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E-Cultivation

Kayathiri Thillairasa
Faculty of Computing
Srilanka Institute of Information Technology (SLIIT)
Malabe, Srilanka

Baskarasothy Pratheeparaj
Faculty of Computing
Srilanka Institute of Information Technology (SLIIT)
Malabe, Srilanka

Rajendran Yathushan
Faculty of Computing
Srilanka Institute of Information Technology (SLIIT)
Malabe, Srilanka

Sivanesan Sarujan
Faculty of computing
Srilanka institute of information Technology(SLIIT)
Malabe, Srilanka

Dhammika De Silva
Faculty of Computing
Sri Lanka Institute of Information Technology (SLIIT)
Metro, Sri Lanka

Abstract:- Agriculture is the most significant sector which impact the Sri Lankan economy and which is the main source of employment for the labor force. Around eighty different varieties of fruits and vegetables are grown all over the agro-climatic areas of Sri Lanka. Various researches are actively going related to plant which could help to maximize the yield productions. This Paper proposes the detection of Pest attack and nutrient deficiency, classification techniques and plant monetarization after the utilization of fertilizer and pesticides with the assistance of finest machine learning technique for the classification in image processing. Instant plant sickness detection and deficiency is important as it beneficial to monitor huge area of crops and detects the defects via symptoms appear on the leaves. In this project we develop Android Mobile app for detecting nutrient deficiency ,diseases and pest detection automatically through image processing and machine learning technique with the objective of providing firm, efficient, user friendly and costless solutions to farmers. The outcome of this study can be applied by farmers to increase the yields without depending on others. Using image processing techniques, the segmentation and feature extractions are done from the affected leaf image. K Means clustering for segmentation will be used to obtain the optimal solutions among the different constraints in image by converting the image from RGB Color Space to L*a*b* Color Space and the image features will be extracted using color co-occurrence method and the feature will be calculated. After the feature extraction, classification will be done by analyzing Artificial neural networks(ANN), Support Vector Machine(SVM), K-Nearest Neighbour(KNN) and with a literature comparison and SVM and CNN is selected as the most appropriate classifier.

I. INTRODUCTION

In the sector of agriculture nutrient deficiency and pest attacks would change the normal behavioral pattern of the plant.

The obligation of shielding food crops from these difficulties in the difficult condition is ascending with increment in human population and its needs. Recognize the symptoms in the leaves for the pest attack and nutrient deficiencies and find the solution in the beginning stage will help to decrease the impact of defects in the plant. Once the symptoms appear, samples of the affected plant parts are collected and examined via traditional approach which is a time consuming, labor intensive and expensive approach. The aim of the system is to provide precise and scalable visual cues to identify *Cucurbita* genus specially pumpkin diseases and provide solution for the rustic farmers by offering the appropriate information about the diseases, fertilizer, pests ,nutrient imbalance and the guide for application of fertilizer and pesticides in effective way .

Using the mobile application with image processing techniques and machine learning to get Effective manner of playing the issue a major role in agriculture sector. The requirement of mobile based application for aiming farmer specific requirements and depends on agricultural sector to detect Cucurbita diseases and nutrient deficiency at early stage needs in rural. Application helps the farmers as a assistance to control the pest attacks and nutrient deficiency with the details of the disease and monitor the plant after the application of solution in the form of pesticide and fertilizers. System would monitor the plant using the image processing technique after the utilization of suggested pesticide or fertilizer.

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After recognizing the symptom on the leaf various processing techniques used for image for performing the several task. A data preparation step to improve performance of uploaded image and to remove the undesired distortion from the image. Uploaded images will go for several processes during the preprocessing steps. At the beginning, loaded image contrast will be increased by stretching in order to remove the shadows distortions. The images will be further converted to L*a*b color space for better segmentation before segmenting the images. In this paper, we are going to analyze the existing algorithms and select the suitable algorithms or modify them in order to recognize the mentioned diseases accurately and to provide the solutions which are recommended by the Department of Agriculture. The proposed algorithm should be cost effectively and efficiently for providing the solution as a mobile app to control the diseases, nutrient deficiency, pest attacks and to minimize the effects of pest assaults as illnesses should be rapidly recognized.

