinguish and organize six separate classes; healthy, narrow brown spot, leaf scald, leaf blast, brown spot, and bacterial leaf blight. The proposed system is one of few in the extant literature able to classify 6 distinct classes. 2–4 classes have been considered most of papers in the extant literature. In the proposed deep CNN transfer learning-based approach, There number stages is applied for the the images first that will go through preprocessing stages, where background removal, resizing, and enhancement is implememnt in images. Data augmentation is also performed to increase the size of the dataset. As discussed in the literature review, most of the papers in the extant literature use small size datasets and that can cause over fitting problems but that overfitting problems are not properly addressed and even any of methods are not applied for that issue. In this work, we apply data augmentation, which can

predict any of minor changes to the original image such as rotation, scale-in/scale-out, and translation.

4. PROPOSED METHODOLOGY

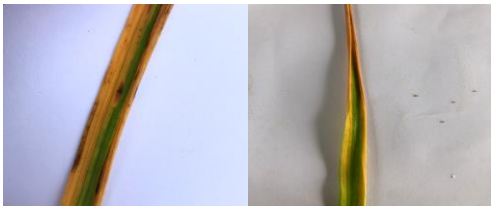
Dataset

The rice leaf image, data set used in this research has been collected and the dataset contains overall 5200 RGB color rice leaf images. In this proposed work we can consider, dataset includes 3 kinds of disease images such as leaf blast, Tungro, and bacterial blight. Dataset also contains as healthy image categories, the training set consists of class labels considers 1000 images and testing stage 300 images used in each class. For training and testing purpose, further classification task with the rice leaf images images is implemented with Enhanced ResNet50V2.

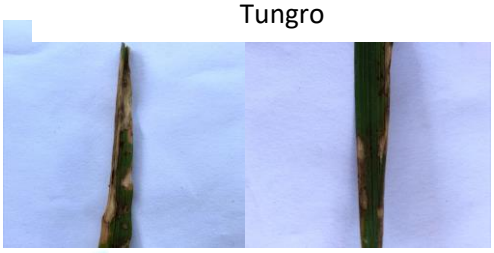
Leaf blast Fungus Magnaporthe oryzae causes the blast infection on leaf and origin indications are white to gray-green lesions with dark brown borders. This is one of the diseases which affect the grain yield. Bacterial blight Bacterium Xanthomonas oryzae reason the blight disease and it initially occurs as water-soaked streaks and that spread from the leaf tips and margins. It can signaling only on the last stage of affect which is identify by the grayish white lesions then become visible sight on the leaves, then that leaves turned into dry and going to die.

Tungro-infected rice plants discoloration of yellow-orange the leaves**.** This is one kind of virus infection on the leaves. In the effect of tungro virus it is covered with dark brown blothes and very light weight comparing with healthy rice plants Figure 1. Shows that affeted rice leaf images with different diseases.

