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Identification of Artificially Ripened Fruits using MATLAB

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Abstract: *Better health is central to human happiness and well-being. Eating ripened fruits gives the good health. People intake a lot of fruits to remain fit. Fruits contain important vitamin, minerals and also fibre. Ripening is the process in fruits that causes them to become more palatable and sweeter. Nowadays, fruits available in the market are mostly artificially ripened. Various types of chemicals are used to ripen the fruits artificially like calcium carbide, which is extremely hazardous to health. It causes health issues like diarrhoea, general weakness, vomiting. But with human eye observation, it is difficult to find out artificially ripened fruits. To identify the artificially ripened fruits, we have design a software using MATLAB. It gets an input image of fruit under test and compares the features (histogram values) with naturally ripened one and detects fruits which are ripened artificially. . In this method, the image processing is executed to detect the artificially ripened fruits. Captured images are inputs to an image processing unit. The image is processed and compared with a standard image to display whether the fruit is artificially ripened or not.*

Keywords:

Artificial ripening, Histogram, MATLAB, Image processing

1. Introduction:

Fruits are an essential component of our food. They are assumed to protect us from diseases and increase our immunity. Most of the times we consume fruits when they get ripened. Botanists explain fruit as the fleshy part in which seeds grow. Fruits of some plants like cotton are very thin. When seeds grow completely fruit cracks up after drying and open up. Seeds spread with the help of air. On the other hand, fruits of plants like mango, apple, guava, and litchi are flesh and sour when seed is in the process of growth. It keeps the fruit protected from birds, animals and insects. When seed grows up completely fruit gets ripened and is consumed. Seed is thrown away for germination.

1.1 What is Ripening?

Ripening is a natural physiological process that makes the fruit sweeter, more palatable, edible, nutritious, softer and attractive. Ripening is also associated with color change due to the pigments that are already present or are produced during ripening [1].

1.2 What happens during Ripening:

Chemistry of Ripening during ripening fruits undergo a number of chemical changes. The starch present in the fruit breaks down to sugars, giving fruit a sweeter taste. Fruit changes its skin color generally from green to red, yellow etc. due to degradation of chlorophyll, as the other pigments show their visible existence. The main polysaccharide stored in fruits is starch. As ripening occurs, there is enzymatic breakdown and hydrolysis of water insoluble starch into smaller saccharides like sucrose, glucose, fructose etc. that are water soluble sugars, attributing fruit a sweeter taste. The ripened fruit still has a lot of acid but its sour taste is masked by the large quantities of sugar present.

The cell wall of fruits consists of polysaccharides, mainly pectin. During ripening various enzymes including polygalactourenase convert this insoluble pectin into a soluble form. As a result, the cell wall and hence fruit becomes less firm. Acids including organic acids like malic acid, citric acid, ascorbic acid, tartaric acid etc. are present in large amounts in raw fruits, giving them a sour taste. As the fruit ripens, acids are also broken down e.g. Ripened guavas have decreased amount of Vitamin C as compared to that in raw fruit.

1.3 Artificial Ripening Agents

As ethylene is the main natural ripening agent, artificial ripening agents are used to produce ethylene. These agents accelerate the process of ripening [2]. Fruits are placed in wooden boxes lined with hay. The crates are placed one over the other and wood fire is lit below it. The smoke produced so contains ethylene which inducing ripening.

