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Advancement in Machine Learning Strategy for the Recognition of Plant Leaf Malady

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Abstract: ***Plant leaf does an exceptional play within the production of the crops since the energy flow is through leaves. Which is why the recognition of the plant leaf sickness is demanded. In the projected paper, the image processing-based methodology is employed to spot the plant diseases by relying on the symptoms on the leaves. There are five steps in the present work. The work starts with the acquisition of images. The Image pre-processing for increasing the standard of the photographs which includes hue conversion, sound elimination, histogram linearization. The snaps are bifurcated employing Mean Shift Cluster algorithmic rule. Hue, form, surface characteristics are obtained. In the final stage, disease classification is accomplished employing Support Vector Machine (SVM).***

Keywords: Hue conversion, Sound elimination, Histogram linearization, Mean Shift Cluster algorithmic rule, Support Vector Machine (SVM).

I. INTRODUCTION

In India, the foremost supply of resources concerning 58 percent of India's inhabitants is farming or crop production. Agriculture is a crucial precinct of India's financial resource as it offers about 17 percent of the entire GDP. India's meal and grocery store provide 70 percent of the sales which makes it the sixth-largest worldwide. By 2022 the agriculture export policy has set a target to increase the exportation of the agricultural commodities to over sixty billion dollars. Illness in plants can be discovered in diverse areas of suchlike roots, stems, fruits, leaves, etc. The important reason for the loss in agricultural production is the diseases found in the leaf. The leaf is the component of the plant that are highly exposed to the environment and are liable to diseases. The plant life cycle is directly affected when the plant leaf is exposed to diseases as the complete energy flow in the plant depends on photosynthesis which mainly occurs in leaves. The agriculture yield per land had improved by the early 19th century because of the newly evolved agricultural techniques. The standard and abundance of agricultural commodities are altered through the presence of diseases in plants. Studying plant disease is the study of visually evident patterns. Hence, plant disease detection is essential as the diseases in plants are inescapable. The traditional method of disease identification was the naked eye method which involves a giant workforce, time eating, and the results were inaccurate due to the expert's subjective perception.

Therefore, Machine learning appears to be a way better option to unravel this downside. A variety of machine learning (ML) techniques are suggested to identify and categorize plant leaf sickness using snaps. This automated technique has made it easier to resolve the problem. But there are few challenges like robustness and accuracy of the result.

II. LITERATURE SURVEY

Camargo et al [1], had exhibited a system for the identification of the visible trait of the leaf illness analysing colored snapshots. The captured images are transformed from gray image to l3a, l3b, and H channel. By using Gaussian filter the transformed images are enhanced. Then the segmentation was performed to recognize an optimal threshold to discriminate among the backdrop and the target body. Later the histogram of intensities was selected and classified the regions as diseased or healthy using the Support Vector Machine (SVM) classifier.

A. Demerits

1) When Area, Perimeter, Centroid, and Diameter are put-to-use as lone input, the accuracy of the classification was below 50%.

2) When texture features were used solely as input the accuracy of classification was below 50%.

Anand et al [2] has submitted a work for diagnosing the brinjal leaf illness by utilizing two techniques. They are ANN and Image processing techniques. Initially, RGB images are read and enhanced using histogram equalization. Segmentation of the input images are done using K-means algorithmic rule and K-nearest neighbor classifier. Gray-level co-occurrence matrix (GLCM) parameters are used for the extraction of features. In the last step, the classification is done using ANN.

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B. Demerits

1) The work proposed is only for some of the diseases of brinjal leaves.

2) There are numerous disadvantages of using Artificial Neural Network such as it requires hardware equipment following its structure. As ANN works with numerical information problems have to be translated into numerical value before being introduced to ANN which directly influences the performance of the network as it depends on the user's ability.

Anand et al [3] have showcased a procedure for recognizing leaf illness utilizing ANN and image processing techniques. The developed framework starts with capturing the leaf images using a digital camera and the image database is created for training and testing. By using CIEL*a*b*, or CIELAB space color approach image segmentation process is performed. In the later stage, the Gabor filter method is utilized for the extraction of features. The recognition process includes two processes, training, and classification. ANN is used for image classification. The final results indicate that the proposed approach had performed well and can successfully classify and detect the diseases.

C. Demerits

1) The accomplishment of the classification algorithm performance merely didn't rely on the number of unrevealed neurons, the numeric features, and the terminating flaw rate but also hang on the quality of the image obtained. Therefore, optimization must be tested for efficient classification of samples to their corresponding classes.