Leaf Blast



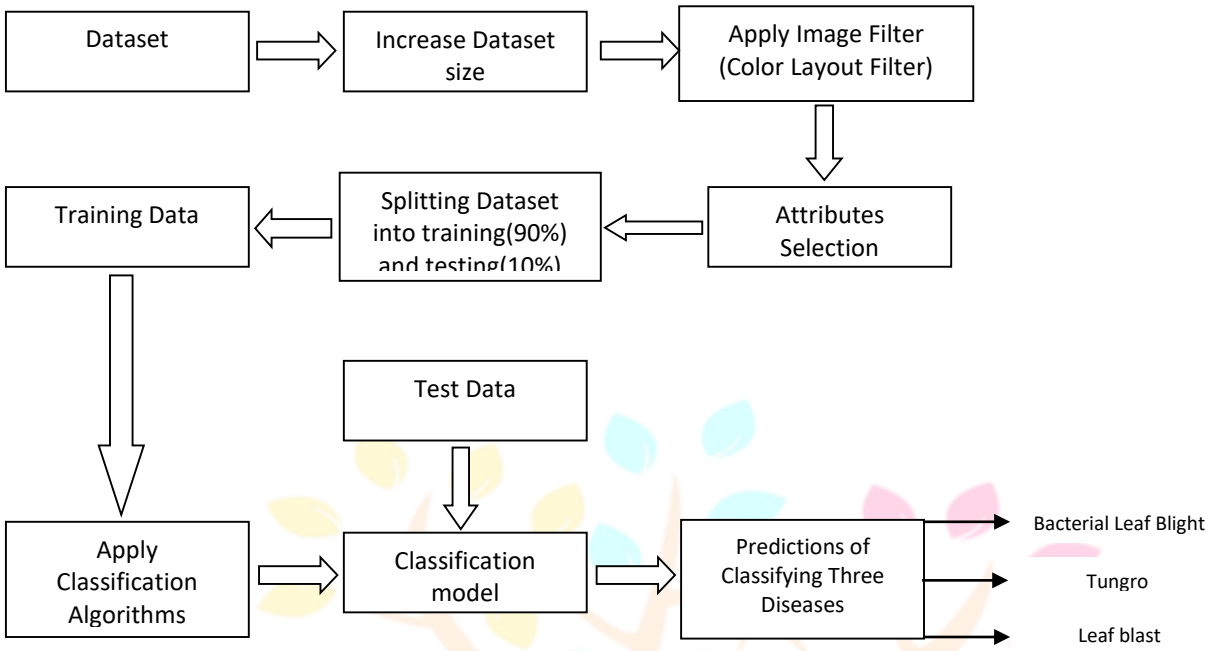
Tungro



Bacterial Leaf Blight

Data Augmentation and Preprocessing

Data preprocessing is essential mission of arrange the original input data and also prepare proper for a constructing and training deep learning model. This stage is always helps to achieving accuracy and performance of the implemented methodology. It helps to improve the eminence of data to encourage the mining of significant needs from the data. All the images in the dataset have RGB coefficients in the range 0-255 and different, so we implemented resize and rescaling. In this work we can do rescaling of pixel values im the range of 0-1 for every image then resized process for all those images into the shape of 224*224*3. Image augmentation system is performing enlarge the images for different image set. Finally augmented image set is shaped by rotating, flipping the images vertically and horizontally, and applying random zooming.



Framing of Convolutional Layers

Convolutional Neural Network is constructed by the Convolutional layer. It is also called as Conv layer. It worked as deriving the significant features from the image using of some of automatic learnable parameters such as weight. Filters have small matrix with dimension. It can convolve across the height and weight of the image. It can take the product value of image matrix and filter matrix. The outcome size of the conv layer is obtained by bring together the feature maps of all filters along the vertical height dimension.

Non-linear Layer

Finally it is added to the convolution layer. It control an activation function to produces non-Linearity of the input data, it helps to enahance the generality content of the model with better way. It receives the feature map from the convolution layer and creates activation map as an output.

An activation function is mainly Rectified Linear Unit (ReLU). It can produce output 0 for the negative input values or else produce the input values of x matrix that can hold any number of values. ReLU (unsaturated) performs better than sigmoid and tanh (saturated).

Pooling Layers

Pooling layers are used to gradually criticize the height and width of the every feature map and maintain it in depth. The pooling layer process employ sliding 2D filter and each control of attribute map and filter sheltering the abridgment the attributes lying within the sections. It is reducing number of parameters learning process and overfitting problems. It can produce amount of output data based on the amount of input data carried.

Max Pooling

Generally pooling operation performed in the neural network. It can consider the greater value from feature map segments. It can take a pool size of 2 Dimension and perform downsampling process of height and width of every feature map. So it can reduce the Overfitting problem. It makes the model more robust to spatial translations in the data.

Fully Connected Layer

Fully connected layer is also known as dense layer. It communicates with the all of the previous and subsequent layers. The output of the pooling layer is compressed and passed to this layer. It process the input for better learning and integrates the spatial information of the training data for predicts the classes.

Output layer

The output layer having full connection with the previous layer and collect the input from that. Output layer contains 4 neurons Each 4 neuraons denotes 4 classes of the rice leaf images. It uses soft max activation to detect the target or final output (class) with highest likelihood value. It can generate only the positive value in the range of [0,1], N dimensional vectors is used and n is number of classed available for processing. Input vector produce any real value for numerator and denominator takes numerator value and summed up with some other positive numbers. Finally probability value added with 1.0.

Enhanced ResNet50v2

There are different transfer deep learning techniques were used for Leaf disease detection such as deep CNN are AlexNet, GoogLeNet, VGG, InceptionV3 These are the most commonly used in transfer learning. There are some complexities with deep CNNs such as disappearance of gradient and degradation problems. To avoid that kind of problems residual modules considered. The Residual network (ResNet) was introduced by Kaiming He, et al., which got the primary place in the ILSVRC and COCO competitions in 2015.The architecture of ResNet50 is a constructed with 50-layer deep neural network. The ResNet50 architecture has groups of 'bottleneck'. Each blocks having 3 layers and they are 1x1, 3x3, 1x1 convolutions, where the 1x1 layers are helped for redcuing the dimensions depth of the feature maps, Next 3x3 convolution layer a restricted access with smaller input/output dimensions. It can generate the shortcut connection that is used to connecting to the output directly and also it skips few layer accesses. Input activation and output have a equal dimension.

