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Simulative Investigation of Plant Diseases using KNN Algorithm

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Abstract: Crop cultivation plays an essential role in the agricultural field. Presently, the loss of food is mainly due to infected crops, which reflexively reduces the production rate. To identify the plant diseases at an untimely phase is not yet explored. The main challenge is to reduce the usage of pesticides in the agricultural field and to increase the quality and quantity of the production rate. Our paper is used to explore the leaf disease prediction at an untimely action using KNN algorithm. A colour based segmentation model is defined to segment the infected region and placing it to its relevant classes. Experimental analyses were done on samples images in terms of time complexity and the area of infected region. Plant diseases can be detected by image processing technique. Disease detection involves steps like image acquisition, image pre-processing, image segmentation, feature extraction and classification. Our project is used to detect the plant diseases and provide solutions to recover from the disease. It shows the affected part of the leaf in percentage.

Keywords: Plant Leaf Image Samples, Image Recognition, Artificial Neural Network, KNN, SVM

I.INTRODUCTION

It is an important task to classify, organize and understand thousands of images efficiently. From application point of view, image classification is useful in image retrieval. Detection and recognition of diseases in plants using machine learning is very fruitful in providing symptoms of identifying diseases at its earliest stages [5]. Computer processing Systems are developed for agricultural applications, such as detection of leaf diseases, fruits diseases etc. In all these techniques, digital images are collected using a digital camera and image processing techniques are applied on these images to extract useful information that are necessary for further analysis [6]. In this work, Digital Image processing is used for take the image as input and then performs some operation on it and then give us the required or expected output. Application of computer vision and image processing techniques certainly assist farmers in all the areas of agriculture activities. India is agriculture country where in more than 65% population depends on agriculture. The crop losses due to diseases are approximately 10 to 30%. Farmers judge the diseases by their experience but this is not accurate and proper way. In few cases farmers have to call the experts for detecting the diseases but this is very time-consuming process. The diseases are mostly on leaves and on stem of plant. The diseases are viral, bacterial, fungal, diseases due to insects, rust, nematodes etc. on plant. It is important task for farmers to find out these diseases as early as possible.

II.PLANT DISEASES ANALYSIS AND ITS SYMPTOMS

Detection of plant disease and assessment of the amount on individual plants or in plant populations is required. For plant disease surveys, disease assessment is required for aiding in the settlement of crop insurance claims, aspects of crop bio-security (bio crimes) and possibly terrorism [8]. The use of visible-wavelength photography is one of emerging methods to detect and quantify disease on plants. Apart from traditional visual assessment methods used to detect and estimate disease intensity, several other methods based on various technologies are also used, including laser-induced fluorescence, radar, microwave, thermography, nuclear magnetic resonance imaging and multi or hyperspectral imagery [8]. Various forms of microscopy are also used to detect and measure various pathogens in infected plants. Awareness of these approaches is important and RGB.

image feature pixel counting techniques is extensively applied to agricultural science [9]. Image analysis can be applied for the following purposes:

1. To detect plant leaf, stem, and fruit diseases.
2. To quantify affected area by disease.

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3. To find the boundaries of the affected area.
4. To determine the colour of the affected area.
5. To determine size & shape of fruits.

In this work, we will review the recent and significant techniques that have been used for plant disease classification. Besides we will identify the key approaches being used in plant disease classification. The major contributions made by each significant work and the challenges posed to efficient classification will also be discussed.

III.OVERVIEW ABOUT THE TECHNQIUES TO BE USED

GIST- A typical GIST is computer over a complete image for the scene classification task. It falls in the global image descriptor category.
SIFT- The typical use of SIFT is to match the local regions in two images on the basis of their reconstruction, alignment or other similar. SIFT can be used for the purpose of identification of some specific objects by using
HOG- Histogram of Oriented Gradient (HOG) [46] is used for object-recognition. It is based on computing edge-gradients. Typical HOG works in the sliding window fashion for object detection applications. HOG computes the complete image after dividing it into the smaller cells, called blocks. HOG can be used alongside SVM for feature detection using classification.
CENTRIST- CENTRIST is a novel visual descriptor, which is more robust to illumination changes, gamma variation etc. as compared to GIST [47] and SIFT [48]. CENTRIST is histogram of Census Transform (CT) values. CT compares intensity value of a pixel with its neighbouring pixels and assigns value 1 or 0 to those pixels. After that the decimal number corresponding to this sequence of 8 neighbouring binary digits is computed and used as CT value of centre pixel. This descriptor retains the local as well as global structure of the scene. However, there are several limitations of this descriptor. It is not invariant to rotation and scale changes. It also does not consider colour information. Further it cannot be used for precise shape description.