In some cases generators are used to produce ethylene gas. The sensors help in regulating the gas supply. 1 ppm of ethylene in air is sufficient to induce ripening. A number of fruits can be ripened by placing them in plastic bags. Sometimes fruits and vegetables are placed in big rooms, in which ethylene or acetylene gas is introduced. For example: bananas are picked up when they are hard and green. They are transported in this stage to avoid damage during shipping and transportation. After reaching the destination they are exposed to ethylene gas to ripen. Calcium Carbide (CaC2) is the most common and widely used artificial ripening agent in various parts of the country especially South Asia including India. It is commonly known as 'Masala'. It is produced on an industrial scale for the production of acetylene used for various purposes. The commonly available grade in market is grey or brown and contains 80-85% calcium carbide. It produces garlic smell in the presence of moisture. When sprayed with water, it reacts chemically to produce acetylene (C2H2) CaC2 + 2H2O Ca(OH)2 + C2H2 (1) Acetylene acts like ethylene and ripens the fruits and vegetables by the similar process. Industrial grade calcium carbide generally contains impurities of arsenic and phosphorus that pose a number of health problems. This is the reason its use is banned in most of the countries. But because of cheap prices and easy availability, it is still in use. Although mainly used as an insecticide, Ethephon is another commonly used artificial agent and is assumed as better than calcium carbide. Fruits and vegetables ripened with Ethephon need less time to ripen, have stronger shelf life and are more attractive on decomposition; it also releases ethylene that fastens the ripening process. In addition to these, ethanol, methanol, ethylene glycol are also used for the same purpose. Sometimes fruit vendors use burning kerosene stoves and incense sticks to fasten ripening. Although these agents increase the rate of ripening and impart attractive and colorful look/ appearance to fruits, but organoleptic properties are lost considerably. It does not give the natural aroma and flavor to the fruits. These fruits have uniform color than when ripened naturally. Artificially ripened fruits are not very tasty and are difficult to cut, have recorded weight loss and have comparatively short shelf life. One can easily distinguish artificially ripened mangoes by careful examination.

2. Proposed Methodology:

A.Testing using MATLAB

The proposed was split into two phases: first we tried out by processing the taken image using MATLAB and distinguished the artificial ripened fruits from the naturally ripened fruits using a histogram threshold value. Fruits that were manually ripened were taken as the input data for the image processing code in MATLAB [3]. The image was read and taken as input through the respective functions in MATLAB. Histogram of an image is a graphical illustration of the tonal spreading in a digital image. The number of pixels are plotted for each tonal value in an image histogram. The histogram for a specific image helps the viewer to have an understanding about the complete tonal spreading at a scan [4]. Many modern digital cameras have an option to display the image histogram value. Photographers makes use of histogram to show the captured tone's distribution and to analyse any lose in blacked-out shadows or blown-out highlights[5]. The horizontal and vertical axis of the graph symbolizes the tonal variations and pixel counts in that particular tone respectively. The black and dark areas of an image is represented on the left side, the medium grey is represented on the middle while the right side shows pure and light white areas. Vertical axis denotes the size of the area which is taken in each zones [6]. Thus, for a very dark image the left side and centre of the histogram will have majority of data points. Conversely, a very bright image's histogram with shadows and few dark areas will have most of its data points on the right side and centre of the graph. Figure 1 provides a complete block diagram for the initial testing.

