Nutrition Deficiency Detection In Agricultural Field Using K-Means Segmentation

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Abstract— Plants are very precious part of our earth and acts as an important source of energy. They are the intrinsic piece of baffle to unravel the matter of worldwide warming. They require the right combination of nutrients to survive, grow and reproduce. Several sorts of deficiency are present in plants. Nitrogen is one of the abundant mineral and a major component of amino acids that plays a vital role in crop production. K-means clustering algorithm is employed for segmentation which differentiate objects that supports group of features into K number of classes and eventually classification is performed using K-means classification. Thus with the help of image processing technique the deficiency in the leaves can be detected accurately in the early stage itself. It will be useful for the farmers and might be helpful for the drastic development in farming.

Keywords— Plants, Approximate adder, nutrition deficiency, K-means classification

I. INTRODUCTION

Plants assume an important part within the earth. There'll be no presence of the world's environment without plants. In any case, as of late, some forms of plants are at the threat of eradication. Considering the tip goal to secure plants and also to index differing types of greenery diversities, a plant database seems to be exceptionally vital. There's immense volume of plant species round the world. With a selected end goal to handle such volumes of information, improvement of a quick and skilled grouping system has become a dynamic territory of research. Additionally, alongside the preservation highlight, acknowledgment of plants has likewise ended up vital to abuse their therapeutic properties and utilizing them as wellsprings of option vitality sources like bio-fuel. There are number of minerals and nutrients which helps in the growth of plants out of those there are 13 essential minerals and nutrients required for healthy growth of plants and crops. Whenever the plants does not get the adequate supply of minerals and nutrients it will reflect on the yield or the standard of the crops and plants. So it is important to maintain the sufficient nutrient level for the plants in agriculture and farming. The well being of the plant is reflected in leaves. Normally color of the leaf is used to identify the nutrition level and health of the plant. Chlorophyll and nitrogen are proportional with one another. So the chlorophyll content reveals the amount of nitrogen present. Many methods have been practiced to monitor these two contents.

Based on the practices followed these methods are classified into two different categories: Destructive and Non-destructive. Image processing technique comes under non-destructive method. Image processing technique is proving to be the promising method among all other methods. We have developed an affordable, user friendly and non-destructive method to monitor the condition of the plants in addition to that it also keeps check on the chlorophyll and nitrogen content of leaves employing a portable photographic equipment.

Nitrogen (N) inadequacy causes blanched, yellowish-green plants with elongated stalks. Since nitrogen is a portable supplement within the plant, indications start on the more established, lower leaves and advance up the plant if the inadequacy continues. The condition is supported by frosty or soaked soil; dry soil, especially after mid-season; lots of low-nitrogen buildup; sandy soil; deficient preparation; draining from overwhelming precipitation; and overflowed or ponded soil when the temperature is warm. Nitrogen is vital for plants because it is a major component of chlorophyll. Nitrogen is also a major component of amino acids which are the building blocks of proteins. Without proteins plant tends to die. Nitrogen deficient plants shows poor growth and it affects the yield.

FIG.1 NITROGEN

II. LITERATURE SURVEY

Y. He, F. Liu, and D. Wu put forwarded the rapid advancement in both fields of precision farming and multimedia technology and provided an overview on state-of-the-art of different methods to connect them together along with techniques from three different aspects: biometric modeling, image acquisition and image processing. Various technical schemes were analyzed and compared with each other and pointed out the future trends.

Piti Auearunyawat by examining the leaf color he developed an automatic nitrogen estimation method in sugarcane. The image of the sugarcane leaves are captured with the help of digital photographic equipment and then the relation between nitrogen content and leaf colors in red(R), green (G), blue(B), and near infrared(IR) are analyzed.

J. Tang, C. Deng, and G.-B. Huang proposed a new ELM-based formed learning scheme of multilayer perceptions. The proposed system is divided into two main components: 1) self-taught feature extraction and they are associated by random starting unknown weights. These attain more consolidated and purposeful feature representations than the convious ELM method which pave way to a better generalization with swift learning.

X. Yao, W. Luo, and Z. Yuan presented a system that reveals various problems regarding plants using a normalized agro-chemical model tends to provide results one week ahead of the traditional observation by implying the inherent correction on color and shape contortion of foliar picture.