IV.PROPOSED METHODOLOGY

Indoor scene classification system involves various steps like feature extraction, feature selection, feature vector generation, training and classification. The flow chart in figure 1 demonstrates all the phases system goes through. The data preparation phase involves the gathering the leaf image dataset from available sources. The actual design of the system starts with gathering data for experimentation. The collected images are then transformed into an appropriate format suitable for system design. Pre processing phase pre-processing involves following steps:

1. Reading the image into matrix is the very first step involved in image processing. The size of matrix is proportional to size of image. Each cell of matrix stores the corresponding pixel value of image.
2. All images from training and testing dataset are normalized to same size.

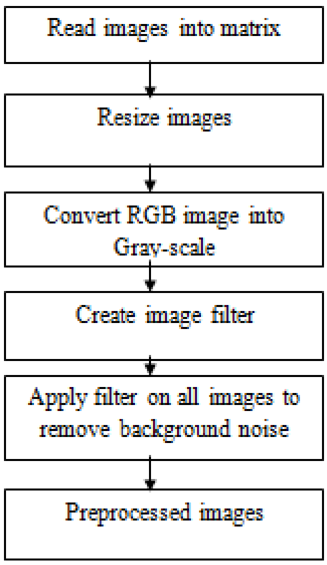

Fig 1 Pre-processing phase of extraction

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3. Convert RGB images to gray scale. The RGB images are converted into gray scale images to make the model computationally efficient.
4. Create image filter using Gaussian filter on the image in order to remove the Gaussian noise from the leaf disease test object after converting it into the gray scale.
5. Apply filter to extraction and classification of image. The image is convolved with Gaussian filter.

The following is the feature matching and classification algorithm for matching the extracted plant disease image with the different images of same plant, which are taken at different times, from different viewpoints, or by different sensors.

Algorithm 1: Feature Extraction Algorithm

1. Load the 3-D (coloured) test image as test object matrix $\mathbf{T_m}$
2. Convert the test image matrix to grayscale image matrix $\mathbf{G_m}$
3. Define the Gaussian Filter **Gf**
4. Apply Gaussian Filter **Gf** on $\mathbf{G_m}$ to produce the de-noised $\mathbf{G_{md}}$
5. Calculate $\mathbf{G_{md}}$ into the front-ground estimation feature $\mathbf{F_{EF}}$
6. Define the dilation object of adequate shape and size $\mathbf{S_{E1}}$
7. Dilate the image $\mathbf{G_{md}}$ with respect to $\mathbf{S_{E1}}$to produce the image object $\mathbf{A_I}$
8. Perform morphological closing of the image object $\mathbf{A_I}$
9. Subtract the $\mathbf{F_{EF}}$ from $\mathbf{G_m}$ to produce **F(BG)**
10. Return the **F(BG)**

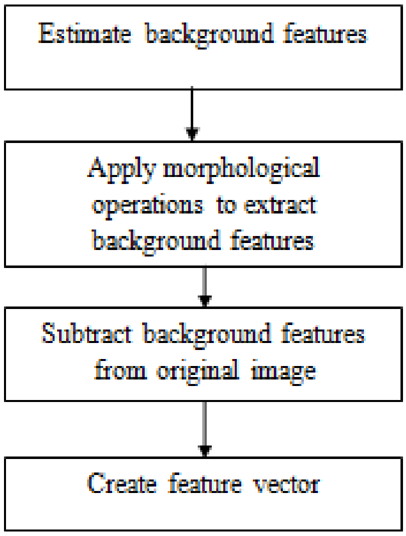

Fig 2Algorithm: KNN Classification Algorithm

Input: a training set of images, a tackled image and a parameter K
Step 1: For every image of the training set and the tackled image to produce feature vectors.
End For
Step 2: Calculate the distances between the vector of the tackled image and the vectors of the training set.
Step 3: Select the K neighbours.
Step 4: If
The labels of the K neighbours are the same then
Let the label of the tackled image be the label of the K neighbours. Else
Use the two-vector distances of the K neighbours to calculate a kennel function.
End If
Output: the classification label of the tackled image

V.DATA AND RESULTS

Database collection - Database of 100 images of leaves of infected and healthy plants are captured in jpeg format.

