A.Sivaranjani,2021, 9:3
ISSN (Online): 2348-4098
ISSN (Print): 2395-4752

Jackfruit Yield Estimation Using Image Processing Techniques

A.Sivaranjani, S.Senthilrani, P. Sri Gayathri Paaraa, V. Manikandan, S. Umamaheswari
Department of Computer Science and Engineering.
University College of Engineering-Panruti.
Panruti, TamilNadu, India.

Abstract-The yield estimation of jackfruit is an important aspect for planning many tasks such as storing, packaging and exporting. To measure the quantity and predicting the yield of jackfruit manually is quite difficult and time consuming, so, in this paper we are going to predict the yield and count the number of jackfruit present in the image that have been taken from the orchard. This work involves the steps of image processing techniques. Image acquisition is finally made from the image produced and then pre-processing takes place by gray scale conversion and median filtering which is used to reduce noise of image. Then segmentation takes place using SLIC approach where super pixels were present. Classification for this work is done considering the features like color and shape of the fruit along with layered construction which results in producing the count and yield prediction of jackfruit.

Keywords:- Yield Estimation, Median Filter, Simple Linear Iterative Clustering.

I. INTRODUCTION

Agriculture is the back bone of the Indian economy. Crop Yield Estimation is to serve the farmers of this nation by predicting the yield amount of whatever crop considering their data from the past references. Crop yield estimation is of great importance to global production. Crop yield estimation is carried out in jackfruit orchard 2-3 weeks prior to harvest and to arrange marketing.

This work is used to predict the yield of jackfruit because in these surroundings jackfruit is one of the main cultivating fruit around Panruti region. Crop yield is a highly complex trait determined by multiple factors such as genotype, environment and their interactions. But in the case of image processing the complete dataset is based on the images submitted for the training and testing to calculate the yield. Computer vision is a field that involves making a machine "see" [1].

This technology uses a camera and computer instead of the human eye to identify, track and measure targets for further image processing. Through production management based on large-scale datasets, be more widely used to solve the current agricultural problems, and better improve the economic, general and robust performance of agricultural automation systems, thus promoting the development of agricultural automation equipment and systems in a more intelligent direction. In this work we are using image processing techniques to predict the yielding of jackfruit [2].

In which first we ought to take a picture of the jackfruit spotted are and then train the image to get the yielding of the fruit using several steps that includes image acquisition, pre-processing, feature extraction, segmentation, classification and counting of the fruit.

1. Image Acquisiton:
In image processing, it is defined as the action of retrieving an image from some source, usually a hardware-based source for processing is possible. It is the first step in the workflow sequence because, without an image, no processing is possible. The image that is acquired is completely unprocessed.

Now the incoming energy is transformed into a voltage by the combination of input electrical power and sensor material that is responsive to a particular type of energy being detected [3].

The output voltage waveform is the response of the sensors and a digital quantity is obtained from each sensor by digitizing its response. Noise reduction is achieved by letting the sensor integrate the input light signal over minutes or even hours [4].

2. Pre-Processing:
Image pre-processing is the term for operations on image at the lowest level of abstraction. These operations do not increase image information content but they decrease it if entropy is an information measure.

The aim of pre-processing is an improvement of the image features relevant for further processing and analysis task [7]. There are four different types of image pre-processing techniques and they are listed as: Pixel brightness transformation, Geometric transformations, Image filtering and segmentation, Fourier transform and image restoration.

3. Feature Extraction:
Feature extraction refers to the process of transforming raw data into numerical features that can be processed while preserving the information in the original data set. It yields better results than applying machine learning directly to the raw data. Feature extraction can be manually or automatically [8].

Manual feature extraction requires identifying and describing the features that are relevant for a given problem and implementing a way to extract those features. Automated feature extraction uses specialized algorithms or deep networks to extract features automatically from signals or images without the need for human intervention [9].

4. Segmentation:
Segmentation is basically a process of pixel classification in which the picture is segmented into subsets by assigning the individual pixels into datasets. Image segmentation is typically used to locate objects and boundaries such as line, curves in images.

The result of image segmentation is a set of segment that collectively covers the entire image, or a set of contours extracted from the image [6]. Each pixel in a region is similar with respect to some characteristic or computed property, such as color, intensity or texture. Segmentation consists of two classes such as classical computer vision approaches and AI based techniques.

