# A Survey on Image Processing Techniques in the field of Agriculture

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***Abstract*—Image processing has found extensive application in various field like medical image processing, satellite image processing and many other prominent fields. In India, agriculture is an importantoccupation and image processing finds its use in areas like weed detection, identifying plant diseasesand others. The traditional methods that were used were inefficient as its accuracy was lesser than 20%. In this paper wepresent the survey on different methods used for weed detection and its accuracy rates achieved through image processing.**

***Keywords—Digital Image Processing;SIFT; FFT; GLCM; Feature Extraction; Histogram Analysis***

## I. INTRODUCTION

With the evolution of human civilization, agriculture has been a part and parcel of the day to day life. This started with the initial refining of the agricultural land to eliminate the weeds before growing the specific crops [2]. A weed is defined as the unnecessary vegetation present in the agricultural field, and hindering the effective growth of productive crops. It not only utilizes the space, but also the other natural resources like sunlight, water and fertility of the soil, thereby reducing the quality of the productive crops. Elimination of the weeds is not an easy task as it involves the manual labor for identification and getting rid of them, although now we can use the modernized utilities specifically designed for weed removal. The agricultural surveys show that around 37% of the annual agricultural produce is affected by the weeds. Along with reducing the quantity and quality of the crops they also affect the ecosystem by their side effects. In a country like India, where agriculture is the main occupation and earning means of the people, weed management is a crucial issue which has to be looked into, to conserve the biological flora and fauna.

Weeds are one of the principle requirements in agrarian creation. According to the reachable approximations, weeds cause up to 33% of the aggregate misfortunes in yield, other than ruining produce different sorts of wellbeing and natural risks. Despite improvement and appropriation of weed administration advancements, the weed issues are for all intents and purposes expanding. This is a direct result of intercropping, mulching and yield turns including shift in weed greenery, because of reception of settled editing frameworks and administration works on including herbicides improvement of herbicide resistance in weeds e.g. Phalaris minor in the 1990s developing danger of wild rice in numerous states and Orobanche in mustard developing regions intrusion by outsider weeds like Parthenium, Lantana, Ageratum, Chromolaena, Mikania and Mimosa in numerous parts of the nation approaching environmental change supporting more forceful development of weed species, and herbicide deposit issues.

This recommends weeds glitches are alterable in nature, requiring consistent agrarian efficiency and ecological wellbeing keeping up. Various components influencing the quality and amount of yield, for example, aggressiveness of harvest and weed present, thickness of harvest and weed present, time of appearance of the weed in respect to the harvest, length of weed present, checking and refinement of administration techniques for minimizing their consequences for rural efficiency and natural wellbeing.

The image processing is utilized as a part of farming applications for various purposes, for example, To recognize sick stem, leaf or organic product, To ascertain influenced territory by illness, To discover framework of influenced zone, To decide shade of influenced zone and To decide size and state of natural products. And so forth.

Image processing is an efficient way to detect the presence of weed. This is required because when we are spraying the herbicide we can know whether we are spraying it on a useful crop or a weed. In this paper we discuss the various image processing techniques that can be applied to efficiently detect weed. Section II covers the details on image processing, section III gives the detailed overview of the existing system followed by conclusion in Section IV.

## II. IMAGE PROCESSING

### *A. Definition*

Image processing[6] is a strategy to change over a picture into advanced frame and play out a few operations on it, keeping in mind the end goal to get an upgraded picture or to concentrate some valuable data from it. It is a kind of sign regulation in

which info is image, similar to video edge or photo and the output might be image or qualities and attributes connected with that image. These images are typically considered as 2D signals while putting the collection of signal processing methods in image processing.

It is among quickly developing innovations today, with its applications in different parts of a business. Image processing is a core area of exploration or research region inside engineering field and computer applications. Image processing fundamentally incorporates three essential strides they are Importing the picture with optical scanner or by digital photography, Analyzing and manipulating the image which incorporates data compression and image enhancement and spotting designs or patterns that are not to human eyes like satellite photos and Output is the last stage in which result can be altered image or report that depends on image investigation or analysis.

