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PADDY LEAF DISEASE DETECTION USING CNN

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Abstract - India is an agricultural country. Farmer has wide range of diversity to select suitable crops.So detection of plant disease is essential. Providing fast, automatic, cheap and accurate image processing based solutions for identifying paddy leaf disease can be great realistic significance. We have collected total of 3400 paddy leaf diseased images that belong to 3 different classes: a) Rice Blast b) Hispa c) Brown Spot.The proposed model includes a image processing techniques to detect the paddy disease and classify the paddy leaf disease using Visual Geometry Group (VGG) integrated with Convolutional Neural Network (CNN) algorithm. Most unique thing about VGG16 is that instead of having a large number of hyper-parameter they focused on having convolution layers of 3x3 filter with a stride 1 always used same padding and maxpool layer of 2x2 filter of stride 2. It follows this arrangement of convolution and max pool layers consistently throughout the whole architecture. In the end it has 2 fully connected layers. The proposed system is useful to farmer to detect paddy diseases at early stage.

Key Words: Ricedisease,CNN,Image classification,VGG 16,etc….

1.INTRODUCTION

Rice is an important agricultural crop. Most of the world's population consume rice as staple food. More than 90 percent of world's rice is produced and consumed in Asia .About 135 million people in Bangladesh use rice as a staple food. Most of the rural employment is due to the rice production. Rice is the major source of food in Bangladesh, providing about 2/3rd of total calorie supply and is grown on about 10.5 million hectares. Therefore disease free cultivation of rice is very crucial to ensure the economic growth of the country.

There are several rice diseases in Bangladesh including viral, bacterial and fungal. These diseases effect the cultivation of rice every year by degrading the quality and quantity which creates major problem for the farmers as well as the country therefore rice disease should be dealt properlyandintime.DiseaseManagementwhich refers to detection, classification and finally treatment of the disease is a very difficulttask.Diseases are identified based on coloured spots or streaks which can be seen on leaves or stem. Different disease has different coloured spots and patterns. Though manual observation can identify disease, it becomes obsolete while considering large fields and non-native diseases. In this case, image processing can be used instead of manual observation.

1.1. Types of Paddy Diseases

A. Brown Spot: Brown spot is a fungal disease that infects the coleoptile, leaves, leaf sheath, panicle branches, glumes, and spikelets. Its most observable damage is the numerous big spots on the leaves which can kill the whole leaf. When infection occurs in the seed, unfilled grains or spotted or discolored seeds areformed.

Symptoms-Water-soaked to yellowish stripes on leaf blades or starting at leaf tips then laterincrease in lengthand width with a wavy margin. Lessions turn yellow to white as the diseaseadvances.

Fig-1: Brown Spot

B. Hispa: Rice hispa is a very serious insectpest of rice, particularly in the Terai region Of Nepal.The adult is a small bluish black beetle, measuring 5 mm in length and is recognized by numerous short spines on the body and forewings. Rice hispascrapes the upper surface of leaf blades leaving only the lowerepidermis.

Symptoms- Scraping of the upper surface of the leaf blade leaving only the lower epidermis as white streaks parallel to the **midrib.**

Fig-2: Hispa

C. Rice Blast: Blast is caused by the fungus *Magnaporthe oryzae.* It can affect all above ground parts of a rice plant: leaf, collar, node, neck, parts of panicle, and sometimes leaf sheath. . Blast can occur wherever blast spores arepresent.It occurs in areas with low soil moisture, frequent and prolonged periods of rain shower, and cool temperature in the daytime.

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Symptoms-disease can infect paddy at all growth stages and all aerial parts of plant (Leaf, neck and node). Among the three leaves and neck infections are moresevere.

Fig-3: Rice Blast

2.RELATED WORK

Many researches have been done on the field of Paddy leaf disease detection by various researcher. Here, we take some of the papers related to Paddy leaf diseases detection using various advanced techniques and some of them shown below,

In paper [1] authors presented disease detection in Paddy through one of the effective methods like K-mean clustering, texture and colour analysis. To classify and recognize different agriculture, it uses the texture and colour features those generally appear in normal and affected areas.

