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Smart Agricultural Improvement using Digital Image Processing

Saynee Paul[1], Koushik Pal[2], Chandrima Banerjee[3], Suniket Pradhan[4], Snehasish Bera[5], Aritra Das[6], Sayani Saha[7], Sneha Samanta[8]
[1, 2, 3, 4, 5, 6, 7, 8]*Department of Electronics & Communication Engineering, Guru Nanak Institute of Technology*

Abstract: ***Image processing is an efficient tool that has been used for various field, agriculture is one of them. Sometimes expert opinion or their ideas become more time consuming so by using this computer vision technology farmers can save times and observe other major parameters like quality of crops, quantity of weeds, canopy etc. combination of image processing along with availability of to communication network can be able to change the situation and save the time it's also within affordable cost, as image processing is a effective technique for analyzing parameter which we discuss in the above part. This paper is basically a short survey on to discuss about some specific image processing techniques which can help the farmers to enhances the agriculture practices, and also weed detection, gardening of fruits and also finding defects or brushes on fruits. By using all these techniques the expertise as well as the farmer can say that it takes less time and the accuracy of the above mentioned parameters is more productive than the traditional method. And application of image processing can also help to improve the decision making for sorting of fruits, soaking, measurement of vegetation etc***

Keywords: Digital image processing, Pesticides,Crops, Agriculture, Segmentation, Object detection, Image filtering, Background extractions.

I. INTRODUCTION

Nowadays with the continuous increasing rate of population, reduction in cultivable land, weather change ,the demand for food is also proportionally increasing, so to enhance the productivity and sustainability in the agriculture field , expertise invented many new ways continuously. Their main intentions are to give minimal inputs for high production and also to save the time . For an example Precision Agriculture is a method that is helping the farmers in meeting their needs.

Fertilizers, Pesticides, soaking and quality of crops are the major factors in agriculture. Maximum of the time expertise are required to realize the problems which may be time taking and also there is a costlier issue in developing countries. So basically DIP is one of the major techniques which can be used to measure all the parameters which is related to cultivation with certainty and economy. This survey is mainly focus on many applications of DIP in various domains of agriculture field and also recent developments of using computer-vision based applications. Basically image processing techniques entail five different basic processes such us prepossessing, segmentation, object detection, image acquisition and classification.

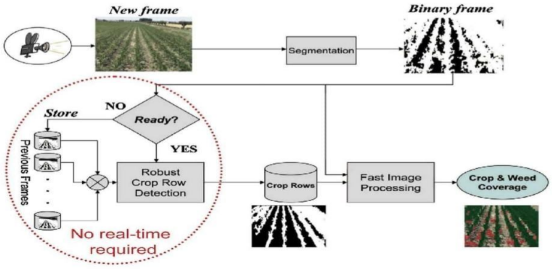


Fig. 1 Flow diagram of the image processing method

A. Gray Scale Conversion

In 2014 Eerens et al, Jayas et al. in the year 2000 and Du and Sun in the year (2004) focused on gray scale conversion as an middle step in food quality evaluation models. They are reported many applications calculating food items like fruits, meat, fishery e.t.c. using of image processing techniques to various area of food quality assessment, the process is mainly pre-processing the images that involves in gray scale conversion, after image acquisition.

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Another work done by Wu et al. (2013),he was focused on the foreign fibers in such as cotton product images that increases segmentation and background separation, use of gray level determination technique. In 2000 Jayas et al. basically show how to classify the agriculture products by natural networks by using the image analysis techniques. using neural networks for classification of the agricultural products. To categorizing of agricultural products the multi-layer neural network classifiers is the best way.

B. Image Object Analysis

Kelman and Linker proposed the shape and color analysis of the mature apples detection in tree images based on 3D convexity analysis in 2014. It is the analysis of three-dimensional convex objects, the Golden Delicious apple variety orchard under natural light conditions. The accuracy of the procedure correctness is about 94% in apples detection when the edges were identified using Canny filter. The Segmentation of plant lets suffering with the problem of occlusion and testing with plants having 2, 3 and4 leaves was Proposed by Pastrana and Rath in 2013. This method solved leaf complexities by ellipse approximation and found leaves clusters using active shape models. Another study by Yang et al. shows integration of a system using digital camera and a personal computer in précising decision-making in using herbicides in agricultural fields. This system processes the color images of the agricultural fields the prediction in the reduction of herbicide use is around 15-64%.Another Study proposed by Chikushi et al in 1990 measures the cucumber root systems. This system obtained 98% accuracy in root length measurement with advantages that there is no effect of randomness and direction of root images, and the system does not need any additional tool.