### *B. Purpose of Image Processing*

The purpose of image process is split into five groups, they're image - Notice the objects that don't seem to be visible, Image sharpening and restoration - to provide an improved image, Image retrieval - explore for the image of interest, measuring of pattern – Measures many objects in a picture and Image Recognition – categorize the objects in a picture.

### *C. Types*

The two forms of ways used for Image process are Analog and Digital Image process. Analog or visual techniques of image process will be used for the arduous copies like printouts and pictures. Image analysts use varied necessities of interpretation whereas they still use these visual techniques for that. The image process isn't simply restricted to space that must be studied. Association is another main tool in image process via visual techniques. Thus analysts mix the individual information and security knowledge to image process.

Digital Processing techniques assist in manipulation of the digital images by using computers shown in Fig. 1.The raw data from imaging sensors from satellite boards contains deficiencies. To get over such faults and to get originality of information, it has to undergo many phases of processing. The three common phases that all types of data have to undergo while using digital technique are Pre- processing, enhancement display and information extraction.

## III. EXISTING WORKS

Some of the important works on weed detection and application of image processing in agriculture are as follows:

### *A. Weed Detection based on Leaf Parameters*

In this method [1] an accuracy of 69 to 80 % is achieved. The basic thing involved in this method is that we will consider some specific features or parameters – shape features and texture features.

There are 11 shape features like aspect ratio, rectangularity, perimeter ratio, circularity, compactness, elongation, boundary rectangular perimeter and intercepts. The 5 texture features are entropy, contrast, inverse difference movement, correlation and energy. The method involves The leaf image is acquired and preprocessing is carried out, Otsu's method of threshold applied, Eroding (which removes the linking objects) and dilating (which fills up the blobs and holes caused due to thresolding) is carried out and finally Discrimination analysis is performed. The results are shown in Fig. 2.The disadvantage is that this method is tedious and we have to take a variety of weed to carry out the experiment.

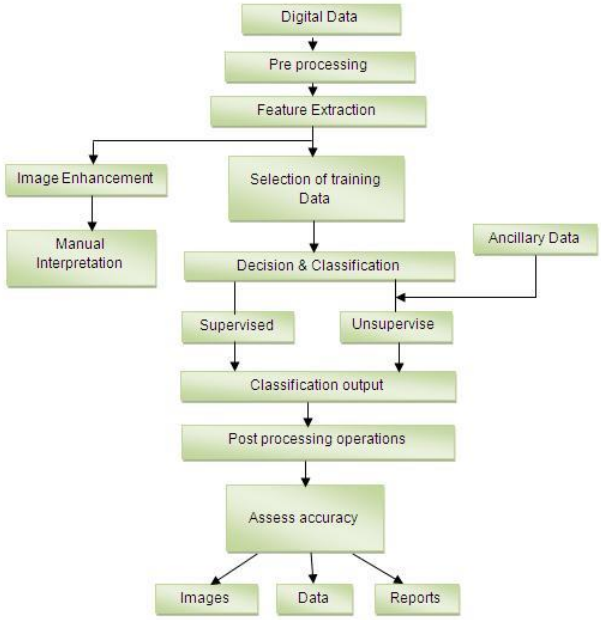


Fig.1. Steps involved in Digital Image Processing

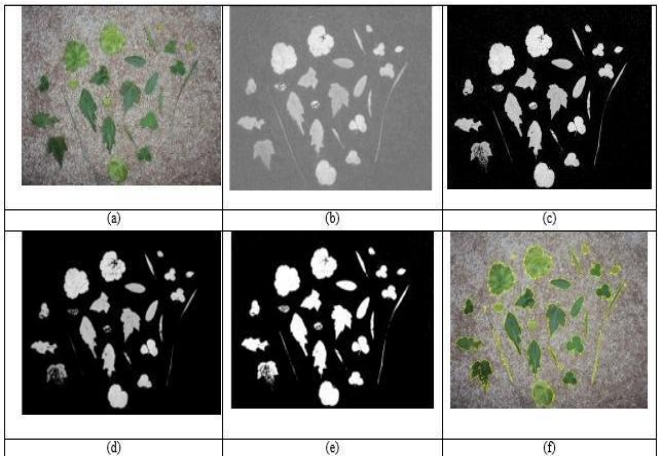


Fig. 2. Images generated at different steps of image processing a)original image; b)excess green image; c)threshold image; d)eroded image; e)dilated image; f)clustered and labelled image