In paper [2], author described as an in-field automatic paddy disease detection system based on a weekly supervised deep learning framework. Furthermore, a new infield image dataset for paddy disease, paddy Disease Database 2017 (WDD2017), is collected to verify the effectiveness of our system. Under two different architectures, i.e. Virtual Geometry Group(VGG) VGG-16 and VGG-FCN-Experimental results demonstrate that the proposed system outperforms conventional CNN architectures on recognition accuracy under the same amount of parameters, meanwhile maintaining accurate localization for corresponding disease areas. Moreover, the proposed system has been packed into a realtime mobile app to provide support for agricultural diseasediagnosis.

In paper [3] author describes a methodology for early and accurately plant diseases detection, using artificial neural network (ANN) and diverse image processing techniques.As the proposed approach is based on ANN classifier for classification and Gabor filter for feature extraction, it gives better results with a recognition rate of up to 90%. An ANN based classifier classifies different plant diseases and uses the combination of textures, colour and features to recognize those diseases.

In paper [4], the authors used CNN to detect ten rice diseases-rice blast, rice false smut,rice brown spot, rice bakanae disease, rice sheath blight, rice sheath rot, rice bacterial leafblight, rice bacterial sheath rot, rice seeding blight and rice bacterial wilt.Their dataset contained 500 images of healthy and diseased rice leaves and stems. Most of the images were captured from the field using digital camera, while some other images were collected from agricultural pest and insect pests picture database. The images were resized to size 512×512 before training. The authors applied normalization, PCA and Whitening as preprocessing steps. The trained CNN model achieved an accuracy of 93% on the test set.An interesting aspect is that they used stochastic pooling, unlike max pooling used by most of the newer architectures. They argued that stochastic pooling enhances the generalization ability of the CNN model and prevents overfitting. The drawback here is that 500 images for 10 classes is a very small number when it comes to convolutional neuralnetwork.

In paper [5], the authors used deep CNN to detect disease from leaves. They trained the neural network with 54306 images of 14 crop species, which represented a total of 26 diseases along with healthy leaves. Though the accuracy was 99.35% on held-out test set, the accuracy fell to 31.4% when tested on another verified dataset of 121 images captured in real life scenario.

3.MATERIAL ANDMETHODS

3.1. PROPOSEDMODEL

The proposed model for paddy leaf disease detection using CNN ,the disease can be predicted at the early stage. This system provides fast, automatic, cheap and accurate image processing based solutions for identifying paddy leaf disease can be great realistic significance. The proposed system detects the type of diseases in paddy leaf but also with greater accuracy. Thus this model not only provides ease of use but can also effectively detect the type of disease. Image transformation function in torch is used for preprocessing the images in dataset. After preprocessing,feature extraction has been done by Convolution Neural Network.Total number of features extracted to differentiate different types of diseases are 25088. Then classification has been done by using VGG16 a CNN model which is a very deep Convolution network for large scale image recognition.

3.2. PREPROCESSING

The dataset contains images from different types of paddy leaf diseases.Total number of images 3355 from kaggle.Out of which 80% have been used for training and 20% have been used for validation. Pre-processing was implemented using image transformation function in Torch vision. Pre-processing steps like Random Ration,Random Resized Crop, Random Horizontal Flip,Normalization. Resize, Centre Crop have been applied to image before sending the image to tensor for creating CNNmodel.

3.3. VISUAL GEOMETRY GROUP

The input to cov1 layer is of fixed size 224 x 224 RGB image. The image is passed through a stack of convolutional (conv.) layers, where the filters were used with a very small receptive field: 3×3 (which is the smallest size to capture the notion of left/right, up/down, centre). In one of the configurations, it also utilizes 1×1 convolution filters, which can be seen as a lineartransformation of the input channels (followed bynon-linearity). The convolution stride is fixed to 1 pixel; the spatial padding of conv. layer input is such that the spatial resolution is preserved after convolution, i.e. the padding is 1-pixel for 3×3 conv. layers. Spatial pooling is carried out by five max-pooling layers, which follow some of the conv. layers (not all the conv. layers are followed bymax-pooling).

