APPLICATION OF IMAGE PROCESSING TECHNIQUES TO DETECT PLANT FOLIAR DISEASES

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ABSTRACT

The agricultural output that the growing Indian population relies on is hindered by several factors, including diseases that affect different parts of plants and the incorrect identification of these diseases at the wrong time. Therefore, there is a need for methods that assist farmers in accurately diagnosing diseases and providing timely results. This proposed technique involves collecting a leaf sample from the farmer, using segmentation methods to isolate the diseased region, and analyzing the features of the segmented leaf using the SVM algorithm to determine whether it is healthy or unhealthy. If the leaf is deemed unhealthy, the type of disease affecting it is detected.

Keywords: Machine Learning, Artificial Intelligence, Classification,Plant Disease Analysis, Support Vector Machines, K means Clustering .

1. INTRODUCTION

Plant sicknesses have been a prime hassle as it is able to cause massive discount and losses in each first-rate and amount of agricultural products [19]. A substantial majority of the growing countrywide populace relies upon on agriculture yields. Farmers have wide variety of range to pick out suitable fruit or vegetable plants to develop. however, the cultivation of these crops [13] for optimum yield and pleasant produce is enormously technical & difficult [2]. it may be progressed by way of the aid of technological aid and mechanized farming [5]. The control of perennial vegetation calls for continuous and near monitoring [9] mainly for the management of illnesses that could affect production considerably [2]. Many authors have worked at the development strategies for the automatic detection and category of leaf diseases primarily based on high resolution multispectral, hyperspectral and stereo photos. The philosophy at the back of precision agriculture isn't only together with a direct budget friendly optimization of agricultural production [8], it additionally stands for a reduction of dangerous outputs into surroundings and non-target organisms [13]. mainly a infection of water, soil, and meals sources with pesticides needs to be as minimum as possible in crop manufacturing.

Computerized detection of plant illnesses is a completely essential research topic as it could show the benefits in tracking large fields of crops, and consequently mechanically come across the symptoms of sicknesses [10] as quickly as they appear on plant leaves. consequently searching out rapid, automatic, much less high priced [5] and accurate approach to hit upon plant disorder cases is of incredible realistic significance [12]. gadget gaining knowledge of [1] based totally detection and popularity of plant illnesses can provide sizable clues to identify [5] and treat the sicknesses in its very early stages. relatively, visually or bare eye identification of plant diseases is pretty pricey, inefficient, faulty and tough. additionally, it requires the knowledge of a nicely-skilled botanist [1]. In [4] the authors have labored at the improvement of methods for the automatic classification of leaf diseases based on excessive decision multispectral, hyperspectral and stereo pictures. Leaves of sugar beet are used for evaluating their technique. Sugar beet leaves might be inflamed with the aid of several diseases, inclusive of rusts, powdery mildew. In [2], a quick and accurate new technique is evolved based on laptop vision picture processing for grading of plant diseases. For that, leaf place became segmented through the use of Otsu's [7] method. After that the sickness spot regions were segmented via the use of Sobel edge operator [3] to come across the disease spot edges. finally, plant diseases are evaluated by way of calculating the quotient of disease spot and leaf areas. Previous works display that device mastering strategies can effectively be applied as an efficacious disorder detection mechanism. Examples of machine getting to know strategies which have been carried out in agricultural researches are synthetic Neural Networks (ANNs), selection trees, ok-means, k nearest associates, guide Vector Machines (SVMs) and BP Neural Networks. as an example, Wang et al. in [19] predicted Phytophthora infestans [8] contamination on tomatoes by using ANNs. also, Camargo and Smith in [5] used SVMs to perceive visible signs and symptoms of cotton mould sicknesses using SVMs.

2. MACHINE LEARNING

A total of five specific gadget mastering techniques for learning classifier had been investigated on this paper. those strategies are decided on because of the cause that these classifiers have achieved nicely in lots of real programs.

2.1 K- Nearest Neighbour (KNN)

The ok Nearest Neighbor is a slow learner which means that this classifier can train and take a look at at the equal time. KNN classifier is an example based classifier that plays classification of unknown times with the aid of relating unknown

to regarded via the use of distance or such similarity functions. It takes okay nearest factors after which assigns class of majority to the unknown instance [11].

2.2 Naïve Bayes Classifier

Naïve Bayesian classification is normally called a statistical method [14] classifier. Its foundation is on Bayes' Theorem, and makes use of probabilistic analysis for green classification. Naïve Bayesian Classifier [14] supply greater correct outcomes in less computation time when implemented to the massive records sets along with hundreds of pix.