2) The image must have a uniform background in light environment and margin distance betwixt the given image and the camera must be 1 or 2 feet.

Pooja et al [4] have put forth work for recognizing leaf disorders using the image processing approach. The digital copies of the images are acquired and pre-processed. The pre- processed images are the inputs for the segmentation process. The segmentation of the pre-processed images is done using the K-means clustering rule. Threshold has been set using Otsu's method which is used to create RGB images from the gray-scale. Methods such as co-occurrence, skewness, contrast, correlation are put-to-use for the extraction of the features. In the ultimate stage, SVM is used for the classification process.

D. Demerits

1) K-means does an excellent job in acquiring the structure of the given input data if and only if the shape of the clusters is in the sphere. If the clusters are in difficult geometric forms, the clustering of data will be very poor and problematic.

III. PROPOSED METHODOLOGY

The epistemology of the current work has been conferred pictorially in Figure 1.

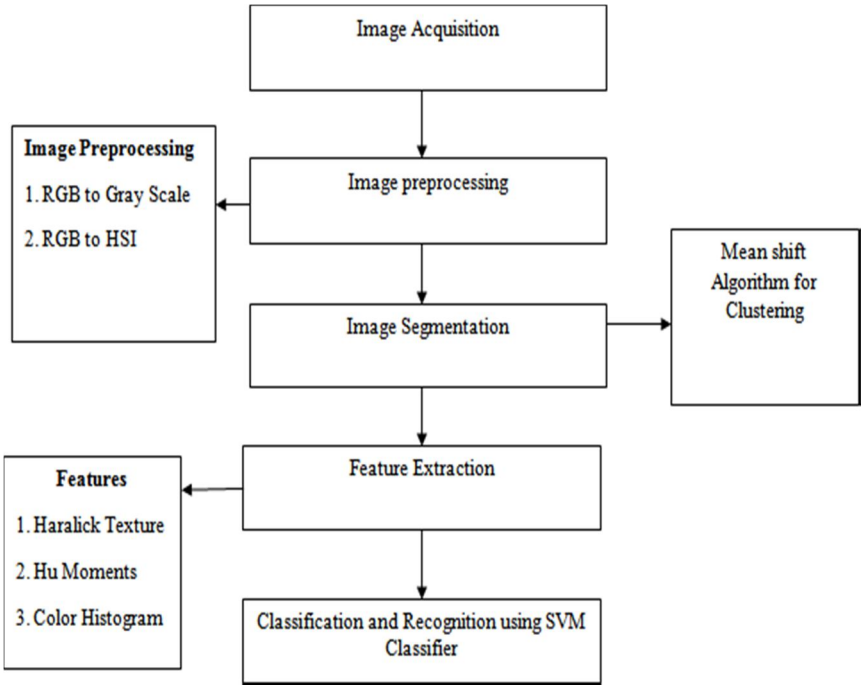


Figure 1.: Summary of the planned system

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A. Acquisition of images

Firstly, the snapshots of the leaves are obtained through the camera. The obtained pictures are collected and stored in the database. The stored images in the database are separated and labeled accordingly to the disorder of the leaf which determines the performance of the used epistemology.



Figure 2: Pictures obtained from a photographic camera

B. Image pre-processing

The images obtained from the camera are subjected to pre- processing increases the standard of the pictures. The pre- processing steps embody hue conversion, sound elimination, histogram linearization, etc. Here hue conversion technique is employed to extend the standard of the pictures. The RGB image is regenerated to gray and so to HSI for the enhancement of the image.



Figure 3: Conversion of RGB image to Gray image

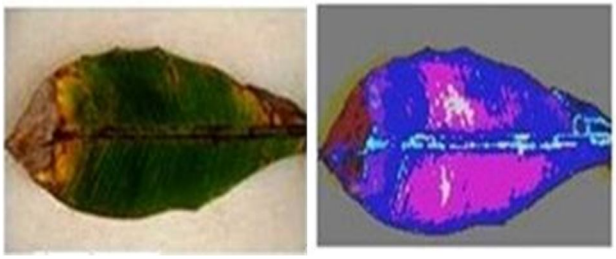


Figure 4: Conversion of RGB image into HSI

C. Image Segmentation

In computer vision, image segmentation is the process of partitioning a digital image into multiple segments. The segmentation intends to reduce and/or change the portrayal of a figure into something more essential and smooth to inspect. There are many variety of rules for image segmentation. Within the planned framework Mean Shift Cluster algorithmic rule is employed for image segmentation. This algorithm is used for sleuthing extremely dense regions. This rule uses the sliding window method for convergency to the middle of the densest region.

