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RESEARCH ARTICLE

A Study of Image Processing in Agriculture for Detect the Plant Diseases

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Abstract- Agricultural Image Processing is one of the core application of Image processing is one of the most growing research area that is having its participation in different application areas including the biometric system, biomedical system, etc. One of such application area is the agricultural industry. In this application area, image processing is been utilizing in different ways to identify the crop, plant, leaves, flower, fruits etc. as well as to identify the disease. study of the diseases in agriculture field. Digital image processing is a technique used for enhancement of the image. To improve the agriculture product automatic detection. Many method of used for segmentation in image processing for agriculture field.

Keywords: "Plant diseases, Image processing step, Images classification approaches, Artificial Neural Network, Support Vector Machine, Clustering method"

I. INTRODUCTION

India is an agricultural country; wherein about 70% of the population depends on agriculture. Farmers have wide range of diversity to select suitable Fruit and Vegetable crops. However, the cultivation of these crops for optimum yield and quality produce is highly technical. It can be improved by the aid of technological support. The management of perennial fruit crops requires close monitoring especially for the management of diseases that can affect production significantly and subsequently the post-harvest life. And fundamental step of image processing.

The image processing can be used in agricultural applications for following purposes:

1. To detect diseased leaf, stem, fruit
2. To quantify affected area by disease.
3. To find shape of affected area.
4. To determine color of affected area
5. To determine size & shape of fruits.

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1.1 Image Acquisition

The data collection is the major aspect of the data collection in area. The same collection has been used 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 collect the actual source image.
An image must be converted to numerical form before processing. This conversion process is called digitization. This process is done by charge-couple device (CCD) that is embedded in modern digital camera [1]. There are many different types of digital camera has been used to acquire digital images. It was selected based on the needs and budget available for research. Some digital cameras used in agriculture application are 3M pixel real color camera [2], Kodak DC50 zoom camera [3], Olympus wide zoom camera [4], Nikon Coolpix P4 digital camera[5], and Panasonic DMC-LX1camera[6].