2.3 Support Vector Machine (SVM)

Vector gadget is gadget mastering approach which is largely used for type. it is a kernel based totally classifier; it was developed for linear separation which become capable of classify records into lessons best. SVM has been used for distinct sensible issues together with face, gesture popularity [10], cancer diagnosis [8] voice identity and glaucoma prognosis.

2.4 Decision Tree

An IJTEEE copyright form need to accompany your very last decision Tree Classifiers (DTC's) are being efficaciously used in many areas which include clinical analysis, analysis, speech recognition, man or woman reputation and so on. choice tree classifiers have potential to transform the complicated choice into smooth and understandable choices.[7]

2.5 Recurrent Neural Networks

Recurrent Neural Networks (RNN) includes remarks connections.In comparison to feed-ahead and lower back propagation networks,the dynamical properties are more significant. Neural network [6] has evolvement within a constant kingdom and the activation values of any devices do no longer change anymore. but in some instances, in line with required state of affairs it's far crucial trade the activation value of the output neurons [6].
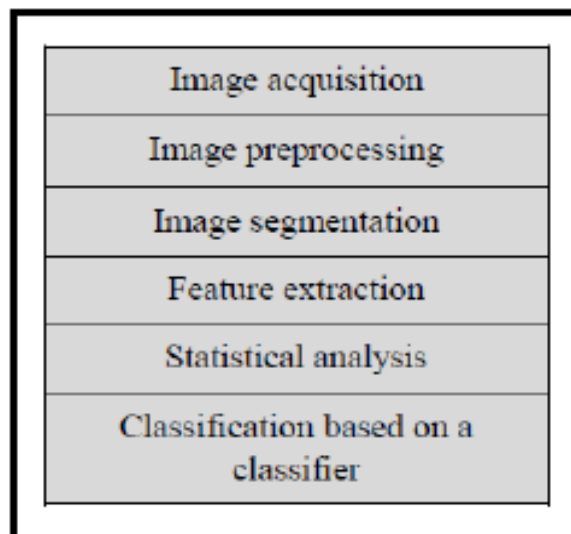
3.   PROPOSED METHOD

Figure. 1 The proposed Method

3.1 Image Dataset

facts set is ready and is used on this research. Leaf samples had been received from indoor and natural scenes. This is composed of sorts of leaves. those leaves can be divided into normal and diseased. The Nikon digicam D90, that's 15 megapixels camera, is used for photograph acquisition cause. software mode is used for greater element inexperienced and blues. Aperture is regular approximately 35 and the lens used is 18-135 mm. Distance of object from lens is about nine to twelve inches. pix are received in indoor lights.

3.2 Segmentation using K means clustering

K means clustering is a partitioning/dividing approach. The characteristic kmeans partitions facts into k mutually exceptional clusters [15], and returns the index price of the cluster to which it has assigned every observation. unlike hierarchical clustering and semi hierarchical, okay-manner clustering operates on real observations or rows (as opposed to the larger set of dissimilarity measures),and creates a unmarried degree of many clusters. The conclusions imply that k-manner clustering is frequently extra suitable than hierarchical clustering for huge quantities of records.

k way treats every commentary or row in the records as an object having a region in area. It unearths a significant partition wherein objects within every cluster are as close to every other as viable, and as a long way from gadgets in

different clusters as possible. you can select from multiple distance measures, depending on the form of statistics that we're clustering. Each cluster inside the partition is defined by using its member objects and by way of its centroid, or even the center. The centroid for every cluster is the factor to which the sum of distances from all objects in that cluster is minimized and evaluated. Kmeans computes cluster centroids otherwise [8] for each distance degree, to decrease the sum with admire to the measure that which has been specific.

k means makes use of an iterative set of rules that minimizes the sum of distances from each item to its cluster centroid, over all clusters that have been created. This algorithm moves items in among clusters until the sum can not be decreased any similarly. The result is a set of clusters which are as compacted and are well-separated as a ways as possible. you will manipulate the details of the minimization the use of several non-obligatory input parameters to kmeans clusters, which includes ones for the initial values of the cluster centroids, and for the most wide variety of iterations. by way of default and by way of preference, kmeans makes use of the k-means algorithm for cluster middle initialization and the squared Euclidean distance metric to determine distances.however, Kmeans clustering is used to partition the leaf image into 3 or extra clusters in which one or greater clusters comprise the sickness in case while the leaf is infected by means of more than one ailment. In our implementation a couple of values of variety of clusters had been tested. best outcomes had been received whilst the range of clusters become both three or 4.

Figure 2 Disease affected leaf

Figure. 3 Disease affected area obtained by K means clustering.