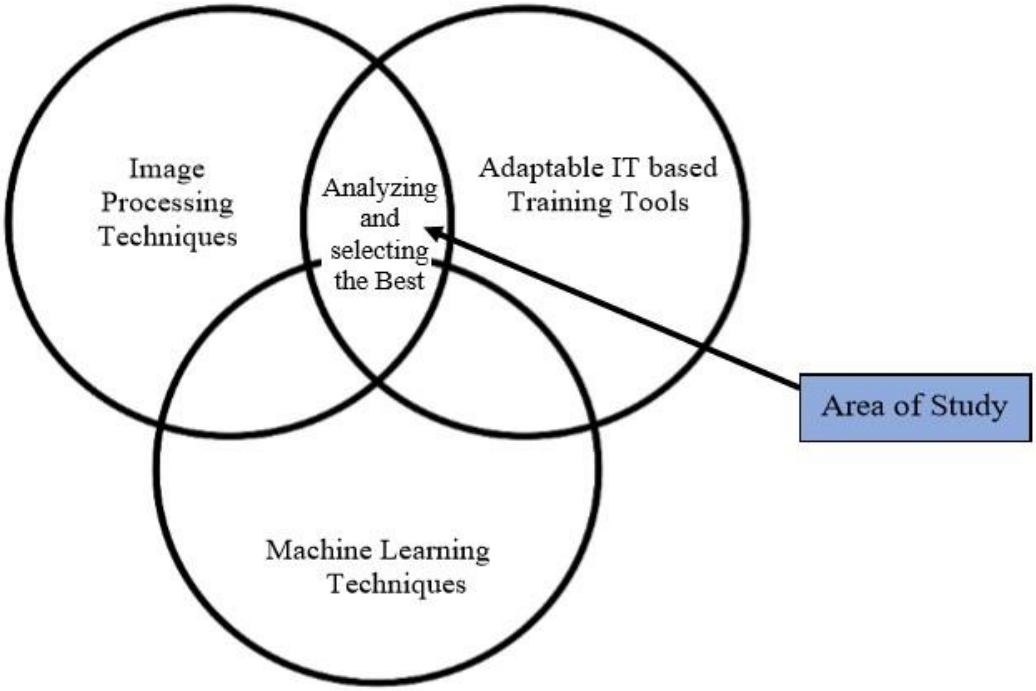

Fig 1:- Image processing technique

System could identify a leaf using the shape, nerve and color it possesses. After it has been identified, the system analyzes the leaf whether it has affected by pests. The system identifies the leaf using the shape of the bitten type and using the symptoms of the leaf. According to the result, the system suggests some pesticides in order to cure the disease or to kill pests. Mostly we use pesticides to reduce infection from the affected leaf. But some pesticides are unable to cure the affected leaf or sometimes they are inefficient in work. So, the system should monitor the plant frequently. If it is mal-functioning solution, the system suggests alternative pesticides to cure the disease. Depending on the results, the system includes an additional facility to identify nutrition symptoms problems which means some leaves turns out to be unhealthy because of nutrition problems. It is difficult to handle non-expert farmers. However, we try to find out the solutions easily for creepers type of plants, especially pumpkin and bitter gourd kind of plants.

II. RELATED WORK

In the study, a plenty of researchers presents a brief survey of approaches on plant disease nutrient deficiency and pest attack detection using the image processing and machine learning techniques. This section discuss the conclusion drawn from the research papers from the earlier researcher related to the topic.

This research paper of detection of plant disease [1]. This proposed system offers a different perspective in detection of the plant disease. The two main features of plant disease detection using deep speed and precision of teaching techniques to be accomplished.

There is space for working on development of innovative, accurate & Quick execution of algorithms which will aid plant scientists in detecting disease. Practice can be performed to estimate automatically the seriousness of the disease identified.

In 2015 [2], the approach on image segmentation, feature extraction and classification steps were conducted. The method of image segmentation is used to identify impacted components of the leaf using K-means clustering based on the paddy leaf image and feature extraction phase derives. Artificial Neural Network is used as the classifier by the researcher. Images for testing were drawn from the internet and some of the pictures were recorded digitally using a digital camera. After segmenting the images, different features were extracted to provide as the input for Artificial Neural Network. They have adopted the discrete wavelet transform (DWT) and gray level gray co-occurrence (GLCM) method. Back propagation neural network (BPNN) used for the classification as well. Here, the number of textures features is equal to the number of inputs to neural network. Mainly the researcher has used MATLAB to load testing and training data file and the classifier is trained using train files to perform the classification which the researcher used in the test file.