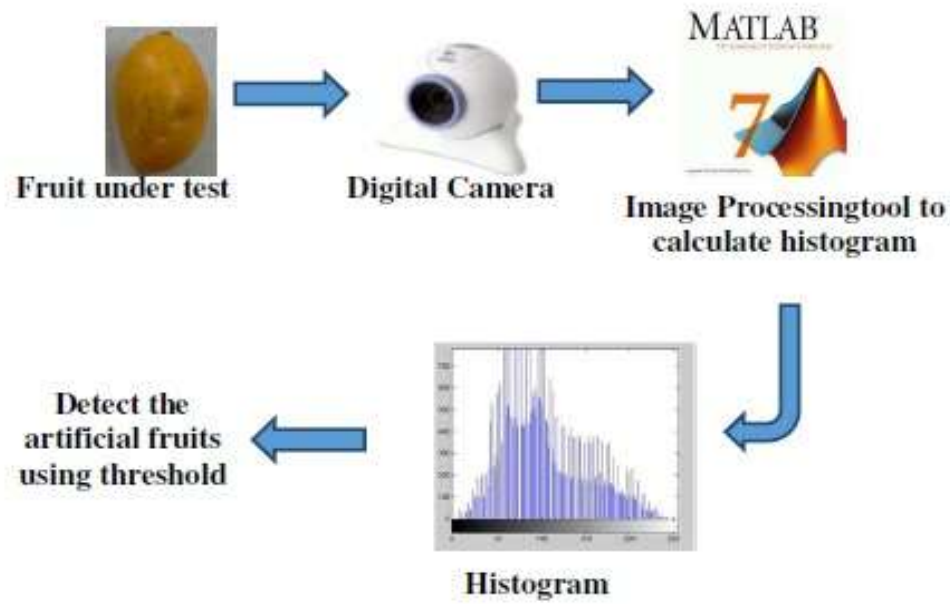

Fig.1- Initial testing block diagram

B. Process flow

Then given image input was processed and its histogram value was calculated. The maximum histogram value was identified using a function[7]. The threshold of histogram value was set after taking up several trials using different input images. The threshold fixed on constant value. It was determined that if the histogram value calculated was greater than this value it was considered to be a fruit ripened artificially and if it was lesser it was considered to be naturally ripened fruit. Then finally it was capable of identifying the mode of ripened fruits. Figure 2 is a flowchart that describes the process done using MATLAB toolkit.

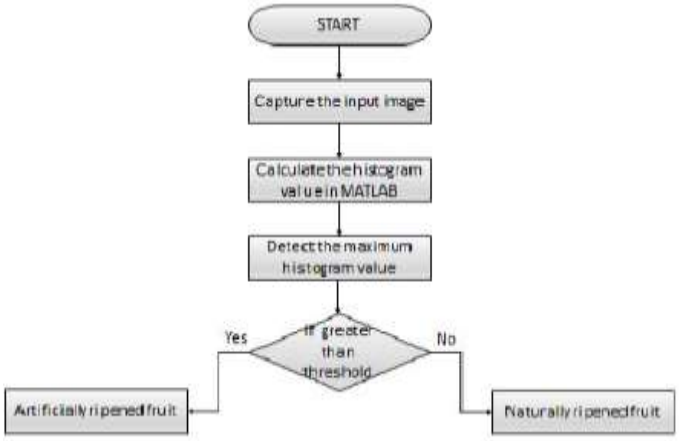

Fig.2- Process flow for MATLAB

The ultimate aim of this project is to help in distinguishing between artificial and naturally ripened fruits.

3. Overall analysis of Reported Work

Fruits nowadays are ripened through some artificial means like usage of chemicals like calcium carbide as ripening agent which might even cause cancer. According to health officials, the consumption of fruits ripened using calcium carbide leads to various harmful effects like vomiting, diarrhea, ulcers of throat and abdomen, general weakness and sometimes damage of eye permanently and breathing shortness.

Finding out the artificially ripened fruits is difficult with human eye observation. To aid the detection we will develop a software which uses image processing to find the artificially ripened fruits. It gets an input image of fruit under test compares the features (histogram values) with a naturally ripened one and detects fruits which are ripened artificially. This method makes usage of the matlab and the image processing is executed to detect artificially ripened fruits.

4. Conclusion:

The proposed method thus identifies the fruits ripened by artificial means and keep people healthy by intake of these healthy fruits. The proposed method aims in developing an application for detecting the artificially ripened and naturally ripened fruits. The image of the fruit processes the image by calculating the histogram value and then classifies the image with the threshold as natural and artificially ripened fruits. The basic aim of this project is that the artificial ripening fruits are extremely harmful to human being and continuous consumption of these kinds of fruits will even lead to extremely harmful diseases like cancer. Thus, this method helps out the users to stay healthy and consume fruits which are nutritious by avoiding the intake of artificially ripened fruits which are ripened with the chemical like calcium carbide.

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