3.3 Feature Extraction

Statistical texture primarily based capabilities are extracted the use of gray degree Cooccurance Matrix (GLCM). these are spatial capabilities that imply pixel dating based totally on grey scale depth and orientation. [19] a total of eleven Haralick features are used which are calculated the usage of gray level Co-incidence Matrix (GLCM). desk 1 suggests the outline of how every texture function is calculated. in the equations, n constitute the variety of discovered values. X is the pattern area and P is the populace.

Table. 1 Statistical Features

Angular second moment (energy)	$\sum_{i=0}^{G-1} \sum_{j=0}^{G-1} [p(i,j)]^2$	(1)
Corelation	$\sum_{i=0}^{G-1} \sum_{j=0}^{G-1} \frac{ijp(i,j) - \mu_x \mu_y}{\sigma_x \sigma_y}$	(2)
Variance	$\sigma^2 = \sum_{i=0}^{G-1} (i - \mu)^2 p(i)$	(3)
Inverse difference	$\sum_{i=0}^{G-1} \sum_{j=0}^{G-1} \frac{p(ij)}{1 + (i-j)^2}$	(4)
Sum Avg	$\sum_{n=0}^{G-1} n^2 \, p_{x-y}(n)$	(5)
Sum variance	$\sum_{i=2}^{2N_g} (i - f6)^2 \, p_{x+y}(i)$	(6)
Sum entropy	$\sum_{i=2}^{2N_g} p_{x+y}(i) \log(p_{x+y}(i))$	(7)
Entropy	$\sum_{i=0}^{G-1} \sum_{j=0}^{G-1} p(i,j) \log_2[p(i)]$	(8)
Diff variance	$\sum_{i=0}^{N_{g-1}} (i - \mu_{x-y})^2 \, p_{x-y}(i)$	(9)
Diff entropy	$\sum_{i=2}^{2N_g} p_{x-y}(i) \log(p_{x-y}(i))$	(10)
Information measure of correlation 1	$\left[\frac{f9 - HXY1}{\max\{HX, HY\}} \right]$	(11)

To create a GLCM, we make use of the gray comatrix function in Matlab. The gray comatrix characteristic creates a new grey-level co-prevalence matrix (GLCM) [6] by using calculating how often a pixel with the depth (gray-scale - level) value i takes place in a specific spatial relationship to a pixel with the value j. by way of default, the spatial courting [15] is described because the pixel of interest and the pixel to its on the spot right (horizontally adjoining and vertically seperated), however you can specify other spatial relationships [14] between the two pixels.

every element of pixels (i,j) inside the resultant glcm is genuinely the sum of the range of instances that the pixel with value i occurred in the specific spatial courting to a pixel with value j inside the corresponding enter picture. The variety of grey degrees [15] inside the virtual photo determines the dimensions of the GLCM. by default, gray comatrix uses scaling of depth to reduce the number of intensity values in an photo to eight, however you may use the wide variety of ranges and the gray limits parameters to manipulate this scaling of grey degrees [15]. the grey-degree co-prevalence matrix can screen sure homes [14] approximately the spatial distribution of the grey levels in the texture photograph [17]. as an example, if most of the entries within the GLCM are focused alongside the diagonal [17], the texture is coarse with respect to the required offset indicated. we have derived several statistical measures from the GLCM.

3.4 Classification

In supervised machine getting to know, assist vector machines (SVMs, additionally help vector networks are supervised gaining knowledge of fashions with related studying succesful algorithms that examine statistics and recognize patterns, used for binary type and to plot regression evaluation. Given a set of schooling samples, each marked as belonging to certainly one of categories, an SVM schooling set of rules builds a model that assigns new examples into one category or the alternative, making it a non-probabilistic binary linear classifier. An SVM version is a representation of the examples as points in space, mapped such that the examples of the separate classes are divided right into a clear hole that is as huge as feasible. New samples are then mapped into that same space and are expected to belong to a category based on which aspect of the distance which they fall on.similarly to performing linear binary category, SVMs can efficaciously carry out a non-linear binary category using what is known as the kernel trick, which maps their inputs into highdimensional characteristic areas. The fashions are educated the use of svmtrain () and categorised the use of svmclassify () instructions in Matlab.

4. CONCLUSION

we've used MATLAB 2013 for the experimentation of the proposed device. once the dataset is ready, we segmented the pictures the use of ok manner clustering. Out of the three clusters created one of the clusters incorporate the sickness affected area. Then we have extracted capabilities from that unique cluster using gray degree Cooccurance Matrix (GLCM). these capabilities are later fed into assist Vector Machines (SVM). The final classification consequences from SVMs suggest whether the leaf in the image dataset is healthy or disease affected. The effects the usage of SVM are acquired from various kernels such as linear, polynomial, quadratic, RBF and polynomial. all the effects from the kernels are able to are expecting the form of the picture very correctly

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