1) *Step 1:* Initialize any random point, and place the window on that data point.
2) *Step 2:* Calculate the mean of all the points lying inside the window.
3) *Step 3:* Shift the search window, such that it is lying on the location of the mean.
4) *Step 4:* Repeat until converge.

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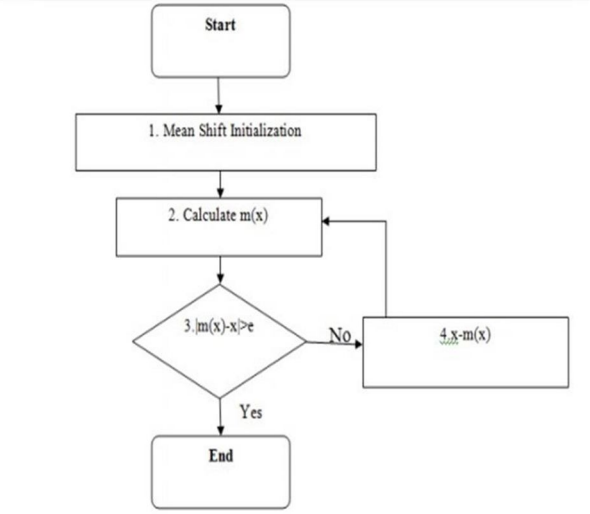


Figure 5: Steps in Mean Shift Cluster algorithmic rule

D. Extraction of features

Hue, form, and surface characteristics are some of the features of a picture that have been extracted using extraction techniques. The planned work principally considers three features such as Hue conversion, Hu moments, and Haralick texture that resemble hue, form, and surface characters. The hue conversion is an illustration of the distribution of colors in a picture. Hu Moments are a set of 7 numbers calculated using central moments that are invariant to image transformations. Haralick texture features consists of data regarding the characteristics of the image texture like gray- tone linear dependencies, homogeneity contrast, the complexity of the image and nature of boundaries present.

E. Classification

This is the ultimate step within the method. SVM is the classification rule utilized. SVM is the supervised machine rule principally used for classification and regression. It's one of the foremost effective algorithms compared to alternative algorithms. The titled data is taken as input and in return, it gives the best result. Based on the titled data the SVM classifier organizes the leaf illness using the extracted features. The concept of the SVM is to form a hyperplane betwixt the data sets to point that category it belongs to. The performance of the Support Vector Machine classifier is evaluated by studying the anticipated data and actual data.

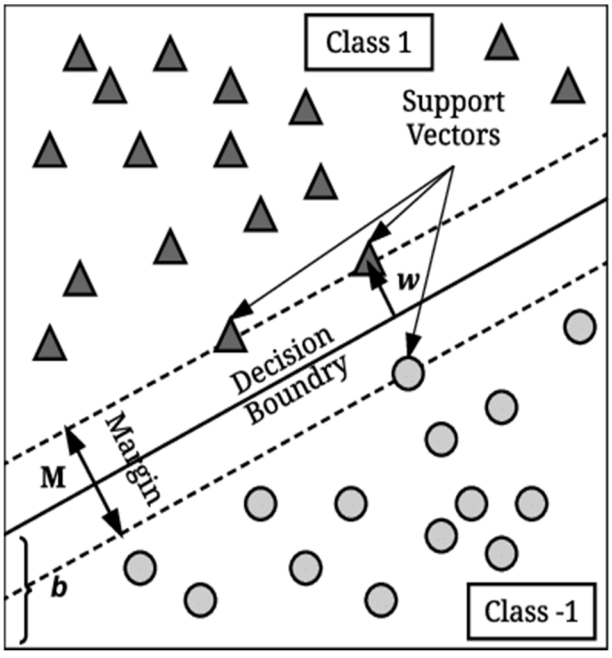


Figure 6: Support Vector Machine Classifier.

