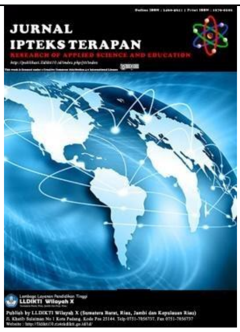

RIPENESS IDENTIFICATION OF PISANG RAJA BASED ON SHAPE AND TEXTURE EXTRACTION USING K-MEANS CLUSTERING

Ramzil Huda[*1], Fernando Ramadhan[2], Agung Ramadhanu[3]
[123]Universitas Putra Indonesia Yptk , Padang, Indonesia
*Email: ramzilhuda1986@gmail.com

Vol. 17 No.4 2023

Submit:
17/10/2023

Accept:
12/12/2023

Publish:
31/12/2023

Abstract

This research introduces a Pisang Raja (King Banana) ripeness identification method using K-Means Clustering based on shape and texture extraction. Pisang Raja undergoes visual changes as it ripens. The method involves image capture, preprocessing, shape and texture feature extraction, and K-Means Clustering for classification. Shape attributes (perimeter, area) and texture features (GLCM, LBP) are extracted and used for clustering Pisang Raja samples into ripeness categories. A diverse dataset is employed for training and evaluation, showing the efficacy of the approach in ripeness identification. The study contributes an automated technique for Pisang Raja ripeness assessment, with potential in the agricultural and food industries.

Keywords: Ripeness Identification, Pisang Raja, Shape and Texture Analysis, K-Means Clustering, Computer Vision.

http://publikasi.lldikti10.id/index.php/jit DOI : https://doi.org/10.22216/jit.v17i4 PAGES : 959-965

ISSN : 1979-9292 / 2460-5611
JIT is Sinta 3 Journal (https://sinta3.kemdikbud.go.id/journals/profile/2143) accredited by the Ministry of Research & Technology, Republic of Indonesia

JURNAL IPTEKS TERAPAN
Research of Applied Science and Education V17.i4 (959-965)
ISSN : 1979-9292
E-ISSN : 2460-5611

INTRODUCTION

In recent decades, the research and development of computer vision systems has grown rapidly (computer vision) is growing very rapidly due to the many needs for its applications. In addition, with a substantial increase in digital images produced every day, there is an increasing need to process images automatically (Kaur et al., 2018). Automation in different applications to different image objects also still requires edge detection as the initial operation.(Pongprasert et al., 2020). Banana (Musa Paradisiaca) is a fruit plant that is a rich source of vitamins, minerals, and Carbohydrates. This fruit is very popular because can be consumed at any time and at any level Age of(Juita & Issn, 2017). Each fruit has characteristics to determine its type and maturity, for example, its size and color. In bananas, these characteristics are used to classify. Currently, the classification of types and ripeness of bananas is still done manually by banana farmers.(Sularida et al., 2018).

Ripeness assessment is of paramount importance in the agricultural and food sectors, particularly for Pisang Raja (King Banana), a banana variety renowned for its unique characteristics. This study introduces an innovative application of K-Means Clustering in computer informatics to accurately identify Pisang Raja's ripeness levels by extracting and analyzing shape attributes (perimeter, area) and texture features (Gray-Level Co-occurrence Matrix, Local Binary Pattern). By automating this process, the research not only offers a practical solution for Pisang Raja ripeness classification but also contributes to the broader field of computer-assisted decision-making in agriculture, holding the potential to optimize harvesting and distribution strategies while ensuring product quality.

Image processing techniques can be used to detect artificially ripened bananas. The study explains that traders often use artificial methods, such as the addition of calcium carbide, to ripen bananas.(Khandarkar et al., 2008).

RESEARCH METHODS

The data in the study was generated through interviews, observations, and literature studies. Interviews conducted are one technique collection of data or facts by conducting Direct observation of the object under study to get the required data(Juita & Issn, 2017). The literature study is derived from all literature related to the image processing and maturity of plantains of shape and color.

ISSN : 1979-9292
E-ISSN : 2460-5611

No	Name	Image
1	Matang01	
2	Matang02	
3	Matang03	
4	Matang04	
5	Mentah01	
6	Mentah02	
7	Mentah03	
8	Mentah04	

Figure 1. Image of ripe and unripe Raja Banana

The banana ripeness identification system based on the color of the fruit skin was built using a working system as shown in Figure 2

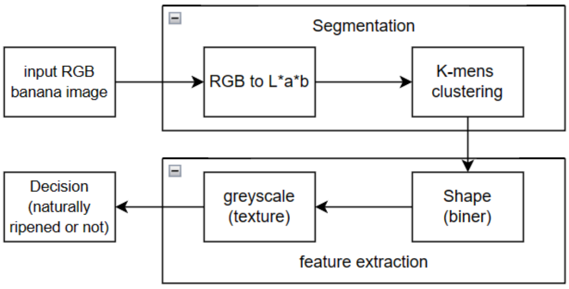

Figure 2. Banana ripeness identification system

RESULT

The following is a description of the stages of the banana maturity identification system in this study.

