Detection of Banana Leaf and Fruit Disease using Neural Network-A Survey

Deekshith.C
Student, Department of Electronics and Communication Engineering
Atria Institute of Technology, Bangalore, India
Email- deekshith1997@gmail.com

Sundari Tribhuvanam
Faculty,Department of Electronics and Communication Engineering
Atria Institute of Technology, Bangalore, India
Email- sundari.t@atria.edu

Abstract- Automatic recognition of plant species and disease recognition is a hard hassle within the vicinity of pattern identification, computer imagination and prognostics. Complex neural community has indicated plethora of research in plant image category with various computer assisted techniques for plant disease identification. With the advent of wireless communication, however, there is a dire need to optimize this research to support the farmers. Advance spotting of banana leaf and fruit disease can restrict the growth of disease, as well as lower the treatment cost. Hand-operated recognition processes need domain knowledge and are time consuming. Convenient and automatic identification system of detecting plant diseases is the need of the day. The proposed work recommends three major phases-pre-processing, feature extraction and disease classification. The proposed system aids the accurate classification of plant diseases. Several plant species samples are considered for investigation with machine learning techniques for automatic identification system.

Keywords – ***Image Processing, Disease Detection, Artificial Neural Network, Internet of Things***

I. INTRODUCTION

The predominant profession of India is agriculture. Plastic, glass walls or roof along with composition paper work towards a green house. The flora, soil and other materials and the roofing cloth heats more due to the solar radiation in the green house. As surveyed, the disorder on the crops and vegetation in a green premises are detected manually by means of the farmers. This technique is time and labour consuming. The probability to boom sickness to the larger region is high while monitoring the plant disorders manually [1]. Traditional and cultural crop management practices are structured via most of the farmers by way of ensuring a robust monitoring and interpret climate on the basis of their experience. The farmers use chemical pesticides to shield their vegetation from eruption of diseases, once they find a right time of disease onset and pest to assault crops. Farmers from the developing international locations are picked out on this studies to authorize them to control the colonic illnesses that have an effect on the alternate vegetation manufacturing whose fall into the category of the grain berry borer and diseases, leaf rust, inexperienced scales mold and antestia virus hurt during many nations[2]. Extreme weather conditions such as heavy rainfalls, extreme heat radiations, humidity are main reasons for diseases and likely to damage crops due to the environmental changes that cannot be controlled by humans. Hence early alarm would be advantageous for the farmers to take corrective measures which would be beneficial in such situations. But the results are to make as effective and appropriate for customer applications on smart phones though the convolutional neural network (CNN) is time and space consuming [3]. In this paper, authors propose the development of a cost-effective and inexpensive smart farming prototype which gives warning to the farmers about the plant disease in advance and corrective actions could be taken. Raspberry Pi and Arduino combination is designed using this framework. Plant disease can be identified and diagnosed with the help of Raspberry Pi that is connected to the camera [4].

An automated system has been proposed to recognize the taxonomy of the Ayurvedic plants by extracting features from their leaf images and applying mathematical operations to obtain the leaf factor. The models were trained in different stages. Color, segmented and grayscale images have been used to examine the reliability of the version.

The performance of the carried out and model is compared with that of the trained version. Performance change is found better in phrases of each accuracy and required training time inside the implemented model which turned into proven within the end result [5]. The lack of the yield due to whole ebullition of disorder may be minimized with the development of the smart farming and plant ailment detection device will permit farmers to locate the disorder at an early degree [4].

II. Literature Review

Sanket Solanke et al, [1], suggest a smart device placed in between the plants lane that will cowl in a zig-zag way in the complete farm with the aim to stumble on crop sicknesses and mechanically do pesting. Labour, fertilizer cost can be reduced using this technique. Ntihemuka Materne and Masahiro Inoue [2] integrates sensor devices and wireless sensor network (WSN), to simultaneously monitor eight important environmental parameters recognized as high correlation to reverberate pests and diseases in plantation by constructing a farmland environmental monitoring platform. Acquisition of enormous amount of data on daily basis has been enabled in the real-time monitoring system in the complete structure of the system. The model is built directly with Internet of Things (IoT) data acquire from database into the CSV files. IoT and machine learning technology has been combined, to impart the innovative ideas and technological developments to improve the farming and agricultural industry.

In [3], authors developed a system based on IOT and deep learning. This system attempts to recognize the stress to the plants by soil fertility, environmental variation and crop diseases. The images of the crops are captured at the regular intervals of time with the help of drones fixed with cameras to monitor the crop field. The developed system handles soil parameters through sensors, environmental factors through Web API's and the disease part through trained model in CNN. Muhammed Hanif Jumat et al.,[4] expand a clever farming framework that is fee-effective and less expensive to detect the plant ailment in advance and notification may be dispatched to farmers to take the corrective actions. Also plants repute can be monitored within the greenhouse with the assist of a web based gadget. Combination of Raspberry Pi and Arduino microcontrollers has been evolved to discover the septoria plant ailment so as to decrease the yield loss.

