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Fruit Counting For Automated Inventory Management System Using Neural Networks

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***Abstract*-In agricultural sector the problem of identification and counting the number of fruits on trees plays an important role in crop estimation works. At present manual counting of fruits is carried out at many places. Manual counting has many drawbacks as it is time consuming and requires plenty of labors. The automated fruit counting approach can help crop management system by providing valuable information of forecasting yields or by planning harvesting schedule to attain more productivity. This work presents an automated and efficient fruit counting system using computer vision techniques and neural network object detection methods. Neural networks have the capability of recognizing complex patterns and they shows better accuracy when compared with other techniques.**

***Keywords*- Neural Networks, Datasets, YOLO architecture, data collection, data labelling.**

I.INTRODUCTION

Counting fruits and vegetables seems like a simple problem, but is highly important task for inventory managements. The routine task is highly labor intensive and huge number of labors. Since there was no enough technologies to solve this issue in past, this problem remained unsolvable. However with the new modern technologies, like many of the processes are getting innovative solutions, this problem can also be solved.

The modern neural network based solutions are highly innovative and can solve complex image processing problems which include image classification, object detection, image segmentation, image style transfer, image recreation and so on. With the availability of more and more data, it is very easy to implement neural network based solutions very fast.

II. PROBLEM STATEMENT

In the field of agriculture, yield estimation and mapping of fruits is vital for growers as it helps to utilize resources efficiently and improves returns per unit area and time. Having accurate knowledge of yield distribution and quantity, a grower can not only manage processes in the irrigation system such as chemigation, fertigation and thinning, but also plan ahead of time their harvest fruits storage and sales.

Producing yield information is currently done by manual sampling which is not only labor intensive but also expensive and time consuming. Such manual samplings also lead to inaccurate yield estimation. Hence there is a need to develop machine vision systems to deal with the above mentioned problems in order to detect the fruits accurately, which in turn reduce the errors in counting the total number of fruits.

III. EXISTING SYSTEM

The existing systems for categories fruits and vegetables include various types of machineries which are used for industrial purpose. But these machineries remain highly costly and complex to maintain.

Other solutions included handpicked counting, which is highly labor intensive and requires more labors.

IV. LITERATURE SURVEY

Different methods has been proposed in past for solving problem statement.

Alimi et al. (2013) described the use of manual fruit measurements (manual phenotyping) for predicting yield in pepper plants. In this thesis, work is to automatically detect and count any fruit in images of dense pepper plants, to reduce manual measurement and labour requirements, and to increase objectivity.

In his recent paper, **van der Heijden et al. (2012)** showed that several manual measurements could be replaced by image analysis leading to the same QTL (positions on a genetic map, which shows a relation with the trait under study).The algorithm used Automatic fruit recognition and counting from multiple images are SVM and bag of words model. The advantages of the application is their work is to automatically detect and count any fruit in images of dense pepper plants, to reduce manual measurement and labour requirements, and to increase objectivity. The disadvantages is However, if considerable overlap is

present between the different organs in the colour cube,the linear colour model approach fails and more contextual information is needed to solve the problem.Besides they showed that image analysis could aid in the identification of additional physiological traits that are hard or impossible to measure by human operators.

V. PROPOSED SYSTEM

In this paper, we are introducing a new approach for solving our given problem statement. With the help of modern neural network based object detection methods we can detect fruits easily.

The proposed system deals with counting and detection of fruits from the image. In this system, the user is given two choices, either to upload an image of the fruits to be counted and detected or to open the webcam and capture the image in real time in order to count and detect the fruits. Once when the user uploads/ captures the image, the system processes the image/ frames and passes through the neural network to detect the location and count the number of fruits.

This paper focuses only on counting 5 different fruits including apple, orange, carrot, banana and broccoli. But with more data, we can count more different types of fruits

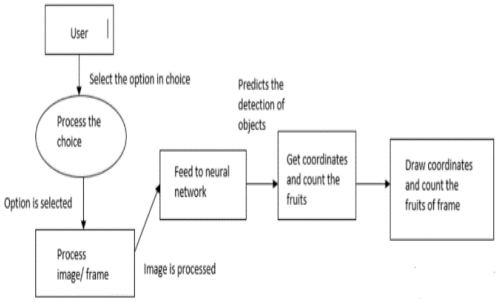

Fig 1. Proposed System Architecture.

VI. IMPLEMENTATION

The implementation of this approach is done in different steps.

1. Data Collection:
The first step of building this system is Data Collection. Data is collected in order to pass to neural networks. We require huge amount data in order to build a successful system. If more number of data's are collected then the possibility of accuracy of the system increases. Data's can be collected through different sources like mobile capturing, downloading from internet and many more. Data Collection is very important as the performance of the system depends upon the number of data's collected.

The dataset used in this paper is created manually through different sources.

Fig 2. Dataset used during data collection process.

2. Data Labelling:
Data labelling is the process of identifying raw data (images, text files, videos, etc.) and adding one or more meaningful and informative labels to provide context so that a machine learning model can learn from it. In this system, after data collection the images are labelled by finding their coordinates in order to detect and count the fruits in the images. Data Labelling should be done for each data collected. This task can be easily done using different tools such as labelImg

3. Choosing the Architecture:
Choosing the right architecture is important while building a system. There are different types of architecture available for object detection. In this paper, the used architecture is Yolo Architecture. Yolo architecture is simple and is very useful for object detection. YOLO (You Only Look Once) real-time object detection algorithm, which is one of the most effective object detection algorithms that also encompasses many of the most innovative ideas coming out of the computer vision research community

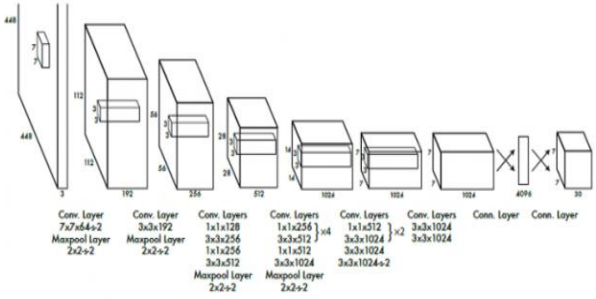

Fig 3.Yolo Architecture Design.

4. Training the Neural Network:
Training is the process in which, the neural network learns from the dataset in order to make future prediction. For training it required a high processing system since this process is computer intensive. Alternative options include using cloud systems for this task. In this paper the training is done using cloud systems mainly Google colab. After successful completion of this task, a weight file will be generated which contains the learning parameters for the neural network.

5. Prediction:
With the weight file generated, by passing the input image to neural network, the count and location coordinates of the object in the image is generated. By connecting with camera, the camera output can be passed to neural network as input, the counts and location of objects can be processed in real time.

VII. CONCLUSION AND FUTURE WORK

The proposed system deals with counting and detection of fruits. We have used modern technologies in building this system. Manual counting is difficult and expensive as it requires a lot of labors and different types of tools. In this system, we have limited the count to minimum and we have acquired great success in counting and detecting the fruits in the images uploaded/ captured by the user.

Though this project is done keeping a single user in mind, in the future this project can be developed for a small as well as large sale industries too. In future, we can increase the limitation of counting so that this system can be used in large scale industries also. We can also collect more datasets and modify the system in order to count and detect pepper and vegetablesreferences.

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