Max-pooling is performed over a 2×2 pixel window, with stride 2.Three Fully-Connected (FC) layers follow a stack of convolutional layers (which has a different depth in different architectures): the first two have 4096 channels each, the third performs 1000-way ILSVRC classification and thus contains 1000 channels (one for each class). The final layer is the soft-max layer. The configuration of the fully connected layers is the same in allnetworks.All hidden layers are equipped with the rectification (Re-LU) non-linearity. It is also noted that none of the networks (except for one) contain Local Response Normalisation (LRN), such normalization does not improve the performance on the ILSVRC dataset, but leads to increased memory consumption and computationtime.

3.4 CONVOLUTIONAL NEURAL NETWORK

A subset of machine learning called deep learning is popular nowadays because of its high performance across many types of data. A great way to use deep learning to classify images is to build a convolutional neural network (CNN). Computers see images using pixels. Pixels in images are usually related. For example, a certain group of pixels may signify an edge in an image or some other pattern. A convolution multiplies a matrix of pixels with a filter matrix or kernel" and sums up the multiplication values.

A CNN is constructed using one or more convolutional layers followed by one or more fully connected layers as multilayer neural network. The architecture of a CNN takes the 2D structure of an image as an input (or other 2D input such as a speech signal). In order to achieve this, the local connections are made to each layers and weights are assigned to each node followed by some form of pooling which results in translation invariant features. One of the benefits of CNNs is that they are easier to train and have fewer parameters than fully connected networks with the same number of hidden units. The CNN contains many functional layers and all of the layers are organized for image classification and feature learning.

The functional layers are classified into 3 categories as pooling layer, convolution layer and activation layer. Pooling layer as well as max layer is implemented after convolutional layer, which enhancing translation invariance for the learned features.

