Smart System to Detect the Maturity Level of Fruit Size Using IoT

B. Srinuvasu Kumar[1], S. G. Santhi[2] and S. Narayana[3]

[1] Research Scholar,Department of CSE,Annmalai University
Tamilnadu, India

[2] Assistant Professor,Department of CSE,Annamalai University
Tamilnadu, India

[3] Professor & HoD,Department of CSE,Gudlavalleru Engg. College
Gudlavalleru, India

Abstract

Abstract: The only way that is available to estimate the maturity of any fruit is estimating through its colour and size. In general small scale cultivators will do this process in person; they check each and every fruit personally and decide the maturity level of the fruit with the help of colour and size. Six different indexes are available in FAMA. Exercising this practice is not recommended as it consumes lot of time the there is scope for human error. In this paper we are emphasising on grading fruits based on the level of its maturity. In this process a technique which is competent enough to estimate the maturity of the fruit with help of the picture of the fruit, i.e. Raspberry Pi. K-means agglomeration will be used by the image processing formula in order to recognise the colour of the targeted fruit.

Keywords: *K-means, maturity, Open-CV, Raspberry Pi, Python, mango, fruit size, color.*

1. Introduction

Fresh fruits that are ready to consume will go through in to different maturity indicators. In specific mangos are mostly traded based on its appearance particularly colour and size. But deciding the maturity of a fruit through its colour and size by a human being is practically biased. In order to address this human error in deciding the quality of the fruit techniques that involve image processing are highly useful in the business of the fruits. These will enhance the accuracy in evaluation the crop which will help both the parties that is seller and buyer [1, 2].

Enormous amount of time and efforts are invested by the countries that primarily dependent on agricultural income to develop a technology that helps to decide the maturity level of the crop. In [6] it is described the process to estimate the maturity of tomatoes with the help of MATLABS, similarly in [3] mangos maturity calculation and estimation is described. The growth of image processing models went to a different level due to emerge of microcontroller boards along with open software. Here in this paper, a process exploitation laptop vision to draw mangoes' diagram procured on-line at FAMA's web site. The system makes use of a computer vision of an open source, device learning software, along with the Open-CV-Python. The system installed in Raspberry Pi.

2. Methods

The laptop which is single boarded and as potential as a desk top could be a Raspberry Pi. It weighs solely forty five g and measures eighty five.60 millimetre x fifty six millimetres twenty one millimetres. Broadcom SoC that contains a Videocore4 GPU along with 64 bit ARM (advanced architecture machine) processor in specific ARM Cortex - A53 will be employed in Raspberry Pi. That runs at one 2 giga cycle with one GB RAM. Raspberry Pi operating system is Raspbian.

Open supply laptop Vision Library Open CV() is an Associate in Nursing open library which contains good number of algorithms that are related to supply laptop vision. Open CV's API allows usual allocation and reallocation of memory [6, 7]. This will simplify the programming complication to the maximum extent. Python programming language and open CV are integrated through open CV-python.

Python syntax is very simple to use as it is straightforward in nature. It is completely dependent on applicable keywords and their readability.
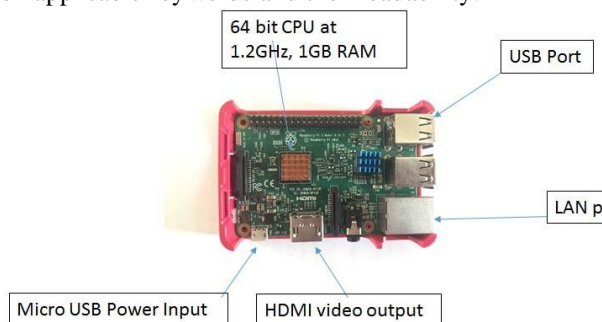

Figure 1: Raspberry Pi 3 Model B

For laptop vision applications, OpenCV-Python accolades a systematic infrastructure and it will also speed up the usage of machine understanding in industrial product. Periodically image processing is the key element in Open CV-Python. .