$$H(x) = f(x) + x$$

If it is inequal There are two approaches were considered, 1) Extra zeros with Identified skip connection. another approach is, $H(x) = f(x) + w1.x$,x refers to 1x1

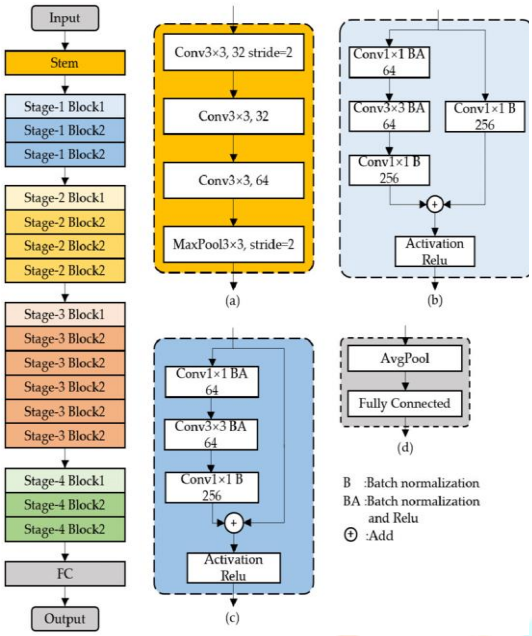


Figure 3. Resnet50 Architechture

Convolutional layer operation is also referred to as a projection layer and it can be used to create matching dimensions. Calculation H(x) is residual to the input. H(x) denotes the true function, x represents the input to the residual unit, f(x) nonlinear layers output value, f(x)+x is the original mapping. The main advantages of residual connections in ResNet50v2 architecture; the relations are permitted to initiate extremely deep networks and can promote accurate and efficient model.

5. EXPERIMENTAL RESULTS

This Research work examined different rice leaf blast disease using various classifiers, including EnhancedResNetV2, CNN. Different stages of study is implemented such as Dataset verification, Data augmentation and preprocessing, CNN and ResNet50v2. The data augmentation work helps to enhance the quality of dataset images through The performance of the different classifiers on an updated rice dataset is analyzed, In rescaling, shear range adjustment, and zoom range modification. Resnet50V2 worked into 6 parts starting from Input layer to output layer and it carry out well identification for Rice leaf diseases.

Implementation Result of Proposed Model

Figure 4.Classification Report

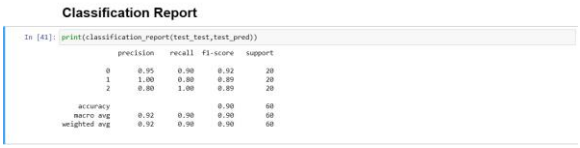


Figure 5. Loss Vs Validation Loss

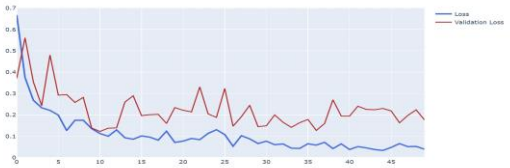


Figure 6. Accuracy Vs Validation Accuracy

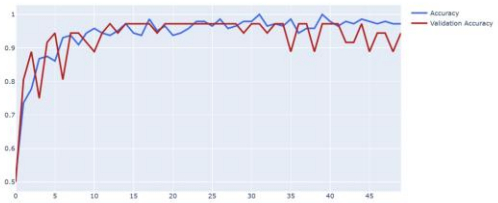
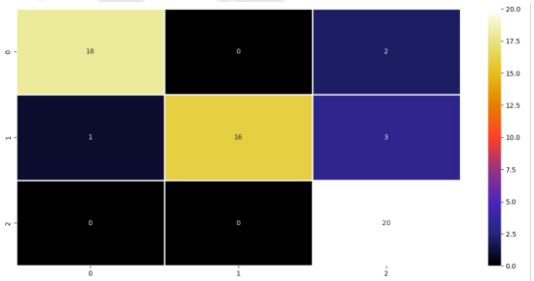


Figure 7. Confussion Matrix



6. CONCLUSION

Final evaluations of the experiments of each Resnet50V2 architectural model have produced the classification of rice leaf disease with good result. Resnet50v2 produced with an accuracy of 99% compared with other methods in this works Experiments shows optimization was carried out and batch size and Learning rate is modifiedThe result shows the proposed Enhanced Resnet50v2 with CNN model exceeds the conventional methods and other CNN architectures found in previous studies in the classification of rice leaf disease. Further research

Resnet50v2 with CNN has better training time, performance and accuracy and also can take the various disease affected leaves on data set and apply effective transfer learning techniques.

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