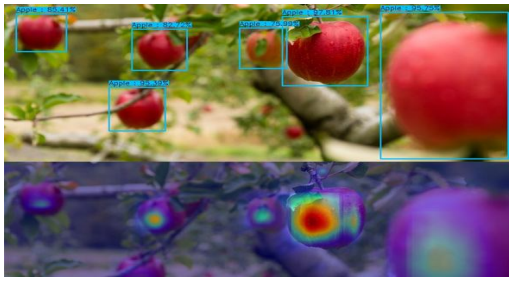


Fig. 2 pictures of image object analysis process

C. Feature Extraction

Weis and Gerhards predicted the attempts to detect weeds using image segmentation from images in 2009. They classified weeds based on shape features and perfectly classified weeds into weeds classes. The results obtained were better than manual weed sampling. The textural features like gray level co-occurrence matrix needed gray levels in an image; It was reported by Ehsanirad and Kumar in 2010 who extracted these features for leaf recognition for plant classification. Other work by Jayas et al in 2000 studied morphological, Fourier descriptors, wavelet transforms, boundary chain codes, spatial moments, color and textural features in the images and extraction techniques. In This study the further discussed features of classification techniques, including nearest neighbor classifier, neural networks, and multi-layer neural network.

D. Image Filtering

In 2012 Sansao et al. proposed a unique approach by using Gabor filter. To get the assess in weed coverage percentage in images. This image filtering method used for filtering crops regions to find the patches of weeds using excess green index images. Guijarro et al. (2011) invented an automatic image segmentation algorithm , it is use to separate barley, cereal and corn crops including weeds from the soil.

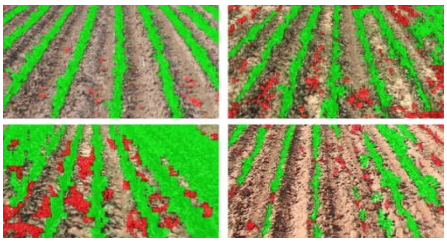


Fig. 3 Classification of different green plants and soil

In this above method the farmers can calculate the future improvements in the productiveness of this method by homomorphism.

E. Image Background Extraction

The main concept of Image background extraction is to minimal use of background and it's prefer to extract it form the images. and we get a result in non-uniform gray-level distribution which is between objects of interest and the image background, In 2004 Du and Sun approaches various applications where while making the food products quality including pizza, cob and corn genetics, etc background is not taken as into consideration. In the same way, Wu et al. (2013) removed background of the foreign fiber images detected in cotton products. Sankaran et al. (2010) focused on finding the plant diseases and also future improvement by some techniques like visible and infrared spectroscopy, hyper spectral imaging, fluorescence spectroscopy and imaging. By this above study expertise could focus on the metabolic activity of the plants.

F. Binary Image Segmentation

In the year 2004 Du and Sun invented various food quality assessment techniques by separating defects and feebleness in the food products using image segmentation. They described the productiveness of various segmentation algorithms applied for apple defects detection, pizza sauce separation and detecting touching pistachio nuts. Another image processing technique invented by Puchalski et al. (2008) which is find out the defects on the apple surfaces, by this method we can get the 96% perfectness in finding of bruises, frost damages, and scabs from the combination from the images.

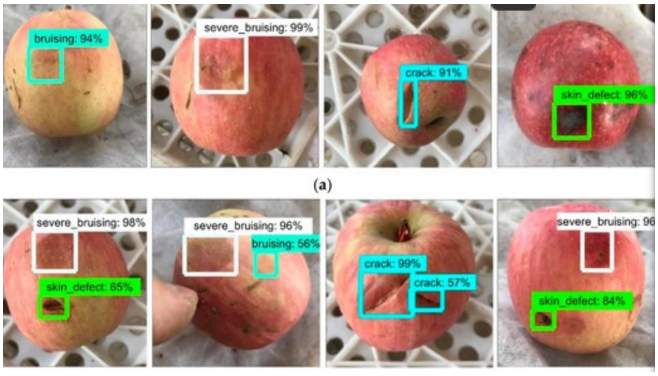


Fig. 4 Result of surface defect finding ,(a) Apples with one kind of surface defect.
(b) Apples with two kind of surface defects.

In 2008 by Tellaeche et al. using binary image segmentation to separate weeds from crops. And this method is mainly used in pesticides management weed affected areas and this method is using by the farmer for decision making. Montalvo et al. in 2013 invented an automatic expert system by using binary image segmentation technique. It's used for identify corps and weeds.
Precision agriculture is a well known technique in agriculture field. This process mainly helps farmers to select the proper seeds, monitoring the disease of the fruits, fertilizer and pesticides usage. And more over many parts of the world specifically in rural areas this kind of information are not easily asses sable and also it's enough costly for the farmer's. The process is mainly depends on location specific data and also it includes of multiple image databases . This image processing technique is used to help in terms of decision making by providing high resolution pictures.