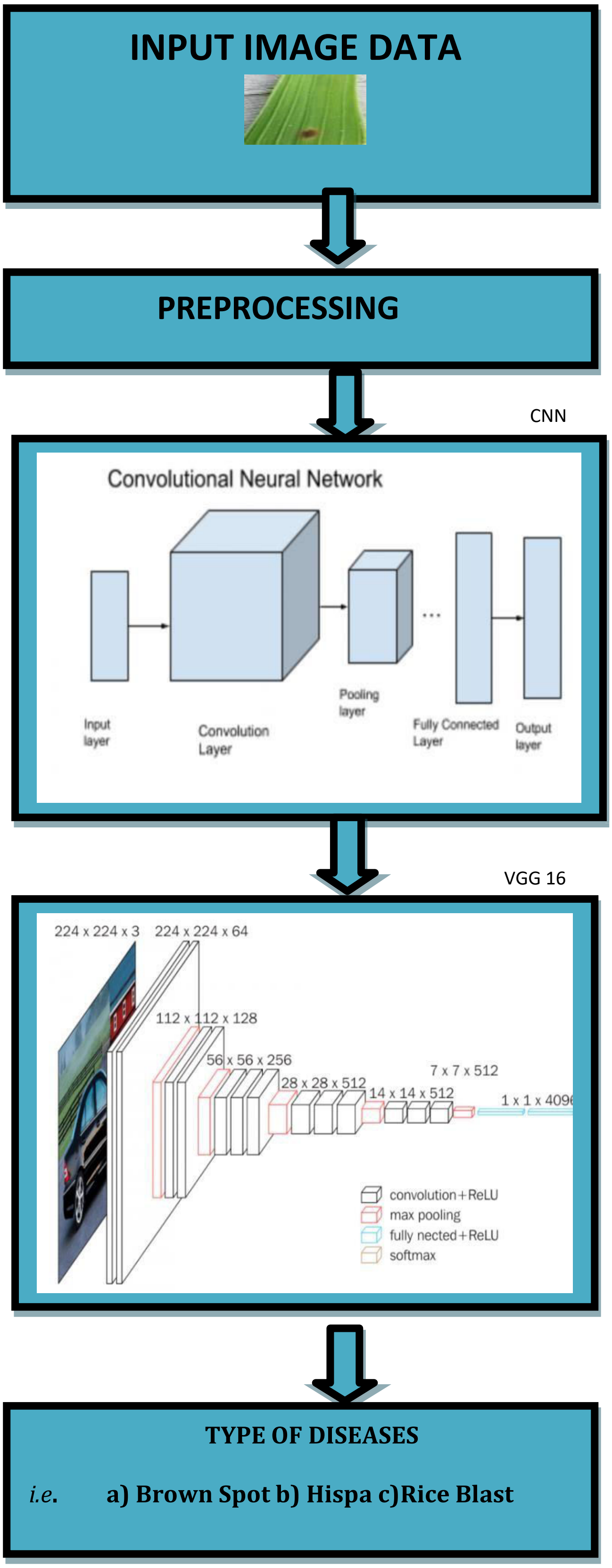

Fig -4.System Architecture

3. CONCLUSIONS

The system aims to develop a robust and user- friendly system for disease classification of paddy leaves. To analyse the paddy leaf disease colour, texture and shape features are extracted from the disease affected segment. Convolutional Neural network is used to classify diseases. We see that the system shows robust result than some existing methods .For now we have identify the type of paddy diseases.In future for better experience we will design the app. So the mobile users can easily login to the app and identify the paddy diseases by uploading the images through webcam or default camera in mobile phone. Based on the experiments and observations, it is evident that the proposed model outperforms other model with an accuracy of 95%. The only issue incurred is time complexity. The network takes about 2 hours for training. So in future work will be based on reducing time complexity by using various analogous algorithms and to collect a much cleaner dataset for better observations. It is concluded that the proposed CNN-VGG framework for paddy disease detection can be used as powerful tool for the disease identificationprocess.

REFERENCES

1. A Anthonys G., and N.Wickramarachchi, "An image recognition system for crop disease identification of paddy fields in Sri Lanka," In Industrial and Information Systems (ICIIS), International Conference on, pp. 403-407,2009.
2. S. Phadikar, J. Sil, and A. K. Das, "Classification of Rice Leaf Diseases Based on Morphological Changes," International Journal of Information and Electronics Engineering, vol. 2, p. 460,2012.
3. A. K. Singh, A. Rubiya, and B. Raja, "Classification of rice disease using digital image processing and svm classifier," International Journal of Electrical and Electronics Engineers, vol. 7, pp. 294-299,2015.
4. Phadikar, S. and Goswami, J. (2016). Vegetation indices basedsegmentation for automatic classification of brown spot and blast diseases of rice. 2016 3rd International Conference on Recent Advances in Information Technology.
5. A Fakhri, A Nasir, M Nordin, A Rahman and A R.Mamat, "A study of image processing in agriculture application under high performance computing environment," International Journal of ComputerScienceTelecommunications.
6. L. Liu and G. Zhou, "Extraction of Rice Leaf Disease Image Based on BP Neural Network," in ComputationalIntelligence and Software Engineering, Wuhan,2009.
7. Monishanker Halder,PADDY LEAF DISEASEDETECTIONUSING NAVIE BAYES.
8. Rao, A. N., Wani, S. P., Ramesha, M. S.and Ladha, J. K. 2017. "Rice production systems," Rice Production Worldwide (February 2017), 185--205.
9. Alam, M. Z., Crump, A. R., Haque, M. M., Islam, M. S., Hossain, E., Hasan S. B., Hasan, S. B. and Hossain, M. S. 2016. "Effects of integrated pest management on pest damage and yield components in a rice agro-ecosystem in the Barisal Region of Bangladesh," Environmental Science (March2016)
10. K. Simonyan, A. Zisserman, Very deep convolutional networks for large-scale image recognition, arXivpreprintarXiv:1409.1556.
11. V. Singh, A. Misra, Detection of plant leaf diseases using image segmentation and soft computingtechniques, Information Processing in Agriculture 4 (1) (2017) 41–49.
12. S. P. Mohanty, D. P. Hughes, M. Salath´e, Using deep learning for image-based plant disease detection,Frontiers in plant science.