Histograms are highly useful in producing details of colour through images. In practice colour histograms are considered to be outstanding with respect to different tasks due to study construction and change view nature. Histograms are effectively analysed by OpenCV Python as it is imbibed with a typical method which will stimulate the proper examination. K-means a clustering algorithm is employed in the process of developing a Histogram. . Through the available closet mean, cluster algorithm K-means will get 'n' number of data points. Each and every cluster's mean will be considered as either "Centre" or "Centroid". From the initial n data points the active k-means will get K isolated clusters by default. The unique cluster assumed to be within the data points are considered as highly comparative to one another data points determines that there is place for multiple clusters [5, 6].
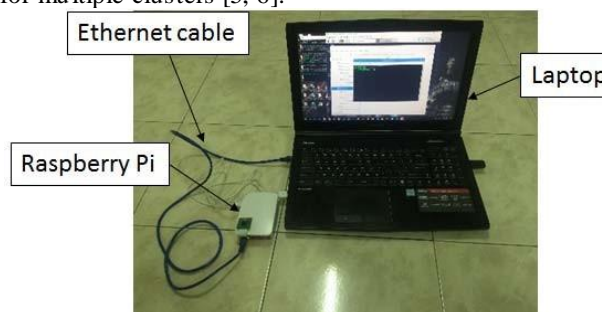

Figure 2: Raspberry Pi display on laptop

By calculating the pixel per every metric ratio, fruit in the image will be evaluated. The ultimate object is to find out the objects' size in the image with the help of object of reference for calculation. Couple of essential qualities must be with the object of reference. Primarily, object must possess dimension, it could be anything like height of width and it should be in measurable units. In addition to that in image the object of reference must be objects' either means of appearance or the position. In any case identification with respect to any of the reference is must. . The application called Tight VNC Viewer will be employed in the process of raspberry Pi display that is monitors of a laptop that is looped with Ethernet. From articles and website of FAMA multiple images of mangos at different stages of the fruit will be gathered.

3. Implementation

K-means clustering will be made to identify the dominant colour to recognize the maturity stage of the mango. Different shades of the colour will represent different stage of the growth of the fruit. As demonstrated in Figure 3 colours will be materialistic in determining the maturity of the mango. The background remains black and on that fruit will be displayed in different colours as per its maturity.

It is essential to compare the object of reference and the picture of the fruit to decide the maturity level of the fruit. Maturity level reference is tabulated in table 1. In order to match the frit image with the close reference object Histogram will be used. As shown in figure 4 a particular fruit's picture will be compared with the object of reference to decide the maturity of the fruit. The value is displayed as 0.00 as the picture is same as object of reference. Hence the closer the value to 0.00 is the similar to the object of reference. Ideally it is one and the same as long as value is less than 0.40. That means if the value is more than 0.40, the object of reference is totally different in spite of its colour similarities.

Confirmation of fruit size, the reference is the most left side. The objects' dimensions that are in centimetres with pixels per metric ratio will decide the remaining objects' sizes. Hence we will get pixel per metric by dividing object width with known width. Whereas width of the object is obtained from algorithm and personal measurement is considered as known width. It's obtaining pictures' pixel per cm. As per the Figure 3, with the assurance of the width of the reference fruit, the remaining frits size can be measured.

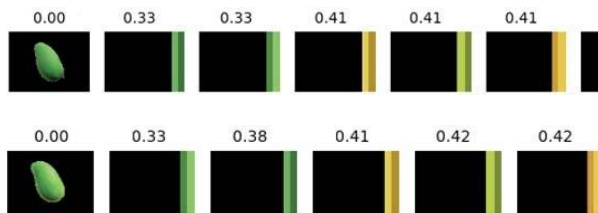Table 1: Dominant three colours of the mangoes in a dataset.

Figure 3: Evaluation and testing the maturity using OpenCV histogram for the mango.

Hence the reference fruit and the personally calculated width is 5.5cm. With the help of determined pixel per metric ratio we will be in position to estimate the size. There after the system will determine the remaining mango size. Only one object of reference will be used to determine the size of the fruit. .