II. CONCLUSIONS

Image processing is a well known technique which has proved as a efficient computer-vision system in agriculture field as well. Some of the different range like Infrared, X-ray were very useful in terms of identify irrigated land mapping, measurement of canopy etc. There are so many methods and also some new methods that are evaluating to assist and facilities in the farming practices. it's noticeable that all the approaches which were contribute the bigger goal of improve the global food production. , we can conclude that image processing is the most conventional and effective tool that can be used for agriculture field with a huge perfectness and provincial parameters.

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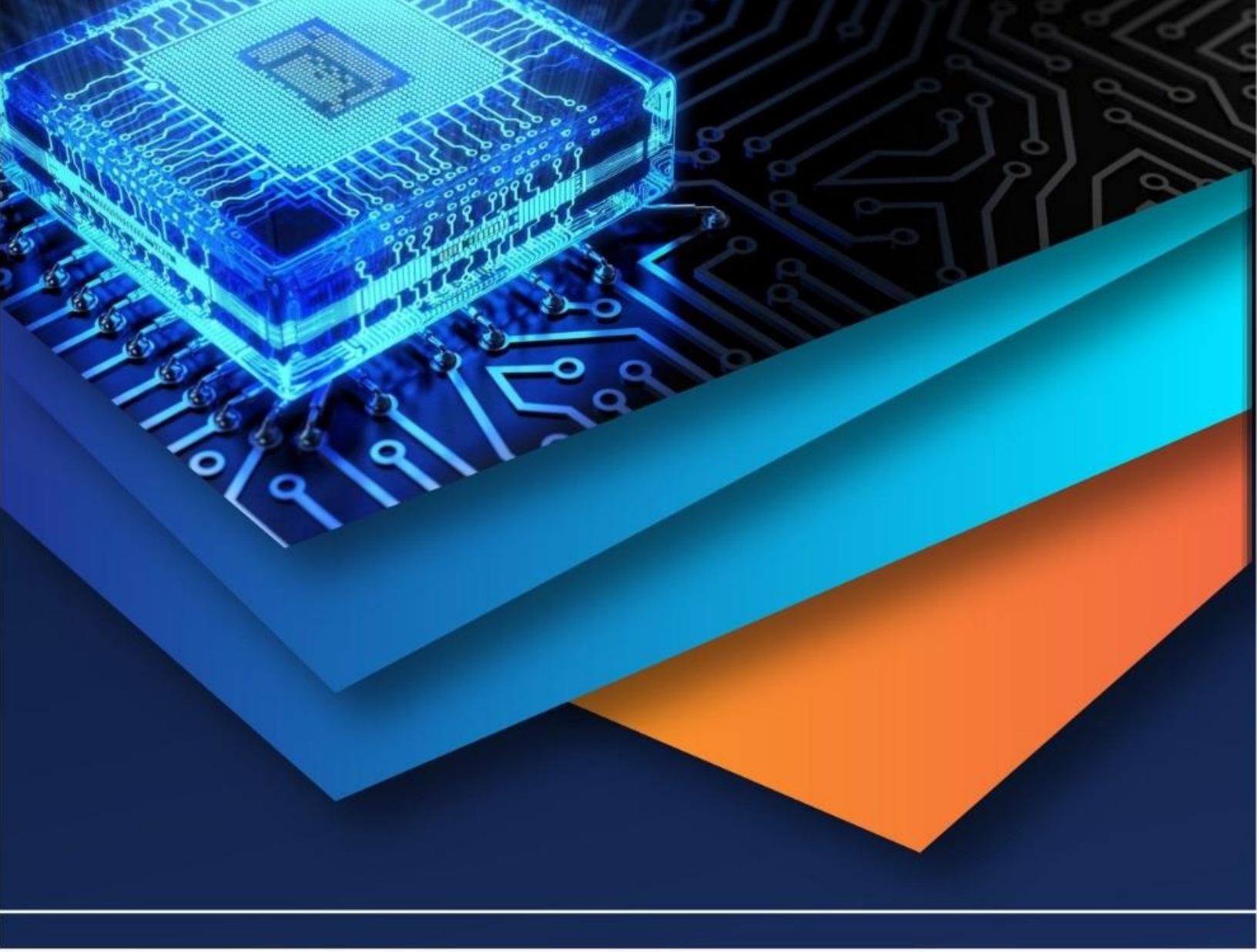
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