In 2013 [3], the study proposed paddy disease identification method in Indonesia in order to enhance the quality and the quantity of rice production using texture analysis with fractal descriptor based on Fourier spectrum . In their proposed method, initially the affected paddy leaves are collected for each category of disease. Then, the lesion area was cropped manually from all leaves. Each lesion image is converted in to HSV color space. Later, the parts of saturation are separated and the histogram equalization is implemented and the pictures are sharpened using Laplacian filters. Moreover, the fractal descriptors are extracted from each lesion image and the classification is performed using probabilistic neural networks (PNN). This technique is accomplished at least 83.00% accuracy in identification of illnesses and deficiency using fractal descriptors.

In 2009 [4], the study focused on extracting the features from paddy through off-line image with the process of converting RGB pictures to binary images using Otsu-based varying, worldwide and manual thresholds. Morphological algorithm is used to eliminate noise in pictures using region filling method and then paddy seeds picture features composed of lesion proportion, lesion form, spot color, border color and crushed paddy leaf color. In the Page | 10 conclusion, the researcher stated that by employing production rule technique, 94.7 percentages of accuracy rates of recognition was marked.

In 2016 [5], a work proposed on developing a system for classifying the paddy plant diseases like leaf blast diseases and bacterial blight disease. The main parts were detection and recognition of 3 paddy leaf diseases in order to achieve the expected outcome. Haar-like features and AdaBoost (Adaptive Boosting) classifier techniques are used in detecting the disease with the accuracy rate of 83.33% while training the datasets and Scale Invarient Feature Transform (SIFT) feature and classifiers namely k-Nearest Neighbour (KNN) and Support Vector Machine (SVM) are used in recognizing the diseases with the accuracy rate of 91.10% using SVM and 93.33% using k-NN. The researcher states that extract features can be getting from alternative methods and various classifiers can be used to improve the accuracy of the result.

The study focuses on a new technology for classification of diseased paddy plants using global contrast enhancement. The particular technology is developed with MATLAB and checked on various pictures. For that, they have studied two classification techniques for paddy plant diseases. One of the significances of this study is that the researchers have looked for automatic, fast, less costly and precise technique of detecting instances of plant disease. Further, They researched the usefulness of ADAR remote sensing information for high-spatial broadband to identify rice peel blight and created an strategy for further investigation of its applicability. According to the methodology, this study can be considered as a comparative study since the researchers have compared two segmentation methods/techniques to detect paddy plant diseases. They noted that places with minimal variations are hard to obtain in the first technique that is segmentation using standardized reductions. Therefore, the angle of picture in segmentation focused solely on cost reduction has not been provided any significance. Moreover, they have observed that deciding the difference between spot color and boundary color is difficult only through the texture analysis technique. After this comparative study, It was chosen that the texture-based strategy would be much superior because nothing would be lost to decrease the price factor. With the observations of the comparative study, they have developed the proposed new technology using the image equalization method. Finally, it can be concluded that the proposed new technology is able to normalize the Page | 11 color vector space in order to let the region to grow easily and to segment the image with low computational time [6].

Chaitali G.Dhaware and K.H.Wanjale [7], have discussed about the modern approaches like image processing techniques, Image Segmentation algorithms used for the automatic detection on various plant leaf diseases which is recognized using the symptoms expose with the plant leaf.

Author Wan Mohd Fidzil et al [8], explained the methods and algorithms for detection for diseases which affect the orchid plant leaves. As per the narration the orchid plant leaf let image will captured using the digital camera and various image processing algorithms and strategies use to border segmentation method morphological processing and filtering techniques to detect the orchid leaf affecting diseases like black leaf spot and solar scorch.

MA Teng-fei [9], discussed about the detection of diseases in an automated way of recognizing the disease using the machine learning method by using the images of the plant. Author has proposed model which contain three phases for the identification of region, generating the features and the disease classification. For that he proposed the SVM based model as an effective way.

Author ananthi, s.vishnovarthini [10], carried out a research on the classification of plant leaf and detection of diseases affects the leaf. They have concerned the controlling the pest which cause the diseases which minimize the yield production and mainly summarized the machine learning and image processing techniques like BPNN, SVM, KNN.

The system [11], This research project is with 5 main characteristics. These include leaf handling, network training module, Leaf identification module, pesticide identification and specialist recommendation module. The Leaves processing module for finding edges of the leaves and also finding the token values by using Image processing.[11] Training the full network and writing the mistake graph is the next module Network Training Module. The Recognition module is analyzing the leaf weather the leaf is already trained one or not. The Pest Identification component finds the plague of the leaf. The final component Expert advice part is going to retrieve the stored database information from the database regarding matching details of that found pest.