D. Liu, D. Wang, D. Zhao, Q. Wei, and N. Jin proposed a neuro-optimal control scheme for a class of unknown discrete-time nonlinear systems with minimal cost. A neural network is developed to figure out the unknown controlled system to carry out the iterative algorithm. Further two other neural networks are used as parametric structures to assist the execution of the iterative algorithm along with a simulation illustration.

Hongming. Zhou introduced Extreme Learning Machine based Auto Encoder (ELM-AE) that learns feature representations using singular values and is used as the fundamental building block for Multi Layer Extreme Learning Machine (ML-ELM). ML-ELM performance is superior compared to auto encoders based deep networks and Deep Belief Networks (DBN), while in par with Deep Boltzmann Machines (DBM) for MNIST dataset.

III. RELATED WORK

This work investigates how the illuminant evaluation techniques is evolved, analysing automatically extracted information about the output from the images. Here by taking into account of indoor/outdoor classification, the images of these classes present different content and are usually taken under different radiance satisfactions. Here worked out various ideas for the selection and so the tuning of the foremost appropriate algorithm (or combination of algorithms) for each class. We also examined the acquisition of a variable class which corresponds to respective images where the indoor/outdoor classifier isn't confident enough. The illuminant estimation algorithms summed up here were obtained from the framework recently proposed by Van de Weijer and Gevers. We provide a method to automatically alter the algorithms' parameters. We have tested the proposed strategies on an appropriate subset of the majorly used Funt and Ciurea dataset [1].

The variance in growth among different stages of healthcare facilities had became the notable social issue in China's urban healthcare system, which has lead to the unreasonable patient admit distribution on the degree of both intra-hospital and inter-healthcare facilities. At the time of this research, we found out a method to check out the favourable macro level patient flow distribution with respect ot multi dimension inputs and outputs for the two-level healthcare system. The proposed method blends the discrete-event simulation (DES), the multi objective optimization and so the simulation budget assigning together to develop the final system performances by finding the approximate Pareto patient flow distribution within the hierarchical healthcare system. The multi objective optimal computing budget allocation (MOCBA) is used to spice up the efficiency in all aspects of finding the solution.

A case study supported the important data is dole out to uphold and utilize the proposed method [2]. The thin-film transistor-liquid crystal display (TFT-LCD) module assembly production could be a versatile job-shop organizing problem which might find difficult to please the customer needs on time. On the module assembly work, each workstation has identical and non-identical parallel machines that allows the roles at various processing speeds looking on the merchandise families. To cope up the enormous number of jobs, the machines are created because many tools are used to organize products sequentially. The main objective of this is to come up with a novel approach to handle the TFT-LCD module assembly scheduling problem by look after the following multiple and sometimes discord objectives simultaneously just like the makes pan, the weighted number of tardy jobs, and so the overall machine setup time, prone to the limitations of product families, non-identical parallel machines, and sequence-dependent setup times.

Specifically, we developed a multi objective hybrid genetic algorithm (MO-HGA) that combines with the variable neighbourhood descent (VND) algorithm as a local search and TOPSIS evaluation technique to derive the only considered solution [3]. In Existing system, we proposed a cost effective and exact non destructive image-based technique to identify the nitrogen amount in wheat crops on field with various sunlight intensities employing a conventional camera. Because the intensity of the sunshine source will have supreme effects on the looks of the wheat plants images even they're acquired from the similar field with the identified fertilizing level treatment. These images, therefore, should be stabilized before subsequent image processing steps.

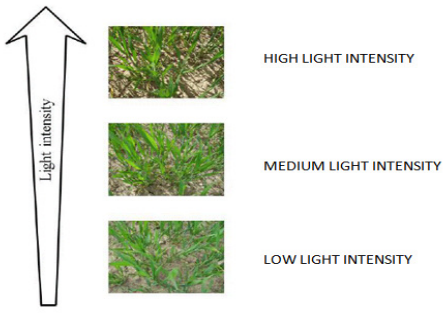

FIG.2 LIGHT INTENSITY

The difference in the color of the wheat leaves after image enhancement process is just influenced by the different fertilizing mixtures. If the nitrogen fertilizer is given to the plants the appearance of the plant leaves are pale green in color. During this step, we introduce a distinctive method for color normalization by using combinations of deep algorithm (GA) and 24-patch Macbeth color checker because the color reference.