5. Classification:
Digital image classification uses the quantitative spectral information contained in an image, which is related to the composition or condition of the target surface. Image analysis can be performed on multispectral as well as hyper spectral imagery [5].

A broad group of digital image processing techniques is directed toward image classification. It used the spectral information represented by the digital numbers in one or more spectral bands, and attempts to classify each individual pixel based on this spectral information. This type of classification is termed as spectral pattern recognition.

II. LITERATURE SURVEY

Dhivya Elavarasan in paper [1] has used deep reinforcement learning to predict the yielding of crops. The proposed work constructs a deep recurrent Q-network model which is a recurrent neural network deep learning algorithm over the Q-learning reinforcement learning algorithm to forecast the crop yield. The sequentially stacked layers of recurrent neural network are fed by the data parameters. The Q-learning network constructs a crop yield prediction environment based on the input parameters. A linear layer maps the recurrent neural network output values to the Q-values.

The reinforcement learning agent incorporates a combination of parametric features with the threshold that assist in predicting crop yield. Finally, the agent receives an aggregate score for the actions performed by minimizing the error and maximizing the forecast accuracy. The proposed model efficiently predicts the crop yield outperforming existing models by preserving the original data distribution with an accuracy of 93.7% and with some drawbacks.

Santi Kumari Behra at paper [2] has estimated the yield of pomegranate fruit using image processing techniques. This paper consist two approaches to detect and count pomegranate fruit using on-tree images i.e. first approach is based on color thresholding with circular Hough transform and second approach based on K-means clustering with Circular Hough transform and the performance of both methods is evaluated by correlation co-efficient.

The main challenge in this research is proper counting of each fruit because the fruit is occluded fully or partially by other parts of tree, fruits appeared in blob. In this paper both the method shows that the algorithm helps to detect and count pomegranate fruits easily. Here also they compare the performance of both approach by regression analysis, which show that the second approach have R_2 value 0.7652 compared to 0.6888 in first method and concluded that the second approach is the better one.

A.B.Payne in paper [3] have estimated the yield of mango that presents an approach to count mango fruit from daytime images of individual trees for the purpose of a machine vision based estimation of mango crop yield. Images of mango trees were acquired over a three day period. Three weeks before commercial harvest occurred. The fruit load of each of fifteen trees was manually counted, and these trees were imaged on four sides.

Further after acquiring perfect image pixels were segmented into fruit and background pixels using color segmentation in the RGB and YCbCR color ranges and a texture segmentation based on adjacent pixel variability. Thus even though there have been some back logs have occurred like it was hard to decrease the color segmentation.

Nageswararao Naik Bhookya in paper [4] has been proposed to detect and count the number of chili present in the orchard from the given image to be analyzed. Normally counting chilly from its orchard is a pretty tough task as it has to be done with large manual power. So this paper image processing techniques to detect and count the number of chili present.

Firstly a clear RGB image containing the all area covered of the single chili plant have been taken to be executed. Then pre-processing is done using a-channel image of lab color spaces and then converting it into delta E image. Then in the process of segmentation the image has been masked to remove the noise from it and used color threshold to convert it into binary image. Then carry on the morphological operations on the binary image to spot the number of chili in it and saying the count of it. However there has been a drawback of hiding of the element must be considered while taking the image of the region.

Scarlet Liu in paper [5] has proposed an application in iOS to count the berries from taking picture of a bunch with mobile. The application called 3D Bunch acquires image from the camera or the album on a smart phone and then estimates the number of berries by a reconstructed 3D Bunch model based on the proposed image analysis techniques that are embedded in the developed iOS app. It also presents features of visualizing the statistics of the reconstructed bunch, which including of the distribution of the detected berry size in pixels and the total number of berries.

It also has the capability of presenting sampling related information, which includes the person who conducted the sampling, the location of samples, the sates id sampling, the variety, farm, vineyards etc. the application was evaluated both on a simulator on a commercial computer and an iPad mini 4. This work had produced an accuracy of 92% along with some drawbacks.