This scheme requires a scanner or digital camera to enter the system's digital images. And also system needs the pest attack or disease symptoms. The scheme will then produce the graphical perspective of the tokens of the added leaf analyzed and the key data of the leaf will also be provided. Another image showing the protected region of the leaf evaluating the injured region of the leaf, then showing the data as a proportion of the Leaves match and pest proportion as well.

"A Segmentation enhanced solid PNN model in various leaf pictures for illness detection" [12]. Proposed the project is used to enhance the agriculture using image processing and system for disease recognition. There is some normalization, level of size, adjustment of intensively level is done They applied histogram equalization done to achieve that. For the recognition process, Extraction techniques for ROI (Region of Interest) can be implemented over the picture. On the basis of the function assessment, clustering is implemented over the picture to split the picture into narrower sections. At the last phase, The PNN is used to recognize the presence of plant disease. [13] Probabilistic neural network with an embedded application of statistical algorithms. A hybrid technique for recognizing plant disease is described in this research paper. They consider leaf to be a main element here. To operate first, they used a circle projection technique to extract features. The PNN technique is used to recognize the disease. Experimental findings indicate that the technique has delivered the precise outcomes.

Diseases, insect attacks and traits are the biggest threats to the Agriculture and theses threats cause an enormous devastation to the entire agricultural sector as well as to the world. In that case, a huge demand for a suitable and appropriate method to identify and solve these threats is highly demanded in nowadays. Especially in a country like India where the majority of the population and economy are depended on the agriculture should even more focus on developing a proper problem-solving method to overcome from the threats in the agricultural sector.

However, in developing countries high losses in the agricultural sector as a result of diseases and other threats happens due to the illiteracy, lack of basic infrastructure for the farming, lack of technological assistant and etc. When considering the all these needs and issues developing a mobile application would be befitting as in modern days farmers can get access to mobile phones easier.

The basic technique uses in this application would be image processing where it helps to identify the fruit or the vegetable, segmentation of weed and soil , disease evaluation, clarification, and identification with the pretrained Artificial Neutral network (ANN) [14]. Image Acquisition- the program will be developed in Android using Eclipse framework and the image captured from the back camera of the device will be the input. Feature extraction module-Basically the background and green pixels of the captured image of the leaf will be removed and directed it for the further analysis. Feature database- Detection and classification will be happened in this stage with a large number of image databases. Decision making this is where the ANN will be using in order to come up with the solution for the captured image.

In this proposed research is regarding about trained models for identification and disease of Tomato plant disease. protection of crop from plant diseases and pathogens is a serious issue. Typical laboratory experiments are accurate but due to various reasons automation of the process would make it to be done easier. An expert system enriched with modern technologies is one of the best solutions.

Tomato plant is known as one of the India's largest agricultural production [12]. In that case disease detection in the plant is highly required. prediction model which based Image processing and IOT sensors would boost the tomato plant diagnosis. Several modeling methods have evolved as a range of different signs and illnesses discovered in tomato plants using ANN,Extreme Learning Machine (ELM), Deep Learning, Support Vector Machines (SVM), etc. Most of the times images are used as the input to the system.

Image processing-based approaches- Captured pictures will be uploaded in to the system and using various analytical techniques especially pre-trained AlexNet Architecture and identification and classification of disease will take in place after that.

An application of Internet of Things- It is combination of several communication technologies, IP protocol and embedded devices. It can interact constantly with real and digital worlds at the same time. Researches have been recorded that 98% of accuracy when predicting the status of the tomato plant using this technology.

III. METHODOLOGY

A. Image Acquisition

The affected leaf image captured using the mobile camera / digital imaging device and uploaded to the system. The uploaded image preprocessed to enhance the quality of image, like remove the non-uniform background, resize the image with the dimension as training data in RGB format. Nonlinear spatial filtering is using to remove the noise from the image.

B. Segmentation

The segmentation of the preprocessed image can be effectively carried out using the Otsu method, HIS model and K-means clustering, fluid C-means clustering, mountain clustering, semi-automatic image segmentation algorithm and subtractive clustering method. Semi-automatic image segmentation algorithm took into account color distribution information inside a rectangular and iteratively segment foreground and background without having difficult user interaction. Border matting was used to estimate simultaneously the alphamatte around the object boundary and the colors of foreground pixels.