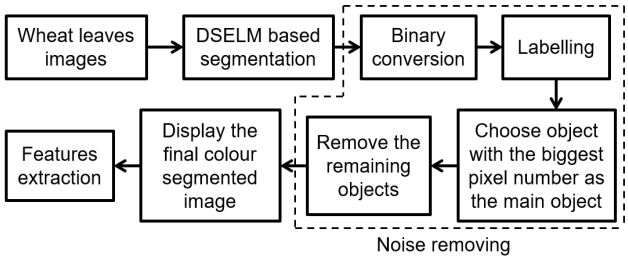

FIG.3 IMAGE SEGMENTATION

Extreme learning machine has been popular and the recent successful approaches in machine learning with much faster training speed than the standard multilayer perceptron (MLP). The GA is one amongst the evolutionary algorithms which involves selection, crossover, and transformation operators to create its population more distinctive and thus prevent the algorithm to be strucked during a local optimum. Conceptually, the variety will increase the algorithm's speed to attain global optimum since it'll countenance the algorithm to determine the answer space faster.

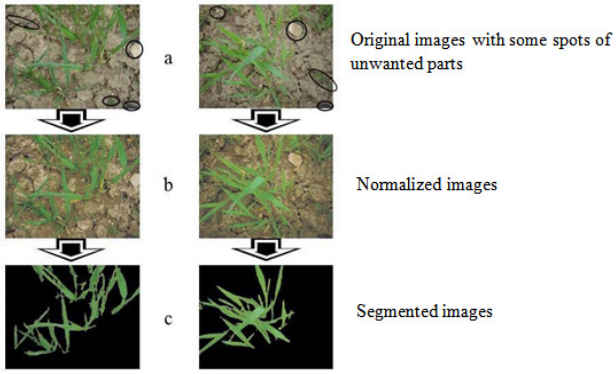

Fig.4 Color Normalization And Image Segmentation

Macbeth color checker is sometimes used as a reference target for pictorial and film making work still as calibration process, the convious step is image segmentation and features extraction. During this step, we utilize DSELM to tell apart wheat leaves because the object of interest from unsatisfactory images, like soil, weeds, dried leaves, stems and stones. After image segmentation, 12 computative features from four styles of instant of every RGB color channel, i.e., mean (mean), instant (variance), third instant (skewness), and fourth instant(kurtosis), are extracted from the segmented images because the nutrient estimation interpreters.

Here states the use of those computative features as interpreters. Since they denote the color distributions of wheat leaves more markedly instead of one color channel from a particular color model or combinations of some color channels. Within the nutrient estimation step, we combine several DSELMs with different invisible layer numbers by using committee machine and optimize the results with GA. The estimated results of the proposed approach are compared with existing nutrient estimation.

This paper proposes a modern intelligent analytical machine vision by using DSELMs fusion and GAs to evaluate nitrogen level in wheat plants for agricultural modernization. A newly developed DSELM-based MLP is employed to formalize the color resolution. Unlike other learning algorithms like back-propagation-based MLP, DSELM is in a position to use more important information with much faster learning speed. Within the meanwhile, the utilized norm-1 (_1)standardization is in a position to come up with more sporadic representations than other MLP learning algorithm. Thus, the matter of color irregularity because of various light concentrations are ready to be met out by upcoming DSELMs fusion with 24-patch Macbeth color checker because the color reference, and its combination with GA for image standardization. In addition, the developed GA is engaged to work out the proper output weights of every DSELM.

DSELM is additionally utilized within the image segmentation process to tell apart the required target from noise images as DSELM is simple instructions and is capable to extract more sporadic and exact features layer-by-layer with higher layers represent more conceptual information than previous layers. Within the nitrogen estimation step, a committee machine is employed to mix the output of DSELMs with various invisible layer numbers. Moreover, the GA is applied to optimize the estimation results.