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RESULT ANALYSIS

The results have been obtained from the various experiments conducted over the proposed model. The training dataset has been classified into two primary classes, which primarily defines the given image is verified and the decision logic is returned with the detected category type.

Sr. No.	KNN	NN	SVM
1	1.185	5.611	0.807
2	1.19	4.923	1.876
3	1.187	5.513	1.965
4	1.181	5.412	2.105
5	1.183	4.734	2.765

Sr. No.	KNN	NN	SVM
1	93.95	91.82	89.8
2	93.83	91.23	89.94
3	94.63	90.28	90.23
4	94.96	90.42	90.54
5	94.36	89.91	89.95

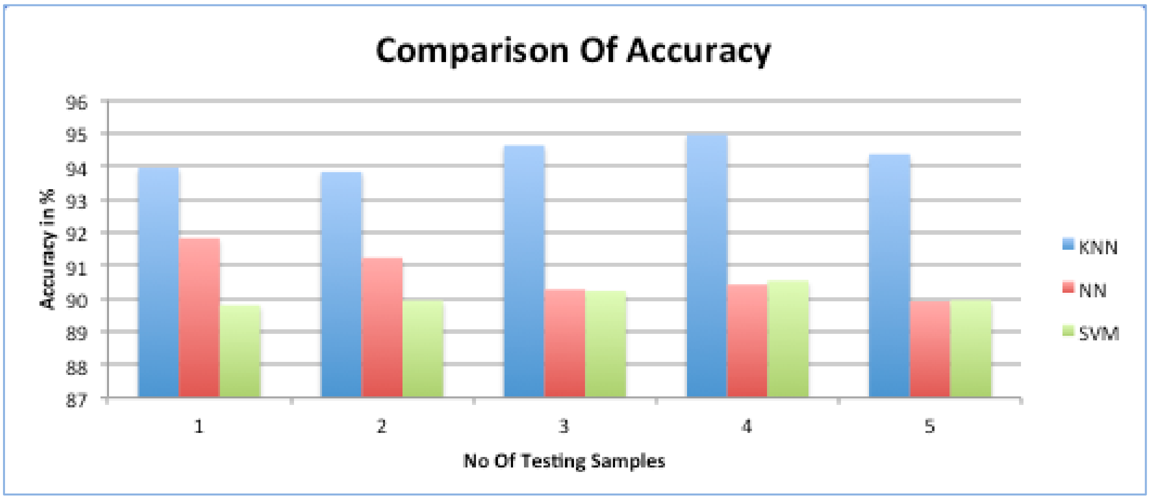

Fig 4 Total Time Taken by all Three Classifiers

Above chart is the comparison chart for elapsed time for processing and categorize the disease found in the testing image. Results show that KNN has taken less time for computation. It means KNN is faster in comparison of NN and SVM.

VI.CONCLUSION

The proposed work is about programmed location of infections and unhealthy part display in the leaf pictures of plants and even in the agribusiness Crop generation. It is finished with the progression of PC innovation which encourages in cultivating expanding the generation. Predominantly there is an issue of recognition exactness and in neural system approach; bolster vector machine (SVM) as of now exists. In this exploration work we will go to examine the different favourable circumstances and disservice of the plant infections forecast procedures and going to propose a novel approach for the recognition calculation. The pictures of different leaves are gained utilizing an advanced camera. At that point picture handling systems are connected to the gained pictures to separate helpful elements that are important for assist examination. From that point onward a few logical systems are utilized to order the pictures as per the particular issue close by. The proposal reviews and summarizes some techniques that have been used for plant disease detection. The two are major classification techniques of plant diseases. The spectroscopic and imaging techniques include fluorescence spectroscopy, visible-IR spectroscopy, fluorescence imaging and hyper spectral imaging. KNN algorithm is effective classifier has been used here to minimize the computation cost. Also many researchers' used this classifier on many datasets. KNN classifier obtains highest result as compared to SVM. The comparison will be done on accuracy and detection time based parameters and will show that KNN is better than existing SVM. A novel approach for disease prediction of plants based on classification technique is proposed.

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