In [5], authors put into effect a deep convolutional neural network (DNN) to observe the sickness in vegetation from their leaves. To detect plant ailment and classification of healthy and diseased leaf images of the vegetation four deep learning models-Inception V3, Inception ResNet V2, Mobile Net V2, Efficient Net Bo are considered. Authors carried out deep-gaining knowledge of model have good predictive ability in terms of each accuracy and loss as compared to other deep-studying strategies. In [6], authors advocate a novel method for information plant leaf contamination and a technique for vigilant finding of plant illness. Utilizing image database and support vector machine (SVM), the proposed work analyses the illness of the leaf. For the purpose of leaf disease identification and location detection this work actualizes image inspection and characterization strategies. Sachin D. Khirade, A. B. Patil [7] discuss about the leaf images of the plants to detect their diseases with segmentation and feature extraction algorithm. ANN methods such as self-organizing feature map, back propagation algorithm, SVMs are used to systemize plant diseases. Plant disease detection and classification using image processing techniques is also introduced.

In [8], authors explain about the formation of IoT structure consisting of an apparatus for sending ongoing ecological information to diffused storage and machine learning computations to anticipate natural conditions for parasitic identification and avoidance. To expect catastrophe in the field, this work illuminates about the crop field administrations of the present and the future ecological conditions. Authors elaborate the contagious illness of crops and anticipate how the disease will spread in the harvest fields and enhance this structure. In [9], authors propose the development of Integrated Pest Management (IPM) ontology and report the use of semi automatic method to describe how these strategies may be used by the farmers using an IoT utility. Current IPM knowledge utilization available as texts and construct ontology out of it is also discussed in detail. IoT framework for IPM is also explained.

Rutuja R. Patil and Sumit Kumar [10] describe about the diagnosis of rice diseases effectively by collecting the agro-metrological information through the IoT model. Diagnosis of rice disorder using multimodal statistics fusion structure named rice-fusion is explained in this paper. For the purpose of the real time and dependable ailment identification single modality is insufficient, and a fusion of heterogeneous modalities are defined. The proposed rice-fusion structure can be used to detect different rice diseases automatically using AI based multimodal data fusion model.

In [11], authors discuss the hyper spectral sensing to observe the pesticide residue on the tea leaves. Spectro radiometer use for the collection of statistics at the leaves treated with three banned chemicals viz., Acetamiprid, Cypermethrin and Monocrotophos to control health of leaves. In paper [12], authors advocate about citrus disorder detection from scattered statistics the use of speedy and accurate deep metric learning-based total framework. Authors endorse a patch based grouping community that contains an embedded module, a cluster prototype module, and a

simple neural community classifier for citrus diseases identification. This paper includes open source citrus fruit and leaves dataset detection of various sicknesses within the leaf images.

In [13], authors discuss about the development and evaluation of an imaging system suitable for use with autonomous unmanned aerial vehicles (UAVs) for citrus greening disorder analysis. In order to assess the degree of starch accumulation in greening inflamed leaves this paper proposes an intensity invariant sensing technique measuring reflectance of polarized amber light. Also machine learning technique is used to discriminate between healthy and infected specimens. Doreen A. Lyimo, V. et al., [14] propose three deep learning algorithms for the purpose of espresso leaf rust contamination rate prognosis, specifically with Back Propagation Neural network (BPNN), CNN, and Recurrent Neural Network(RNN). Coffee leaf Rust detection is analyzed in detail. The farmer may be benefited from this analysis to stumble on the espresso plant disorder earlier and save from further damage.

In [15], authors discuss specifically two sicknesses of the cardamom plants: Colletotrichum Blight and Phyclosticta leaf spot and three grape sicknesses: Black Rot, ESCA and Isariopsis leaf spot. To dispose the undesirable background of an input image this work uses U^2-Net by means of selecting multi scale functions. Efficient NetV2 model is proposed in this paper to diagnose the cardamom plant disease. In [16], authors suggest method to come across strawberry verticillium wilt disorder appropriately with community based totally quicker RNN and multi-assignment learning. In [17], authors propose an early and cost-effective solution the class of the mango leaves inflamed by means of anthrac-nostril fungal sickness with multilayer CNN.

In [18], authors propose the advent of dataset infected by HLB of 5406 citrus leaf images. Based on Huanglongbing (HLB) infected leaf images received from plant village and crowd AI. Authors evaluate the overall performance of six distinctive device studying fashions to discover the severity detection of the citrus HLB. In [19], authors discuss plant disease detection tasks for texture classification problems using deep learning models pre-trained on the object categories. This paper discusses the reduced datasets available for the purpose of the precision agriculture.