Thus these papers we took for reference provides greater accuracy and clear scope to get the output correctly with some drawbacks along with them. We aim to count and detect the accurate yield production of jackfruit from its orchards by using image processing techniques.Thus these papers we took for reference provides greater accuracy and clear scope to get the output correctly with some drawbacks along with them. We aim to count and detect the accurate yield production of jackfruit from its orchards by using image processing techniques.

III. PROPOSED SYSTEM

1. Architecture Diagram:

Architecture diagram is the conceptual model that defines the structure, behavior, and more views of a system. An architecture description is a formal description and representation of a system, organized in a way that supports reasoning about the structures and behaviors of the system. This architecture diagram explains about the process that takes place during the process of yield estimation of jackfruit.

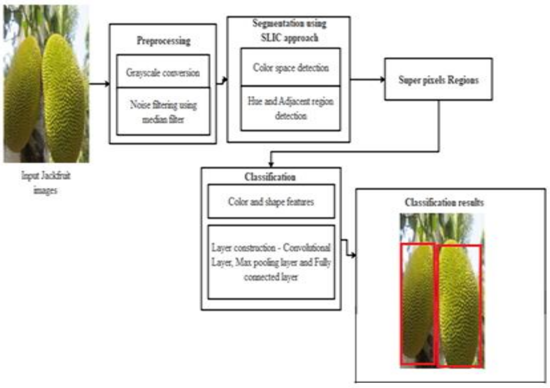

Fig 1. System Architecture.

2. Image Acquisition:
This step deals with representation of the visual characteristics of an object, such as a physical scene or the interior structure of an object. We produce the picture we took from the targeted bunch of fruits from the orchard to be yield calculated. For image acquisition we have used a normal camera. About 20 pictures have been trained to get the outlet of gaining the count of jackfruit in the trained image.

3. Gray Scale Conversion:
Gray scale conversion is a process that removes all color information leaving only the luminance of each pixel. The only color shades that will e present after this conversion will be gray eliminating the RGB color effect. To get a grayscale image, the color information from each channel is removed, leaving only the luminance values, and that is why the image becomes gray[10].

4. Median Filtering:
Median filter is effective when the goal is to simultaneously reduce noise and preserve edges. Such noise reduction is a typical pre processing step to improve the results of later processing. This particular technique is widely used in digital image processing because, under certain conditions, it preserves edges while removing noise, also having applications in signal processing.

5. SLIC Approach:
SLIC – Simple Linear Iterative Clustering. This technique uses an algorithm that clustering pixels on the combined five dimensional color and image plane space to efficiently generate compact, nearly uniform super pixels. The simplicity of this approach makes it extremely esy to use. [5]

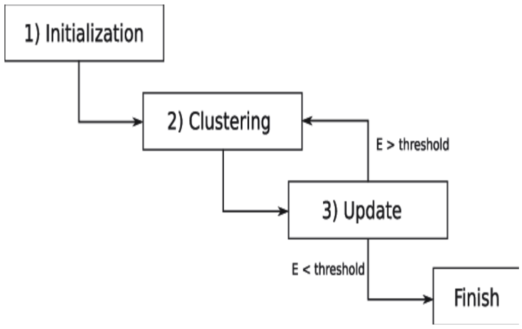

Fig 2. Process of SLIC Approach.

This architecture diagram explains about the process for SLIC approach such as:

- **Step 1:** Initially the image will be divided into clusters and sets the centers of the clusters.
- **Step 2:** Then performs a new clustering of the pixels to the centers, based on the distance function as in step 2 and step 4.
- **Step 3:** Updates the center of the clusters using the coordinate position and intensity of the cluster pixels where step 2 and step 3 are repeated until the residual error is low enough.

6. Classification:
Classification in this work is mainly carried on using the color and shape feature of the fruit. The growth and yield of the fruit is analyzed using their color and shape from the images provided.

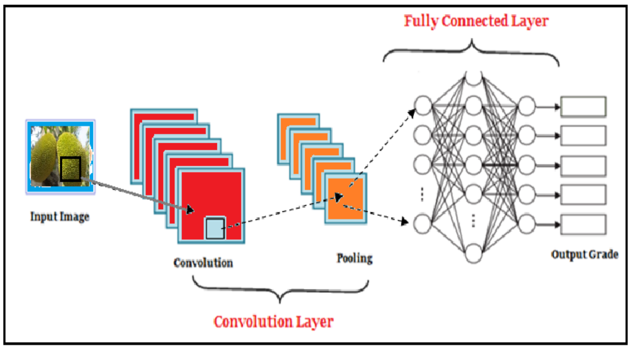

Fig 3. Architecture of CNN.