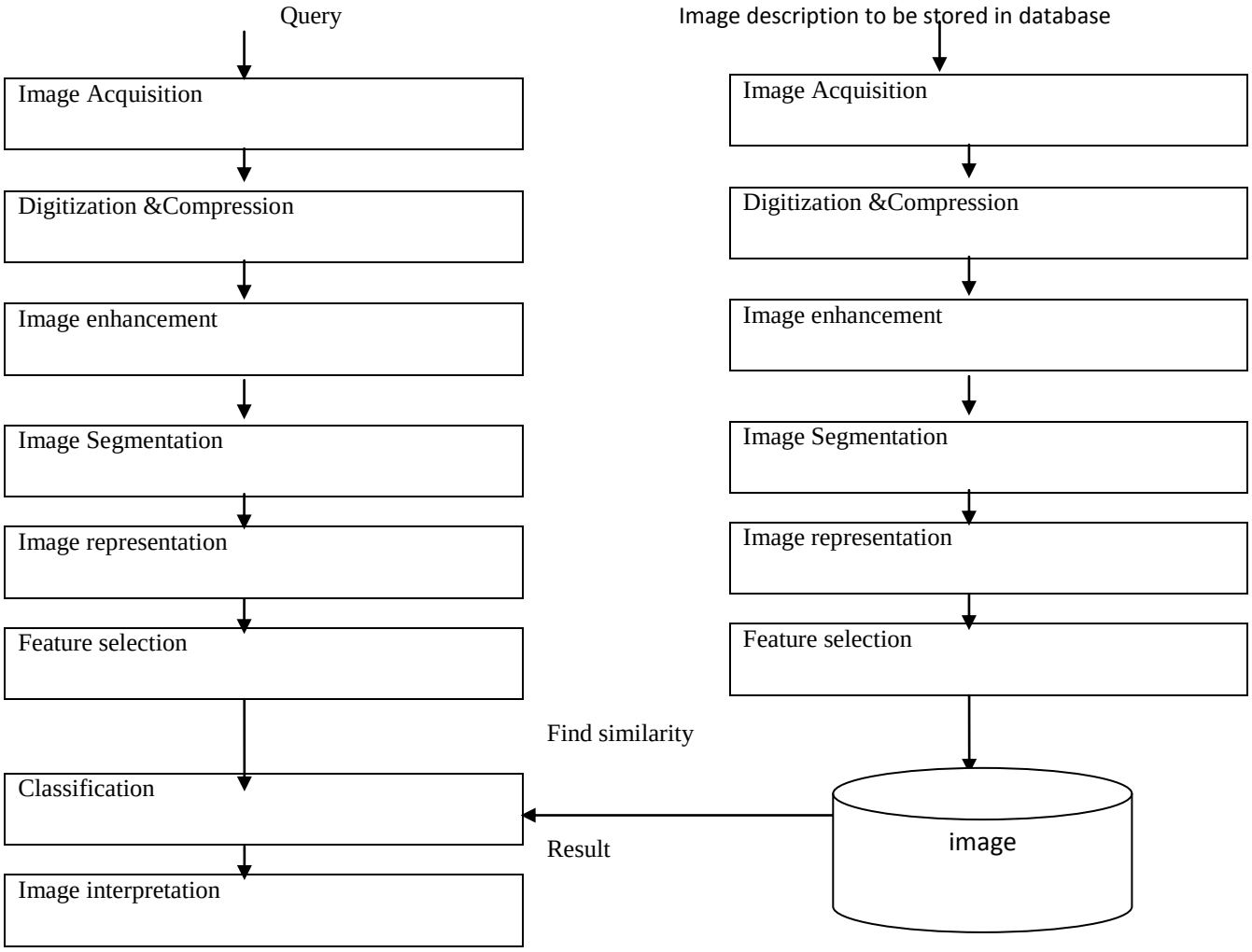

Fig:1-step of image processing

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1.2 Image Preprocessing

The principle objective of the image enhancement is to process an image for a specific task so that the processed image is better viewed than the original image. Image enhancement methods basically fall into two domains, spatial and frequency domain.

- Spatial domain: as the name suggests in this approach different methods are used, which will affect the manipulation of pixel values of an image
- Frequency domain: in this method first a Fourier transform of the image is computed and then different operations are performed on them and finally results are obtained by getting the inverse Fourier transform of the image.

There are three main categories of image preprocessing which is image compression (used to reduce the amount of computer memory needed), image enhancement (to modify the brightness and contrast of an image) and image measurement (involves segmenting the image to separate the objects of interest from the background [1]. For example in agriculture application, [7] used median filter as a method to remove noise in preprocessing stage.

1.3 Image Segmentation

In image processing, segmentation falls in to the category of extracting different image attributes of an original image. Segmentation subdivides an image into constituent regions or objects. The level to which that subdivision carried out is a problem specific. The simplest method among all segmentation methods is threshold-based method, whose volume uses either a manually or automated generated threshold values for segmentation. In this method first the histogram of the image is computed then a particular value of threshold (intensity) is selected to segment the region. However in this method the intensity values often suffer from non-uniformly distributed contrast values inside the vessels. So, in case of small structure vessel segmentation, global threshold based methods are not useful. Segmentation is again having different types given as under. [8] also separated the background image from the major part of rice leaf image in image segmentation stage.

1.4 Image Representation and Description

Representation and description almost always follow the output of a segmentation stage. The first decision must be made whether the data should be represented as a boundary or complete region. Boundary representation is appropriate when the focus is on external shape characteristics whereas regional representation is focusing on internal properties, such as texture and skeletal shape. In plant species identification using digital morphometrics, image representation is done by using leaf shape analysis. The [9] have made a review of previous methods used to analyze the leaf shape using three ways: two-dimensional outline shape of leaf petal, the structure of the vein network and the characters of leaf margin. The two-dimensional outline shape of leaf petal is a boundary representation while the structure of the vein network and the characters of leaf margin are regional representation. Some research examples using leaf shape analyses and . A method must be specified for describing the data so that features of interest are highlighted. Description, also called as feature selection, deals with extracting attributes that result in some quantitative information of interest. For example using content based image retrieval, the length and width of leaf in pixel, and the area of leaf in pixel2 are three feature selections that are gained from image representation phase. These descriptors are then used in classification in order to find the distance or similarity with the descriptors stored in database

1.5 Image Recognition

Recognition is the process that assigns a label to an object based on information provided by its descriptors. Classification is a usual process used to recognize image. Classification is needed to distinguish a plant species with other species based on the data obtained from feature selection. The descriptors from the image data stored in database are compared with the descriptors from the query image. The closer gap within those descriptors is then chosen to appoint the query image to be in which class. Artificial neural network (ANN) and fuzzy logic are the most commonly techniques used in classification. Some previous works on agriculture image processing using fuzzy classifier refer to and . Some previous works agriculture image processing using ANN classifier, refer to [3], [4], and [6].

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II. IMAGE CLASSIFICATION APPROACHES

Various image classification approaches are defined briefly:

1. *On The Basis Of Characteristic Used:*

    a. Shape based : This methods make use of the objects' 2D spatial information. Common features used in shape-based classification schemes are the points (centroid, set of points),primitive geometric shapes(rectangle or ellipse), skeleton, silhouette and contour
    b. Motion-based: This methods use temporal tracked features of objects for the classification

2. *On The Basis Of Training Sample Used:*

    a. Supervised Classification: The process of using samples of known informational classes (training sets) to classify pixels of unknown identity. Example: minimum distance to means algorithm, parallelepiped algorithm, maximum likelihood algorithm
    b. Unsupervised Classification: In this type of classification is a method which examines a large number of unknown pixels and divides it into number of classes based on natural groupings present in the image values. Computer determines spectrally separable class and then defines their information value. No extensive prior knowledge is required. Example: K means clustering algorithm.

3. *On The Basis Of Assumption Of Parameter on Data:*

    a. Parametric classifier: The parameters like mean vector and covariance matrix are used. There is an assumption of Gaussian distribution. The parameters like mean vector and covariance matrix are frequently generated from training sample .Example: Maximum likelihood, linear discriminant analysis.
    b. Non Parametric classifier: There is no assumption about the data. Non-parametric classifiers do not make use of statistical parameters to calculate class separation. Example: Artificial neural network, support vector machine, decision tree classifier, expert system.