In [20], authors propose the method to detect the disease from the leaf images integrating machine learning and image processing automated plant disease detection on a large scale. This segmentation technique and utilization of SVM demonstrate disorder class with an accuracy of 95%. Wanzhi Liao et al., [21] provide an explanation for potential disorder prognosis in banana leaf via utilizing the fusion of near range hyper spectral (HS) and high-resolution (HR) visible RGB image. To reap a more suitable HS picture, authors apply joint bilateral filter out to switch the textural systems of HR image to low decision image. Sandy Lauguico, et al., [22], advise the detection of three disorder of the grape leaves-Black Rot, Black Measles and Isariopsis along with the healthy leaves and considers correct identification with pre trained network models. This work compares the detection with AlexNet, Google Net and ResNet with satisfactory performance of the models.

III. METHODOLOGY

Plant ailments possesses a very detrimental warning to the agricultural enterprise and feature the potential of striking the whole human society into hunger if no longer detected earlier.

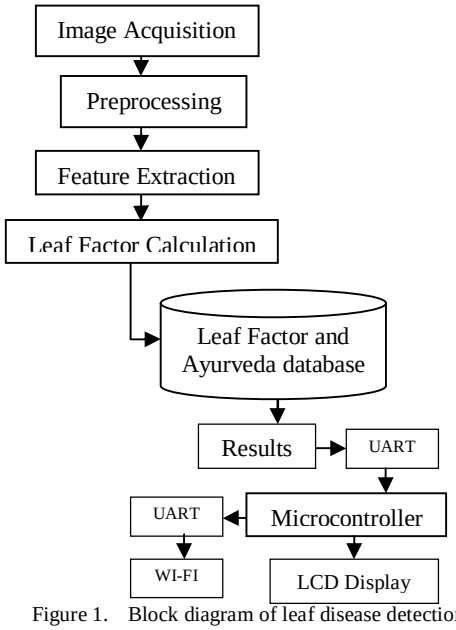

Figure 1. Block diagram of leaf disease detection

Timely detection of the plant illnesses via the farmers turns into simpler and inexpensive with the accomplishment of machine mastering models within the domain of plant pathology which averts the wastage of plant life and shielding the spreading of diseases from diseased to healthy flowers. Figure 1 indicates the block diagram of leaf disorder detection system.

The proposed system includes five steps namely, Image acquisition, pre-processing, feature extraction, classification and analysis. Different classifiers and multitude of methods can be used for the reason of plant sickness detection. In this system, four algorithm can be considered. The CNN and K-nearest Neighbor (KNN) will used for disease identification. The XAI approach is used to provide an explanation for capacity for the predictions made by means of the classifiers with Local Interpretable Model-agnostic Explanations (LIME). LIME photo package is used to put into effect LIME version and at the beginning, an object 'explainer' will be created. This object uses the approach explain_instance() that takes in 3-D image statistics and the version's predictor function (model.Are expecting). Based on the prediction from the trained version the statements are written.The performance analysis of the these models was done using the metrics: accuracy, precision, Recall and F1-score to find the best executing model for the disease detection of the banana leaves from the plant village dataset.

The steps of proposed work is as follows:1. Leaf disease image classification using CNN, KNN and Performance analysis. 2. Provide explainability to the predictions made through the respective machine studying models. 3. Evaluate user believe of each the carried out AI and XAI fashions the use of a person take a look at and accumulate comments from farmers which will provide recommendations for future studies.

The proposed work consists of 5 steps - Image acquisition, pre-processing, characteristic extraction, classification training and trying out. Image processing strategies has been carried out for the cause of leaf reputation. The leaf image of a particular plant preprocessed for noise elimination, facet detection. In feature extraction section, features associated with leaf disease are recognized. The leaf aspect of the particular leaf is calculated which is specific for a specific leaf kind and is stored in the database. When a new leaf image is fed to the proposed system, the leaf issue of that particular leaf is calculated as compared with the database and the maximum matching leaf is the output, it's far given to controller enabled with Wi-Fi identical records may be dispatched to the concern person through Wi-Fi to mobile application.

IV. CONCLUSION

Supporting agriculture domain using technological advancement is the major concern of the day. This paper studies the various plant diseases and their early detection using modern tools and technology to benefit the farmers for easier and fast classification of plant disease and controlling them. Hence lowers the treatment cost. This paper aims in advance spotting of banana leaf disease and restriction of the growth of diseases, as well as lower the treatment cost. This paper proposes a complete system of plant disease detection with image processing, machine learning and IoT to instill the confidence in farmers with AI and XAI models.

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