IV. PROPOSED SYSTEM

The input image should be preprocessed because images are corrupted by a kind of multiplicative noise like intensity level and shadow on a cotton leaf images which will contain useful information about the leaf spot that may be utilized in the diagnosis. K-means clustering algorithm is employed for segmentation which classifies objects supported a group of features into K number of classes where feature extraction is color feature variance used for matching the train image features from database images and eventually recognition is performed.

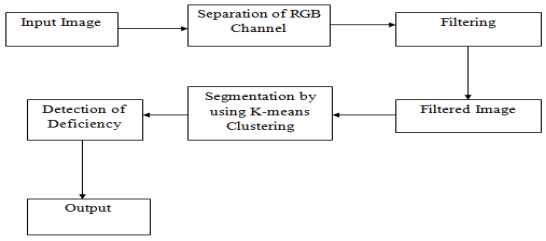

FIG.5 BLOCK DIAGRAM

A. Image Acquisition

The data collection is that the major aspect of the data collection in area. The identical collection has been utilized in other studies of automatic scan images segmentation. Various image databases' available world-wide along their name, description and applications. The image acquisition is required to gather the particular source image. An image must be converted to numerical form before

processing. This conversion process is termed digitization. The primary step of each image processing application is image acquisition or image capturing. The photographs of leaves are captured using the photographic equipment and it'll store it in some formats like .PNG, .JPG, .JPEG etc.

B. Pre-Processing

The principle objective of the image enhancement is to process an image for a particular task so the processed image is best viewed than the original image. Preprocessing is process which helps us to scale back the background noise. Intensity of the image should be normalized. By Enhancing input image or image captured by photographic equipment, is to get rid of the background noise, image can get enhanced visual appearance of input images. By this enhancement process artifact image is highlighted. Image preprocessing is employed to form an enhanced and please full version of the captured image. The RGB color model is an additive color model in which red, green, blue light are added together to reproduce a broad array of colors. The color of a pixel is formed from three components; red, green, and blue (RGB). The disadvantages of RGB models are, it requires large space to store and it'll take longer to process. So there's a desire for converting the RGB model to Gray model. Resizing is a very important step in image preprocessing. Resizing is nothing but, changing the dimensions of a picture. The captured image is resized using some resizing methods consistent with the need of the system.

C. Filtration

This is also a process which comes under pre processing; a mean filtering technique is employed to get rid of unwanted noise in enhanced image. The median filtering technique is employed by mean to calculate PSNR value.

D. Segmentation

Image segmentation is the process of screening a digital image into multiple segments. Each of the pixels in a region is comparable with relevant to some characteristic or computed property, like color, intensity, or texture. The segmentation step was used to separate the image into different regions that supports similar characteristics within the image. These regions show distinct and unique characteristics from each other and may not intersect each other. Each of the regions should portray some level of consistency within the region. K-Mean Clustering method is the best methods to detect the deficiency of plants. K-means Clustering algorithm is simple and faster than the hierarchical clustering. And it is a method of vector quantization, originally from signal processing helps to deal with large number of variable. But it produces different cluster result for various number of cluster. It also helps in identifying the nutrition deficiency of plants. Clustering is the task of grouping a set of different objects in a manner that objects in the group are pretty much similar to each other. The same method is used in k-means clustering. In k-means clustering it splits the provided data into a definite number of clusters. It classifies a given set of information into k number of disjoint cluster. K-means algorithm consists of two separate phases, in the first phase it will find the k centroid and in the second phase each points will be placed in a position where centroid can be placed nearer from the respective information. Each centroid will be going around trying to place itself in the average distance between the clusters. The centroid for every cluster is that the point to which the sum of distances from all the objects in this cluster is minimized. So K-means is an iterative algorithm during which it minimizes the sum of distances from each object to its cluster centroid, over all clusters.

E. Feature Extraction

Feature extraction is the most significant part of this project. The properties variance, entropy, contrast etc are extracted from the image and are accustomed train the dataset for the classification. Image processing is the analysis and manipulation of graphical images from sources like photographs. There are three main steps in image processing; first, is the conversion of captured images into binary values that a computer can process; second, is the image enhancement and data compression, and also the third is the output step that consists of the display of the processed image. The foremost important a part of this segmentation method is extension of feature space.