First, affected leaves affected part and green color pixels will be identified. Threshold value of the green color pixels will be illustrated using the threshold equation

$$(x, y) = \begin{cases} 1, & if\ f(x,y) \geq T \\ 0, & if\ f(x,y) < T \end{cases}$$

Enhance the image using K means algorithms which lead to the high quality image to detect the nutrient deficiency. Edge detection technology will be use to find the carrying pattern of the pest which is used to detect the pest.

C. Feature extraction & Classification

The targeted regions features are extracted after the segmentation using techniques feature extraction methods are Skewness Asymmetric degree of pixels distribution in the specified window around its mean.

$$m = \frac{1}{mn} \sum_{i=1}^{m} \sum_{j=1}^{n} p(i, j)$$

$$m = \frac{1}{mn} \sum_{i=1}^{m} \sum_{j=1}^{n} \left(\frac{p(i,j) - m}{\sigma}\right)^3$$

Different intensity value between the neighborhood pixels

$$C = \sum_{i,} (i - j)^2 P(i, j)$$

After extraction the features from the affected leaf image the component uses deep learning algorithm and the technique to extract the image model. Therefor the image model has dependences on external library. Tensor flow is a library it is used for handle Deep learning algorithms such as convolutional neural network (CNN) algorithm. It is used for the image classification like identify healthy leaf or un-healthy leaf. Neural networks (CNN) algorithm learn the complex image by small layers there will be many layer for an image. Moreover, the keras used to deep neural networks its likely tensorflow. Trained image model has 1000 dataset for each disease ,pest affected and nutrient deficiency of the plant

D. Testing the features using selected techniques

In this phase, which is the final process in selecting the most appropriate classifier among the SVM classifier, CNN. So, at the end of the research comparing with the percentage of the accuracy, the better classifier is being suggested with the above mentioned algorithm. As well literature review based selection of most appreciable classifier also could be applied with the extracted features. So, either practically or analytically a most preferable with more accurate classifier will be selected.

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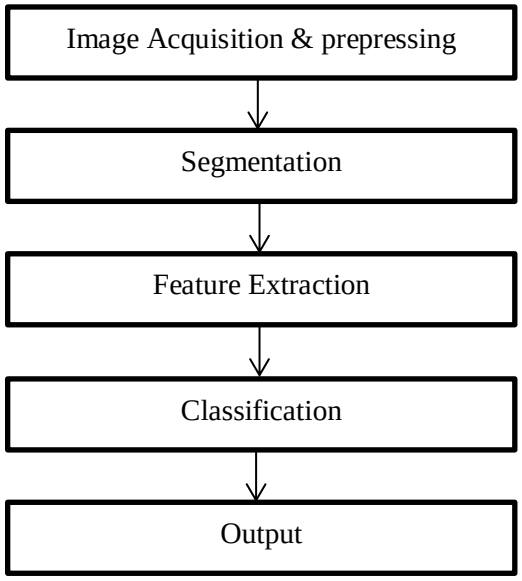

Fig 2:- Model Extraction Method

E. Image comparison using OpenCv for plant monitoring

The proposed system need to compare leaf images whether the leafs are still affecting by pests or not. Use the OpenCv which can find the changes of the images. SIFT is the method of OpenCv which is gets the key points of the images. The system needs to compare those key points therefore it uses the KnnMatch method of OpenCv which method is compares key points of the images and gets the good points. According to the number of good points system can predict the similarities of the images. Then system can easily find the solution for the affected leaves.

IV. CONCLUSION

Detecting the pest attacks, nutrient deficiency and monitoring the plant is the main purpose of the system. Our proposed methodologies are efficient and accurate for the automatic detection and monitoring in the early stage. Methods focus on the technique of image processing which is applied to the infected or affected leaves or unhealthy leaves image and use of machine learning CNN and K means clustering technique methods for detection can be efficient and accurate to classify the disease and to suggest solution.

V. FUTURE WORK

In this paper we have discussed about the detecting and giving the best solution by monitoring the pumpkin plant diseases and nutrient deficiency via examining the affected leaves using the machine learning and image processing techniques. yet there is still room for improvement as long as it is not close to 100 percent. By using more efficient way to choose best features, this method can be made to work in real time and Can be implemented in available Neural Networks which may rise the accuracy for the detection for a common genus plant .

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