A. Image Input
   Imagery is another term for images as one of the multimedia components that plays a very important role as Visual forms of information. Citra has characteristics that text data does not have, namely Imagery rich with information.(Permadi & Murinto, 2015).
   In image input, previously acquired image datasets are used. The dataset was acquired from bananas that have different levels of maturity. The dataset obtained as many as 8 images and was acquired during the day. The image was acquired using a smartphone camera with a distance from the banana to the camera of 50 cm.

B. Image Processing
   1. RGB image
      RGB images (color images) are images in which each pixel has 3(three) specific color components, namely red, green,

JURNAL IPTEKS TERAPAN
Research of Applied Science and Education V17.i4 (959-965)
ISSN : 1979-9292
E-ISSN : 2460-5611

and blue components. (Sularida et al., 2018)
Here's the equation for RGB images:

RGB = (((R ∗ 256) + G) ∗ 256) + B (1)

2. CIELab Imagery
When color histograms in different colors were investigated it was observed that L*a*b provided better feature space for segmentation of color images. It was recommended by CIE in 1976 as a way of representing acquired color and their difference. L* is the lightness factor, a* and b* are the chromaticity co-ordinates.(Chithra et al., n.d.).
L*(lightness) axis – 0 is black; 100 is white.

$$L* = 116\left(\frac{Y}{Yn}\right)^{1/3} - 16 \quad (2)$$

a* (red-green) axis – positive values are red and negative values are green and 0 is neutral.

$$a* = 500\left(\left(\frac{X}{Xn}\right)^{1/2} - \left(\frac{Y}{Yn}\right)^{1/2}\right) \quad (3)$$

b* (yellow-blue) axis –positive values are yellow and negative values are green and 0 is neutral.

$$b* = 500\left(\left(\frac{Y}{Yn}\right)^{1/2} - \left(\frac{Z}{Zn}\right)^{1/2}\right) \quad (4)$$

3. K-MEANS CLUSTERING
In processing food images clustering is an efficient method. This method classifies pixels into different groups called clusters, in such a way that each pixels share some common trait. Clustering is done using some distance calculating measurements. The computational task of partitioning the pixel set into k subsets is often referred to as unsupervised learning. It is a very fast procedure and also an attractive one. The clustering algorithm assumes that a vector space is formed from the pixel features and tries to identify clustering in them. The objects are clustered around the centroids µi i =1...k which is computed by minimizing the following-objective.(Chithra et al., n.d.).

$$V = \sum_{i}^{k} = \sum_{xj \in si} (x_j - \mu_i)^2 \quad (5)$$

In (5) k is the number of clusters i.e. Si , i = 1,2,3..k and µ is the mean point or centroid of all points xj si.

4. Canny Edge Detection
Carrying out a trial of the canny edge detection method to obtain edge shapes from the Raja Banana's image, if it is necessary to improve the performance of the method, the researcher will carry out improvements(Enggari et al., 2022).
The results obtained from this research are to map an image to obtain better edge results using the Canny edge detection

JURNAL IPTEKS TERAPAN
Research of Applied Science and Education V17.i4 (959-965)
ISSN : 1979-9292
E-ISSN : 2460-5611

method(Widagdho Yodha & Wahid Kurniawan, 2014).

5. Median Filter
The median measures the intensity level of pixels which separates the high-intensity value pixels from lower-intensity value pixels. It is also a type of order statistic filter. The most popular and useful of the rank filters is the median filter. It works by selecting the middle pixel value from the ordered set of values within the m x n neighborhood 'W' around the reference pixel. If mn is the even number, the arithmetic average of the two values closest to the middle of the ordered set is used instead.(Chithra et al., n.d.)
It is represented as

$$f(x, y) = \text{median}\{g(r,c)|(r,c)\ W\} \quad (6)$$

6. Feature Extraction
Feature extraction is an important step in image processing that includes extraction of features from given image to get meaning of given image. Goal of the features extraction is to extract correct, unique features that distinguish a image from others in given set. There are many types of features including shape, color-based or texture based, etc. (There might be a lot numbers of features other than this). A popular method is to use GLCM (Gray-Level Co-Occurrence Matrix). The GLCM functions characterize the texture of an image by calculating how often pairs of pixels.(Veling, 2019).