*B. Crop Detection by Machine Vision*

In this method [2] the image is acquired and then excess green algorithm is performed to separate the crop from the environment. The labeling algorithm is then performed which basically groups similar pixels. Size based feature extraction is carried out in which morphological characteristics like region, outer limits, chord i.e. longest and perpendicular chord i.e. longest are taken into account. The basic idea in this step is to differentiate the weed from the crop. The original crop is masked and the weed is detected using excessive green algorithm.This method is very simple to understand and apply, however the accuracy is on the lower side. The results are shown in Fig. 3.


Fig. 3. Weed Detection

*C. Machine vision system for Automatic Weeding Strategy*

In machine vision technology [3], the fundamental part of the framework is to identify the kind of weed out of image processing. Three methods of image processing, including statistical methodology GLCM and structural methodology FFT and SIFT, are used and compared with other to best solution of identifying the weeds in agriculture field for classification. The created machine vision framework comprises of a mechanical structure, which incorporates a sprayer, a Logitech web advanced camera, 12v engine combined with a pump framework and a little size CPU as a processor.

***Grey Level Co-occurrence Matrix (GLCM)***

GLCM is a classification of various blends of pixel shine (dark/grey levels) that happen in a picture. Essentially, GLCM is a connection between two neighboring pixels at once called the reference and the neighbor pixel. The grey worth connections in an objective are changed into a co-event lattice space by the procedure of normalization of matrix.

Grey level; matrix of co-occurrence has ended up being a capable source for use in classification of texture. Various textural parameters that is been calculated by the matrix of gives the complete fine points of the image content. The strategy utilized here is digitized pictures that were put away at a few levels of compression. GLCM ends up being a decent separate identifier in inspecting diverse images yet no such claim can be made for picture/image quality. Henceforth the hunt for the best picture quality metric proceeds. Grey level representation is productive and adequate for investigation/analysis of SAR pictures.

***Fast Fourier Transform (FFT)***

A FastFourier Transform (FFT) algorithm [5] is used for computing the Discrete Fourier Transform (DFT) of a succession or sequence, or it is converse. Fourier analysis is a process of converting a signal from frequency domain to a representation in the original domain(frequently time or space) and vice versa. A FFT quickly registers such changes by factorizing the DFT matrix into a result of meager (for the most part zero) elements. [1] Accordingly, it figures out how to lessen the difficulty of calculating the DFT from $O(n^2)$, which emerges on the off chance that one essentially applies the meaning of DFT, to O (n \log n), where n is the information or data size.The primary point of interest of a FFT is rate, which it gets by diminishing the quantity of counts expected to break down a waveform. A hindrance connected with the FFT is the confined scope of waveform information that can be changed and the need to apply a window weighting function.

***Scale-invariant feature transform (SIFT)***

Scale-invariant feature transform (or SIFT) is an algorithm in PC vision to distinguish and depict the features that are local to an image. Thisalgorithm was published in 1999 by David Lowe. SIFT can strongly distinguish the objects which are even among the under partial occlusion and clutter, in light of the fact that the SIFT highlight descriptor is invariant to uniform scaling, orientation, and in part invariant to relative contortion and lighting changes. The points of interest are great review rates (precision). Components are strong to impediment and disorder. Moderately proficient contrasted with more established algorithms.

***D. Histogram Analysis***

This technique [4] manages the improvement of an algorithm for ongoing particular weed recognition system taking into account Histogram Analysis of a picture or image that is utilized for the weed categorization. This algorithm is particularly formed to arrange pictures into wide and limited class for constant specific herbicide application. The algorithm depended on a Histogram of a green channel of a picture or image to identify the objective region in the fields.

The created framework/system has been tried on weeds in the lab, which have demonstrated that the framework to be extremely adequacy in weed recognizable proof. Further the outcomes demonstrate an exceptionally dependable execution on pictures of weeds taken under differing field conditions.

