

# Detection of Ripeness of Mangosteen Fruit Using Hsv Color Space Transformation Method

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## Abstract

Rapid advances in innovation in the PC field are increasingly making applications and exploration of image handling strategies created. Image processing has an important role in various fields. Image processing applications are concerned with image processing with regard to color transformation. In this case, the method of transforming the color space as part of the image processing helps in detecting the colors in the image and processing them. Color space is a mathematical model that describes the color represented into the number model. HSV color space is a color space composed of 3 components, namely Hue, Saturation, Value. Hue is related to purity (color pattern), Saturation is related to the saturation of color, Value expresses the brightness level of the color. In this study, based on the results of testing using mangosteen fruit imagery to detect the type of ripeness by transforming rgb color space into HSV color space conducted using sample data as much as 60 fruit data consisting of 45 training samples consisting of 15 images of mangosteen fruit in each type of ripeness, and 15 test samples consisting of 5 samples of ripe mangosteen fruit, 5 samples of half-cooked mangosteen fruit and 5 samples of raw mangosteen fruit obtained success rate accuracy of 86.6%, so it can be concluded that the HSV Color Space Transformation method can be used to detect the ripeness of mangosteen fruit.

**Keywords:** detection, mangosteen image, Transformation, HSV, euclidean distance.

## 1. Introduction

Mangosteen plant is one of the plants of the class Dicotyledonae, guttiferae family, and genus Garcinia. Mangosteen plant is a plant that lives in the tropics and is familiar to the people of Indonesia. The fruit of this plant has a sweet taste and a little sour so much liked by anyone[1]. Because of its taste, this mangosteen plant is nicknamed the Queen of fruits. The quality of mangosteen fruit (Garcinia mangostana) is determined by various parameters including the parameters of maturity level based on color index [2]. Detection of the presence of objects using digital imagery is the process of knowing the presence of objects in an image. A digital image contains pixels whose number of rows and columns are fixed. Pixels are the smallest image elements of a digital image. Pixels are stored on a memory computer as a raster folder, an integer-type two-dimensional array [3]. Object detection falls into the scientific category of computer vision. Applications that implement object detection are the ripeness of mangosteen fruit by using color space transformation methods. Image processing aims to improve the quality of images so that they are easily interpreted by humans or machines. Input in the form of imagery, but the output image has a much better quality than the input image [4]. Image or image is one of the multimedia components that play a very important role as a form of information [5].

Image transformation is the process of changing an image form where it can be a change in pixel geometry such as rotation (rotatio), shift (translation)[6]. Scalling, etc. Image transformation serves to obtain clearer information (feature extraction) in an

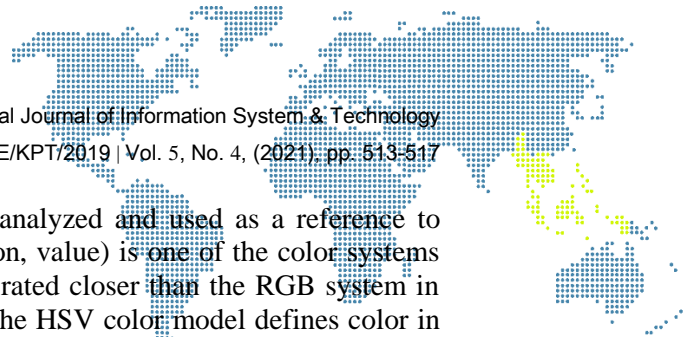
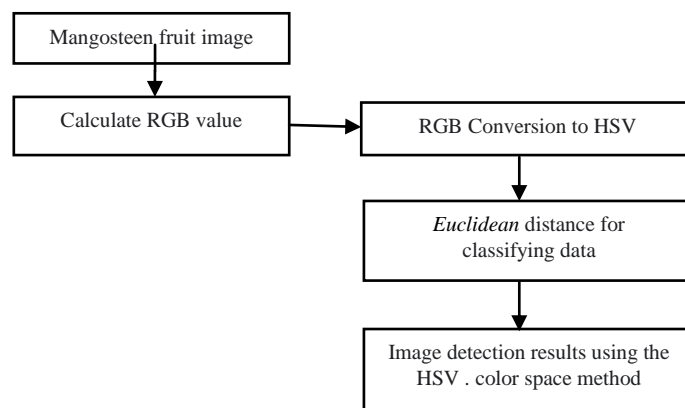


image. The results of the transformation can be reanalyzed and used as a reference to carry out further processing [7]. HSV (hue, saturation, value) is one of the color systems used by humans in choosing colors. This system is rated closer than the RGB system in the elaboration of color sensations by the eyes[8]. The HSV color model defines color in hue, saturation and value terminology. Hue states its true colors, such as red, violet, and yellow[9]. Hue is used to distinguish colors and determine redness, greenness, etc., from light. Hue is associated with light wavelengths. Saturation indicates the purity level of a color, which indicates how much white is given to the color. Value is an attribute that expresses the amount of light received by the eye regardless of color[10].