4. *On The Basis Of Pixel Information Used:*

    a. Per pixel classifier: Conventional classifier generates a signature by using the combination of the spectra of all training-set pixels from a given feature. The contributions of all materials present in the training-set pixels are present in the resulting signature. It can be parametric or nonparametric the accuracy may not meet up because of the impact of the mixed pixel problem. Example: maximum likelihood, ANN, support vector machine and minimum distance.
    b. Sub pixel classifiers: The spectral value of each pixel is assumed to be a linear or non-linear combination of defined pure materials called end members, providing proportional membership of each pixel to each end member. Sub pixel classifier has the capability to handle the mixed pixel problem, suitable for medium and coarse spatial resolution images. Example: spectral mixture analysis, sub pixel classifier, Fuzzy-set classifiers.
    c. Per-field classifier: The per-field classifier is intended to handle the problem of environmental heterogeneity, and also improves the classification accuracy. Generally used by GIS-based classification approaches.
    d. Object-oriented classifiers: Pixels of the image are united into objects and then classification is performed on the basis of objects. It involves 2 stages: image segmentation and image classification Image segmentation unites pixels into objects, and a classification is then implemented on the basis of objects. Example: e Cognition.

5. *On The Basis Of Number Of Outputs For Each Spatial Element:*

    a. Hard Classification: Also known as crisp classification in this each pixel is required or forced to show membership to a single class.eg maximum likelihood, minimum distance, artificial neural network, decision tree, and support vector machine.
    b. Soft classification: also known as fuzzy classification in this each pixel may exhibit numerous and partial class membership. Produces more accurate result.

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6. *On The Basis Of Spatial Information:*

   a. Spectral Classifiers: This image classification uses pure spectral information .Example: Maximum likelihood, minimum distance, artificial neural network
   b. Contextual Classifiers: This image classification uses the spatially neighbouring pixel information. Example: frequency-based contextual classifier.
   c. Spectral-contextual classifiers: This classification uses both spectral and spatial information initial classification images are generated using parametric or non-parametric classifiers and then contextual classifiers are implemented in the classified images. Example: combination of parametric or non-parametric and contextual algorithm.

III. IMAGE CLASSIFICATION TECHNIQUE

TABLE I

DIFFERENT TECHNIQUES FOR CLASSIFICATION

Classification method	Description	Characteristics
Artificial Neural Network	ANN is a type of artificial intelligence that imitates some functions of the person mind. ANNs have three layers that are interconnected. The first layer consists of input neurons. Those neurons send data on to the second layer, which in turn sends the output neurons to the third layer. ANN is also known as a neural network.	A large number of very simple processing neuron-like processing elements. A large number of weighted connections between the elements. Distributed representation of knowledge. over the connections Knowledge is acquired by network through a learning process.
Clustering Method	This is an iterative technique that is used to partition an image into clusters. Clusters can be selected manually, randomly, or based on some conditions. Distance between the pixel and cluster centre is calculated by the squared or absolute difference between a pixel and a cluster centre. Clusters can be selected manually, randomly, or based on some conditions.. The difference is typically based on pixel clour, intensity, texture, and location, or a weighted combination of these factors. More commonly used clustering algorithms are K – means algorithm, fuzzy c-means algorithm, expectation – maximization (EM) algorithm	clustering based on intensity and threshold separation**.** It uses Stochastic approach Performance and accuracy depends upon the Threshold selection .
SVM (Servo Vector Machine)	A support vector machine builds a hyper plane or set of hyper planes in a high- or infinite dimensional space, used for classification. generalization error of the classifier.	SVM uses Nonparametric with binary classifier approach and can handle more input data very efficiently. Performance and accuracy depends upon the hyper plane selection and kernel parameter.

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TABLE II

Advantages and Disadvantages of Different Classification Techniques

Classification method	Advantages	Disadvantages
Artificial Neural Network	• It is a non-parametric classifier. • It is an universal functional with arbitrary accuracy. • capable to present functions such as OR, AND, NO T • It is a data driven self adaptive technique • efficiently handle • noisy inputs • Computation rate is High	• It is semantically poor. • The training of • ANN is time taking. • Problem of over fitting. • Difficult in choosing the type network architecture
Clustering method	• Simpler classifier as exclusion of any training process. • Applicable in case of a small dataset which is not trained	• Speed of computing distance increases according to numbers available in training samples. • Expensive testing of each instance and sensitive to irrelevant inputs
SVM (Servo Vector Machine)	• It gains flexibility in the choice of the form of the threshold. • Contains a nonlinear transformation. • It provides a good Generalization capability. • The problem of over fitting is eliminated. • Reduction in computational complexity. • Simple to manage decision rule complexity and Error frequency	• Result transparency is low. • Training is time consuming. • Structure of algorithm is difficult to understand • Determination of optimal parameters I not easy when there is nonlinearly separable training data.

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