F. Classification

The classification methods may be considered as derivative from detection methods, these one's tends to analyze and label the various factors affecting the plants rather than discovering one specific deficiency in middle of different conditions and symptoms. As within the case of measurement of quantity, classification methods nearly include a segmentation step, which is often followed by obtaining the variety of features which will nourish some kind of classifier. The methods presented within the following are grouped consistent with the type of classification strategy employed.

V. IMPLEMENTATION

In the project work, the experiments are carried through Matlab coding. We have prepared a GUI layout with menu inventory. By clicking on each menu, it performs an independent operation. Keeping Digital image processing as a tool to research the color plant image and extract the important features of the plant image, was implemented in the present study. Advanced digital technology has made it feasible to exploit multi-dimensional signals with systems that range from simple digital circuits to advanced parallel computers. It's an betterment of pictorial information for human interpretation and processing of image data for storage, transmission, and representation for autonomous machine perception.

FIG.6 ORIGINAL IMAGE

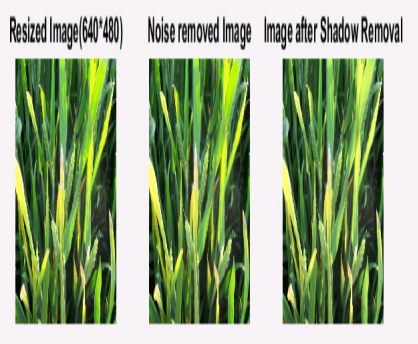

FIG.7 PREPROCESSED IMAGE

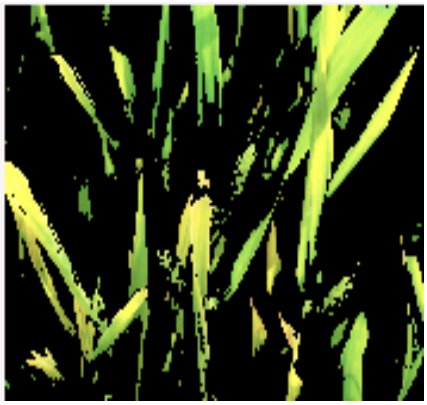

FIG.8 K-MEANS SEGMENTATION

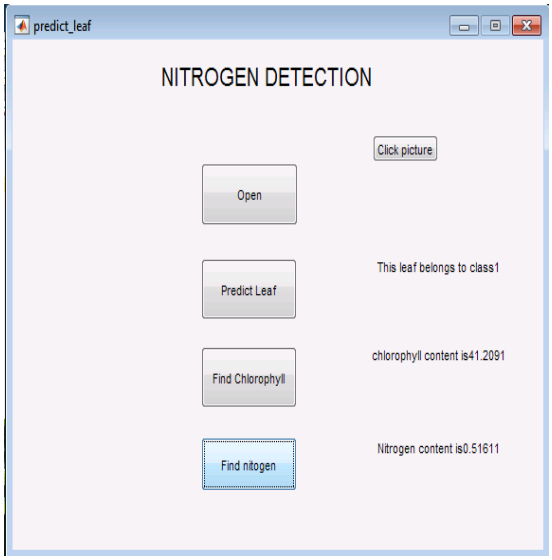

FIG.9 NITROGEN DETECTION

VI. CONCLUSION

Plant unhealthiness is caused by both living organism and nonliving factors such as insects, fungi, bacteria, bad drainage, too hot or too cold temperature, poor fertility, unseemly light, lesser availability of oxygen etc. Nitrogen is taken into account as one of the foremost important nutrients because it plays a fundamental role in plant life cycle. it's necessary for growth, and a significant component required for chlorophyll production and photosynthetic apparatus and in other plant cell ingredient as nucleic acids, amino acids and proteins. Chlorophyll & Nitrogen are essential elements in plants. These are associated with each other. Chlorophyll could be a green substance in plants. Hence chlorophyll is necessary factor for a plant, so efficient calculation of chlorophyll pigment helps to take care of the healthy crops by applying actual needed fertilizer to crop field. Image processing was applied as fast, helpful and nondestructive procedures for crop development verifying.

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