## 2. Research Methodology

This research is used to find out the level of ripeness of mangosteen fruit by detecting and applying the method of color space transformation to accelerate the selection of the level of ripeness of mangosteen fruit. As for the planning in detection using the transformation of HSV color space is as follows:

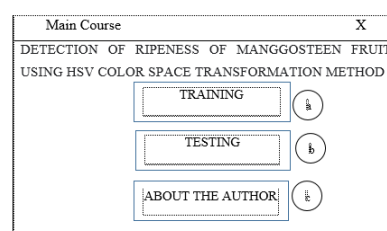


**Figure 1.** HSV color space transformation planning diagram

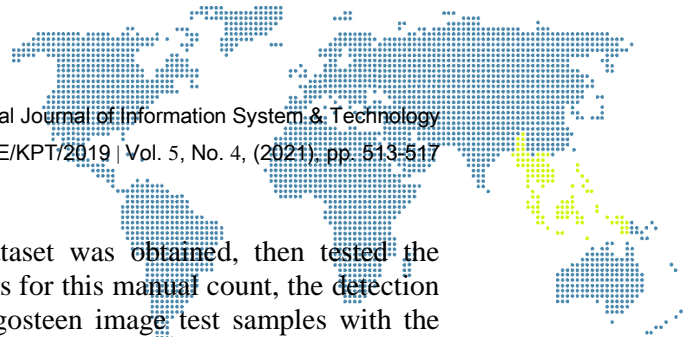
The image above is the flow of a system in detecting the ripeness of mangosteen fruit. The image of mangosteen fruit that has been taken as many as 60 pieces with 3 types of maturity levels are ripe with a blackish purple color, half-cooked with orange color, and raw with green color. Starting from inputting the image of mangosteen fruit with .jpg format, then take the RGB value and then the RGB value is converted to the HSV color space. Next classification with euclidean distance calculation. After that summarized with the closest distance it produces a classification of detection of the level of ripeness of mangosteen fruit and the results of image detection using the HSV color space transformation method were obtained and the process of detection of mangosteen fruit maturity based on color using the HSV color space transformation method was completed.

## 3. Result and Discussion

### 3.1. Interface Design



**Figure 2.** Interface Design



### 3.2. Data Analysis

Based on figure 4.5, after the HSV image dataset was obtained, then tested the detection of the level of basil of mangosteen fruit. As for this manual count, the detection of maturity levels is done with the image of mangosteen image test samples with the classification of raw maturity levels. The following is an image of the test sample that will be detected the level of maturity:



**Figure 3.** Image of the Mangosteen Test

Based on the image above, to facilitate manual calculation at the time of detection of the maturity level of mangosteen fruit, test images are taken in 4.2 images with a resolution of 3x3 pixels. The RGB values of the test image are as follows:

**Table 1.** RGB 3x3 Test Image Value

X/y	0	1	2
0	118	15	23
	25	30	49
	91	78	84
1	103	40	132
	38	71	172
	138	33	52
2	89	74	81
	146	73	42
	158	51	60

Next is to look for the average values of Red, Green and Blue in the test image as follows:

$$R = \frac{118+15+23+103+40+132+89+74+81}{9}$$

$$R = 75$$

$$G = \frac{25+30+49+38+71+172+146+73+42}{9}$$

$$G = 71,7$$

$$B = \frac{91+78+84+138+33+52+158+51+60}{9}$$

$$B = 82,7$$

Next is to look for HSV values based on RGB values in the test image as follows:

$$H = \tan^{-1} \frac{3 \times (71,7 - 82,7)}{(75 - 71,7) + (75 - 82,7)} = 0,131$$

