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To cite this article: Nurul Kusuma Delina *et al* 2020 *J. Phys.: Conf. Ser.* **1569** 022032

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The Measurement Of Maturity Level In Chili's Using Index Pixel

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Abstract. A lot of knowledge and techniques of image processing which are now available are widely various. Much research as well as development is conducted in terms of detecting ripe fruits, one of which is chili. It is one of the local commodities that is marketable. The process of being ripe chili is relatively fast. Generally, to measure ripeness is still carried out manually. The disadvantage of this method is that the level of accuracy is inconsistent, causing fruit decay in numbers. On behalf of lowering the risk of fruit decay, the research conducted uses index pixel method. This means itself is the normalization of variety illuminated by taking ratio in each group of smallest points in an image processing. In this study, the image taking of chili using box equipped with black background is confirmed to be useful in reducing time of segmentation process. When it is in the process of detecting image by searching for the average of index pixel, then RGB will be counted using Learning Vector Quantization (LVQ) that is the calculation utilizing weighing value. As a result, the classification of maturity level can be seen in the test with a very high percentage value and influence to detect fruit ripeness, signed by the color of RG pixels (red and green) by 94.9% correctly detected, the color pixel RB (red and blue) is quite influential by 93.9% correctly detected, and the color of the GB pixel (green and blue) which was less influential at 63.6% was correctly detected.

Keywords: chili; index pixel; maturity level; RGB

1. Introduction

The chili, one of local commodities which is easily sold out, makes chili itself be one of the spices needed. The ripeness level of chili is heavily various and influential during harvest. This condition is caused by storage temperature [1] [2].

In general, to measure maturity level of chili fruit performed by producers is still subjective according to color of that pepper. This indicator is valued as ineffective method since the weakness has inaccurate and inconsistent score and can early cause decay [3]. In terms of minimizing the decay of this pepper, using index pixel algorithm can be chosen as a way to detect maturity level.

In order to look for index pixel, the image processing utilized is colored image, famously called RGB. Euclidean distance, in index pixel stage, is a method which is utilized to measure distance among three color types and to classify data needed, it is fixed by presentation of class target which has already decided by means of learning vector quantization (LVQ) method.

2. Literature Review

2.1. Index Pixel

Index constitutes normalization towards a variety of illuminations of ratio-taking. Before image processing will be saved in the form of grayscale which possesses color scale from black to white with grayness degree. The index ranges from black 0 to white 255 [2].

Pixel, known as a picture element, is a set of thousands of smallest element points and each owns a certain color which can easily be found on a computer. Every pixel has a color connected to the other

pixels. Thus, this forms pattern resulting in the figure. The pixel will be shown in numerous colors of grey scales between white and black. The subsequent step, after measuring the scoring average of both pixel and RGB, is quantifying weights using LVQ. Metode is one of the artificial neural networks using distance proximity search method from two variables.

The following is a formula of Learning Vector Quantization (LVQ).

Formula:

$$w_j(n) = w_j(f) + a\left[x - W_j(f)\right] \tag{1}$$
$$l_i \neq c, thu$$
$$w_j(n) = w_j(f) - a\left[x - W_j(f)\right] \tag{2}$$

This method is truly influential during classifying maturity level of chili fruit.

2.2. Chili

The red chili pepper is a shrub plant having a scientific name, Genus Capsicum sp. This pepper contains antioxidant, asparagine, and capsaicin which act as anti-cancer substance. This circumstance makes chili produced not only for the spice industry but also for medicine and herb industry aim.

Maturity index in red chili pepper is decided by how different the pigment changes. Based on carotenoid pigment which causes a change of color owned from green to orange, it can be categorized that this pepper is in the process to be ripe [4].

Fig. 1 chili in the process to be ripe

Whereas bright red chili can be classified as complete mature of a chili. This is caused by carotenoid pigment and a shift in chlorophyll and anthocyanin as well as a shift in physiology and biochemistry.

Fig. 2 a complete ripeness of a chili.

For fruit decay, it will easily identify when it is a change of color from red to darker color owing to biochemistry activity in decrease [5].

Fig. 3 Chili in the process of decay

3. Research Methode

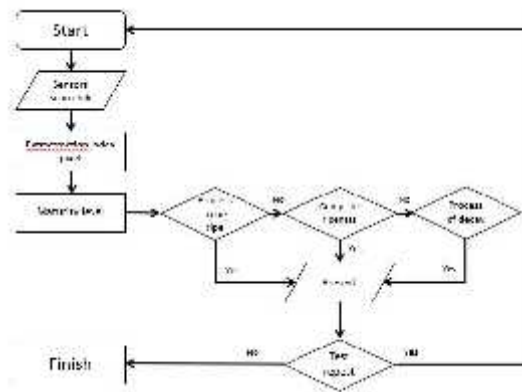This study will be conducted as a flowchart in figure 4.

Fig. 4 Flowchart of research

This flowchart of research constitutes the stages of the study planned. Firstly, this study begins with sensor scanning chilies by using index pixel algorithm. Secondly, it is extracting index pixel and it can go on classifying maturity level based on their groups like chili in the process to be ripe, completely ripe, to be decayed.

IV. Result Of Analyzing Pixel Data

In this research conducted, index pixel is used as a base of the grouping maturity level of this fruit. The next stage is counting the length of maturity average of RGB using LVQ. Index pixel score which is acquired will be classified directly in every group to ease more in implementation. The subsequent stage is to put in 99 sampling data in terms of analyzing the score of a color pixel of RGB being several groups called RG, RB, GB.