The examination of the outcomes appears more than 95 percent order precision more than 140 example pictures (wide and limited) with 70 tests from every classification of weeds.

The target to build up the algorithm is to perceive the nearness of weeds and separate the nearness of expansive leaves weeds and limited leaves weeds. For territories where weeds are distinguished, results show more than 95 percent characterization precision more than 140 example pictures with 70 tests from every class.

### *E. Spatial and Spectral Methods forWeed Detection and Localization*

This technique [7] helps in identification and restriction of weed patches so as to enhance the learning on competition of weed-crop. A remote control air ship or aircraft gave a camera permitted to acquire minimal price and recurring data. Diverse handlings were included to distinguish weed patches utilizing special technique first, then spectral technique. Initial, a movement of colorimetric base permitted to isolate the plant pixels and soil. At that point, a particular calculation including Gabor channel was connected to identify crop columns on the vegetation picture. The deductions of weed patches are done from the examination of vegetation and harvest pictures. At last the advancement of a multispectral securing gadget is presented. To start with results for the separation of weeds and harvests utilizing the ghastly properties are appeared from research center tests

### *F. Image Processing used in the detection og Plant Diseases*

India is a farming nation, wherein around 70 percent of the general population relies upon horticulture/agriculture. The investigations on diseased plants allude to the investigations of outwardly perceived examples of a particular plant. Harm of the bug is one of the significant diseases which influence the yield. Bug sprays/pesticides are not generally demonstrated effective in light of the fact that bug sprays might be harmful to some sort of fowls. It additionally harms regular environment. A typical practice for plant researchers is to appraise the harm of plant by an eye on a rough scale in view of rate of influenced zone. It results in low yield and subjectivity. The writing study done in this paper [8] gives another knowledge in recognition of the disease of plant.

From above writing study it is found that the accompanying techniques are utilized by various specialists for plant infection identification and examination: Back propagation neural system. Airborne hyper spectral imagery and red edge methods. Image investigation coordinated with Central Lab. of Agricultural Expert System (CLASE) analytic model. Mix of morphological elements of leaves, picture handling sustain forward neural system based classifier and fluffy surface choice procedure for highlight choice. Bolster vector machines for creating climate based forecast models of plant illnesses. Wavelet based picture handling system and neural system. Picture Processing with PCA and Probabilistic Neural Network (PNN). Mix of picture developing, picture division, Zooming calculation and Self Organizing Map (SOM) neural system for ordering unhealthy ascent pictures. Self-sorting out maps &back proliferation neural systems with hereditary calculations for advancement &support vector machines for characterization. Picture cutting separating and thresholding. Otsu division, K-implies grouping & back propagation sustain forward neural system.

### *G. High Performance Computing Environment*

This technique [9] gives essential comprehension of parallel and distributed image processing for horticulture/agriculture application. The benefits of parallel and distributed are decreased computational time and plant identification made much quicker. The disadvantage is the restricted writing accessible on this theme. The superior processing strategy is utilized to take care of high obscurity issue, it decreases computational time and the outcomes are delivered proficiently. HPC engineering includes parallel preparing equipment, dispersed framework and crossover sort. All these are utilized to plan the framework which will help us in picture handling. Parallel preparing for picture acknowledgment in horticulture application is accomplished by handling at the same time utilizing 2 or additionally preparing units. The three strategies are information parallel, errand parallel and pipeline parallel. We utilize information parallel to foresee leaf populace chlorophyll content from cotton plant picture. In errand parallel every undertakings will be allotted to various preparing units. On the off chance that a framework requires various information or picture to be handled we utilize pipeline parallel technique.

## IV. CONCLUSION

Image processing has found a various application in several fields. In India, agriculture is an important occupation and image processing finds its use in areas like weed detection, identifying plant diseases and others. The traditional methods that were used were inefficient as its accuracy was lesser than 20%.As there exist different methods in detecting the weeds in agriculture, out of all those SIFT (Scale-invariant feature transform) and Histogram Analysis gives more accuracy in detecting the weeds simply means classifying accuracy. Histogram Analysis gives around 95% accuracy and SIFT gives around 99% accuracy.

## V. ACKNOWLEDGMENT

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