$$V = \frac{75+71,7+82,7}{3} = 76,5$$

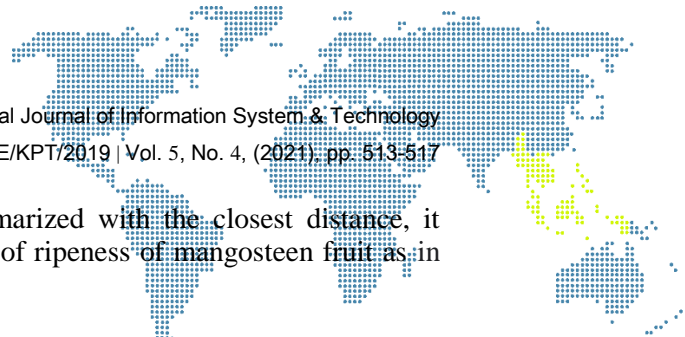
$$S = 1 - \frac{71,7}{76,5} = 0,06$$

After getting the value of H = 1.4, S = 0.06 and the value V = 76.5 for the test image sample, the next is to detect the maturity level of the test image by comparing the closest distance of the HSV value dataset of the trainer image A, B and C in table 4.6. The process is as follows:

$$\text{Image A} = \sqrt{(0,131 - (0,005))^2 + (76,518 - 72,777)^2 + (0,061 - 0,241)^2} = 3,73$$

$$\text{Image B} = \sqrt{(0,131 - (0,085))^2 + (76,518 - 77,629)^2 + (0,061 - 0,132)^2} = 1,11$$

$$\text{Image C} = \sqrt{(0,131 - (0,118))^2 + (76,518 - 75,222)^2 + (0,061 - 0,044)^2} = 1,29$$



Based on the euclidean distance count, then summarized with the closest distance, it results in the classification of detection of the level of ripeness of mangosteen fruit as in the table below:

**Table 2.** Nearest Distance Data Based on Test Mangosteen Image

Data	Distance From New Data	Maturity Level
Mangosteen image A	3,73	Ripe
Mangosteen image B	1,11	Half Ripe
Mangosteen image C	1,29	Raw

Based on the results of the classification of neighbors with the closest distance is the image of mangosteen B with the identification of the level of efficacy "Half-Cooked", so that the data of the mangosteen image processed into the identification of the level of efficacy "Half-Baked". The stages in the application system for the detection of the image of half-cooked manggi fruit are carried out in the same way as the previous process, so that the final result of the detection of the ripeness of mangosteen fruit for the image of half-cooked mangosteen fruit is as follows:



**Figure 4.** Image Detection of Half Ripe Mangosteen

Based on the results of the detection test of maturity level with 15 images of mangosteen fruit consisting of 3 types of maturity levels found the following results:

**Table 3.** Results of Testing the Maturity Level of Mangosteen Fruit Image

No	Image Name	Maturity Level	Detection Results	Information
1	Ripe1.jpg	Ripe	Ripe	Correct
2	Ripe2.jpg	Ripe	Ripe	Correct
3	Ripe3.jpg	Ripe	Ripe	Correct
4	Ripe4.jpg	Ripe	Ripe	Correct
5	Ripe5.jpg	Ripe	Ripe	Correct
6	Half Ripe1.jpg	Half Ripe	Half Ripe	Correct
7	Half Ripe2.jpg	Half Ripe	Half Ripe	Correct
8	Half Ripe3.jpg	Half Ripe	Half Ripe	Correct
9	Half Ripe4.jpg	Half Ripe	Raw	Wrong
10	Half Ripe5.jpg	Half Ripe	Half Ripe	Correct
11	Raw1.jpg	Raw	Raw	Correct
12	Raw2.jpg	Raw	Half Ripe	Wrong
13	Raw3.jpg	Raw	Raw	Correct
14	Raw4.jpg	Raw	Raw	Correct
15	Raw5.jpg	Raw	Raw	Correct

Based on the table of test results above, found 13 images of mangosteen fruit tests that were successfully detected with 2 images of the wrong mangosteen discard. The next calculated the level of accuracy based on the test results of the mangosteen fruit image as many as 15 images. The formula is as follows:

$$\text{Accurasi} = \frac{\text{Number of correct classification}}{\text{Amount of data}} \times 100\%$$
$$\text{Accurasi} = \frac{13}{15} \times 100\% = 86,6 \%$$

#### 4. Conclusions

Detection of the ripeness of mangosteen fruit by extraction of HSV color space method can be done on the image of ripe, undercooked and raw mangosteen fruit. The results of detection of the maturity rate of mangosteen fruit with the HSV color room method provide an accuracy of 86.6% with test image data of 15 mangosteen images. Based on the test results, the accuracy of detection will certainly change with the more data tested

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