4.1 Red and green testing

Fig. 5 Plot Confusion

Plot confusion is a result of index pixel data-taking towards testing red and green pixel. Red and green pixel is so influential to define each group. The classification of maturity level in every group can be shown below:

1) In the process to be ripe, the percentage is 31% or 31 data that can truly be detected.
2) For complete ripeness, the percentage is 32,3% or 32 data that can truly be detected.
3) In the process of decay from being ripe, the percentage is 31,3 % or 31 data that can truly be detected.
4) The total result of classifying whole data is 94,9% or 94 data from red and green which can be detected and 5,1 % or 5 data that can be undetected.

Table. 1 Epoch percentage of red and green

Red–Green	Percentage		**Time**
Epoch	Detected	Undetected	
10	90,90%	9,10%	0:00:06
50	96,00%	4,00%	0:00:29
100	94,90%	5,10%	0:00:58
150	96,00%	4,00%	0:01:27
200	94,90%	5,10%	0:01:57
250	96,00%	4,00%	0:02:24
300	97,00%	3,00%	0:02:53
350	96,00%	4,00%	0:03:22
400	94,90%	5,10%	0:03:49
450	94,90%	5,10%	0:04:17
500	96,00%	4,00%	0:04:47

It can be seen that epoch % from scale 10 to 500 with a percentage result 90.90% once, 94.90% four times, 96.00% and 97.00% fifteen times and once respectively.
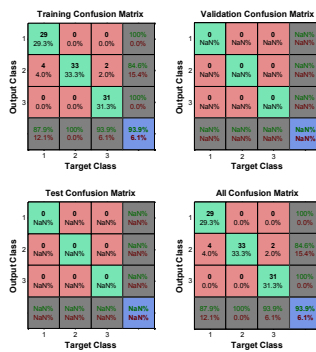
4.2 Red and blue testing

Fig. 6 Plot Confusion

Plot confusion is a result of index pixel data-taking towards testing red and blue pixel. Red and blue pixel is so influential to define each group. The classification of maturity level in every group can be shown below:

1) In the process to be ripe, the percentage is 29.3% or 29 data that can truly be detected.
2) For complete ripeness, the percentage is 33.3% or 33 data that can truly be detected.
3) In the process of decay from being ripe, the percentage is 31.3 % or 31 data that can truly be detected.
4) The total result of classifying whole data is 93.9% or 93 data from red and blue which can be detected and 6.1 % or 6 data that can be undetected.

Table. 2 Epoch percentage of red and blue

Red–Blue	Percentage		Time
Epoch	Detected	Undetected	
10	92,90%	7,10%	0:00:05
50	90,90%	9,10%	0:00:30
100	93,90%	6,10%	0:01:08
150	91,90%	8,10%	0:01:26
200	91,90%	8,10%	0:02:39
250	93,90%	6,10%	0:02:22
300	92,90%	7,10%	0:03:09
350	93,90%	6,10%	0:03:19
400	93,90%	6,10%	0:04:04
450	92,90%	7,10%	0:04:14
500	93,90%	6,10%	0:05:00

It can be seen that epoch % from scale 10 to 500 with a percentage result 90.90% once, 91.90% twice, 92.20% and 93.90% three times and five times respectively.

4.3 Green and blue testing

Fig. 7 Plot Confusion

The figure above is the result of detecting the index pixel score in green and blue pixel testing. Green and the blue pixel is less influential to define each group used. The accurate degree of maturity level in every group can be shown below:

1) In the process to be ripe, the percentage is 0 or no percentage is detected.
2) For complete ripeness, the percentage is 32.3% or 32 data that can truly be detected.
3) In the process of decay from being ripe, the percentage is 31.3 % or 31 data that can truly be detected.
4) The total result of classifying whole data is 63.6% or 63 data from green and blue which can be detected and 36.4 % or 36 data that can be undetected.

Table 3 Epoch percentage of red and blue

Green-Blue	Percentage		Time
Epoch	Detected	Undetected	
10	58,60%	41,40%	0:00:08
50	93,90%	6,10%	0:00:32
100	96,00%	4,00%	0:01:19
150	94,90%	5,10%	0:01:31
200	94,90%	5,10%	0:02:39
250	94,90%	5,10%	0:02:37
300	96,00%	4,00%	0:00:32
350	63,60%	36,40%	0:03:37
400	90,90%	9,13	0:04:43
450	94,90%	5,10%	0:04:47
500	96,00%	4,00%	0:04:54

It can be seen that epoch % from scale 10 to 500 with a percentage result 90.90% once, 91.90% twice, 92.20% and 93.90% three times and five times respectively.

V. Conclusion

In the process of the maturity level of chili pepper using the index pixel method can start with collecting pixel score which is so influential. This can be done by dividing three types of colourful image processing of RGB. The process is, then, the distribution of RGB colour which can be divided into two colours such as RG, RB, GB to collect the most influential colour and the most dominance in classifying maturity towards chili fruit.

As a result of classifying maturity level, it can be perceived in testing equipped with the too big and influential percentage in terms of detecting ripeness degree. This is RG pixel (red and green) by 94.9 % detected; RB pixel (red and blue) which is influential enough, by 93.9% detected; and GB pixel (green and blue) which is less influential, by 63.6% detected.

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