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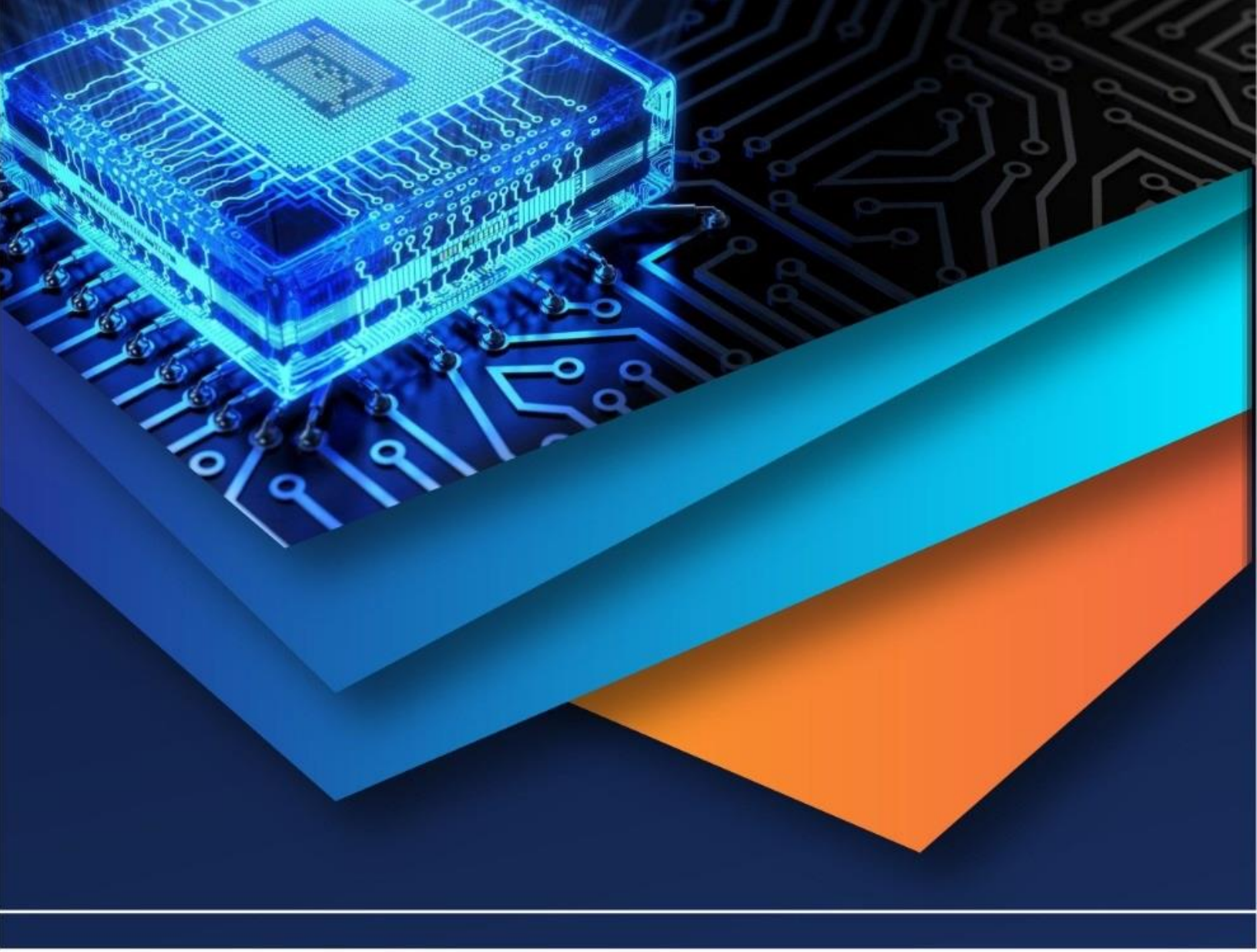
IV. CONCLUSION

In the proposed framework the Internet of Things (IoT) and Machine Learning (ML) techniques are utilized. After the pictures are captured using the photographic camera they are stored in the database for further classification. The snaps are pre-processed for the betterment of the standard of the snaps. Transformation of Red, Green, Blue (RGB) image to gray image and Hue, Saturation, Intensity (HSI) color model. The segmentation of the pre-processed image is done using the Mean Shift Cluster algorithmic rule. Features like color histogram, Hu moments and Haralick texture are extracted. At the ultimate stage, the classification of the diseases is done employing the (SVM) classifier. After the detection of the disease, the message will be sent to the agricultural officer about the plant disease using the Internet of Things (IoT). Later the officer provides information about the disease and the pesticides that need to be used to cure the plant disease. This helps the farmers and the crop yield is increased.

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