The accurate size can't be calculated by the system it will get an approximate value. Along with that the fruits maturity level will be estimated with its colour. In further grading procedure, the program will use K-means clustering as it can identify the maturity of the fruit with its colour. At the end system will be successful in comparing fruits and decide the maturity level with the help of OpenCV python Histogram.

4. Conclusion and Future Works

FEMA's fruit grading system is analysed thoroughly. . FEMA is using six different indexes to check the maturity of the fruit. Along with FEMA practices a thorough research is conducted with the available literature. The compatibility among Raspberry Pi and Python and OpenCV python is very effective. Even with 5V and 1 GHz of RAM the program could nun very fast with proper processing. The required

equipment is also very nominal with single laptop screen, keyboard and mouse are sufficient to use this system effectively. Next, by utilizing Python with OpenCV-Python, the calculation of k-intends to locate the prevailing shade of the fruit, size of the fruit utilizing Euclidean separation and looking at the maturity levels of the fruit utilizing OpenCV-Python histogram has been explored.. Hence maturity identification by analysing size and colour with help of Raspberry Pi is introduced. The size of the fruit will be estimated by the system. Along with size calculation system will estimate the maturity of the fruit with its colour as it uses K-means clustering procedure.

There are different and unique concepts at research level which can improve the accuracy in measuring the maturity level of the fruits. One among those concepts is with the help of the shape of the image estimating the volume of the fruit. It can be done as size calculation is the base to calculate the volume of the fruit and it will be an added value to the existing system.
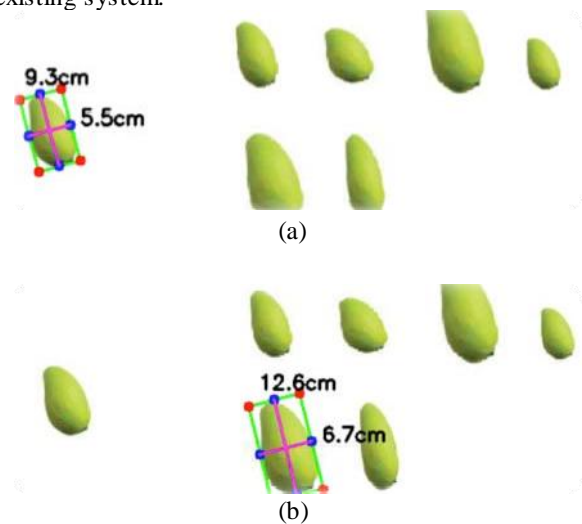

(a)

(b)

Figure 3: The size of the fruit on the far left is used as a reference to measure size of the fruit on the right; (a) Reference measurement; (b) Measurement for other size of mango.

References

[1]   F. A. M. A. FAMA, "Official Portal of Federal Agricultural Marketing Authority - Standard & Grade Specifications," 2016.

[2]   P. Yimyam and S. Jaitrong, "Mango maturity classification by using physical properties q1," in *The 12th Annual Conference of Thai Society of Agricultural Engineering*, 2011.

[3]   M. Nagle, K. Intani, G. Romano, B. Mahayothee, V. Sardsud, and J. Müller, "Determination of surface color of'all yellow'mango cultivars using computer

vision," *Int. J. Agric. Biol. Eng.*, vol. 9, no. 1, p. 42, 2016.

[4]   [4] M. Firdaus and B. Mohd, "Mango (Harum Manis) Quality Grading System," Grading Syst. Harum Manis, vol. 1, no. January, pp. 1–3, 2014.

[5]   [5] C. S. Nandi, B. Tudu, and C. Koley, "An automated machine vision based system for fruit sorting and grading," in Proceedings of the International Conference on Sensing Technology, ICST, 2012.

[6]   M. P. Arakeri and Lakshmana, "Computer Vision Based Fruit Grading System for Quality Evaluation of Tomato in Agriculture industry," Procedia Comput. Sci., vol. 79, pp. 426–433, 2016.

[7]   E. Element14, "Element14.com," Premier Farnell plc., 2016