The layer construction involves for classification that includes:

6.1 Convolutional Layer – This layer is known as the core building block of a CNN. The layer's parameters consist of a set of learnable filters or kernels, which have a small receptive field, but extend through the full depth of the input volume.

6.2 Max-Pooling Layer – This layer calculates the maximum, or largest, value in each feature map. This layer work well than other layers in the case of image classification.

6.3 Fully Connected Layer – This layer forms the last few layers in the networks. In this layer all the inputs from one layer are connected to every activation unit of the next layer.

IV. RESULT

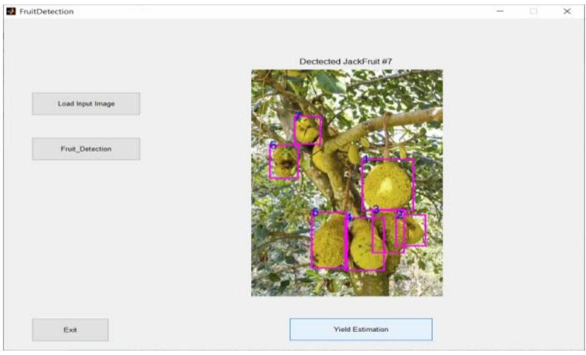

Fig 4. Result after calculating the count of jackfruit in the image.

V. CONCLUSION

In this paper, counting and prediction of yielding of jackfruit has been carried on using image processing techniques. A simple picture of jackfruit bunch from the orchard has been produced for image acquisition. Then the image has been pre processed under gray scale conversion along with median filtering for the purpose of noise removal. Segmentation part takes place after that using super pixel segmentation under SLIC approach for perfect edge detection. And then classification of the fruit using their color and shape features have been done at where the resulted counting along with the yield prediction prior to 2-3 weeks will be displayed.

REFERENCES

[1] Dhivya Elavarasan and P. M. Durairaj Vincent, "Crop Yield Prediction Using Deep Reinforcement Learning Model for Sustainable Agrarian Applications" IEEE (2020).

[2] Santi Kumari BeheraMomin, Abhishek Pattnaik and Amiya Kumar Rath, "Yield Estimation of Pomegranate Using Image Processing Techniques" IJITEE (2019).

[3] A.B. Payne, K.B. Walsh, P.P. Subedi and D. Jarvis, "Estimation of mango crop using image analysis-Segmentation method" ELSEVIER (2013).

[4] Nageswararao Naik Bhookya, R.Malmathanraj and P.Palanisamy, "Yield Estimation of Chilli Crop Using Image Processing Techniques" ICACCS (2020).

[5] Scarlett Liu, Xiandong Zeng and Mark Whitty, "3D Bunch: A Novel iOS-Smartphone application to Evaluate the Number of Grape Berries per Bunch Using Image Analysis Techniques" IEEE (2020).

[6] Thiago L M Barreto, Rafael Rosa and Christian Wimmer, "Classification of Detected Changes From Multitemporal High-Res Xband SAR Images: Intensity and Texture Descriptors From Super Pixels" IEEE (2016).

[7] R. Chinchuluun, "Citrus yield mapping system on a canopy shake and catch harvester," ASABE Annual International Meeting Presentation, 2007, pp 78-79.

[8] F. Cointault and P. Gouton, "Texture or color analysis in agronomic images for wheat ear counting". Third International IEEE Conference on Signal Image Technologies and InternetBased System, 2008, pp 696-701.

[9] P.Wijethunga, S. Samarasinghe, D. Kulasiri and I. Woodhead, "Digital Image Analysis Based AutomatedKiwifruitCounting Technique," 2008.

[10] R. Maini and Dr. H.Aggarwal, "Study and Comparison of Various Image Edge Detection Techniques," International Journal of Image Processing (IJIP), 2009, vol. 3, pp 43-48.