Based on the pictures of plantains in table Figure 1, we input each image into an identification system that was created using Matlab R2021b. The image of the plantain fruit is grouped into two classes, namely: 1. Ripe bananas (yellow color), and 2. Unripe bananas (green color)

1. Input Image

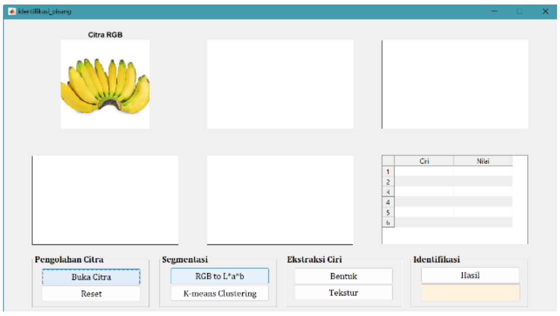

Figure 3. Input picture of plantain

2. Processing Results
At this stage, the image will be processed from the RGB color space to the l*a*b color space.

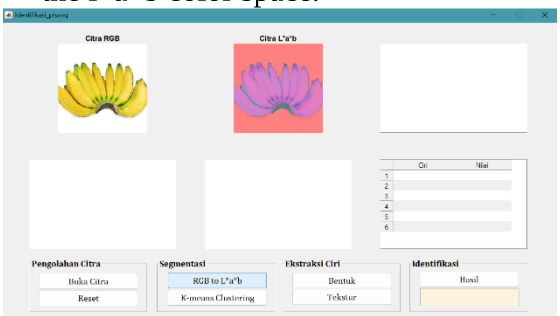

Figure 4. RGB image to l*a*b

3. Segmentation Result Image
Using K-means clustering to separate objects from the background

JURNAL IPTEKS TERAPAN
Research of Applied Science and Education V17.i4 (959-965)

ISSN : 1979-9292

E-ISSN : 2460-5611

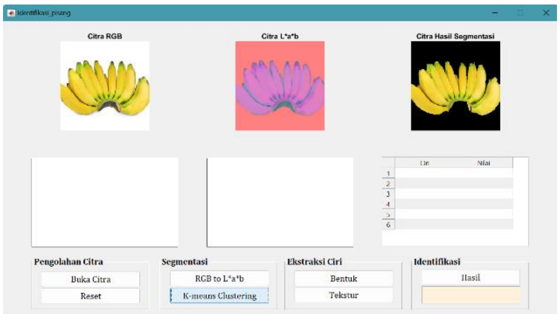

Figure 5. Image Segmentation

4. Feature Extraction
   The segmented image will be converted into a Binary image for shape extraction and then converted into a Greyscale image for texture extraction.

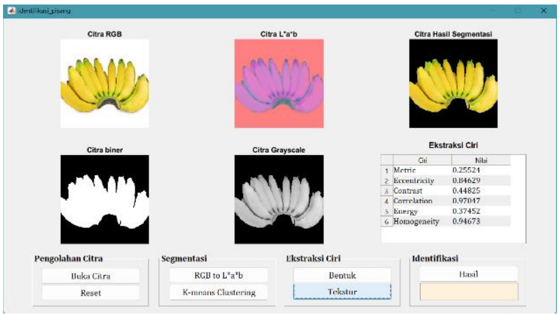

Figure 6. Feature Extraction

5. Identification
   The results of this identification are the results of image processing of all pictures of plantains in Table figure 1

Object	Metric	Eccentricity	Contrast	Correlation	Energy	Homogeneity
Matang 01	0,2550	0,8460	0,4480	0,9705	0,3745	0,9467
Matang 02	0,2260	0,8180	0,5977	0,9566	0,3207	0,9192
Matang 03	0,5850	0,8190	0,4207	0,9729	0,3941	0,9594
Matang 04	0,1590	0,8300	0,5928	0,9360	0,3670	0,8698
Mentah 01	0,1180	0,8700	0,3684	0,9835	0,4738	0,9811
Mentah 02	0,2340	0,7610	0,1480	0,9291	0,4235	0,9617
Mentah 03	0,3210	0,8410	0,2896	0,9580	0,4165	0,9483
Mentah 04	0,4320	0,6800	0,1402	0,9866	0,4318	0,9764

Figure 6. Identification Table

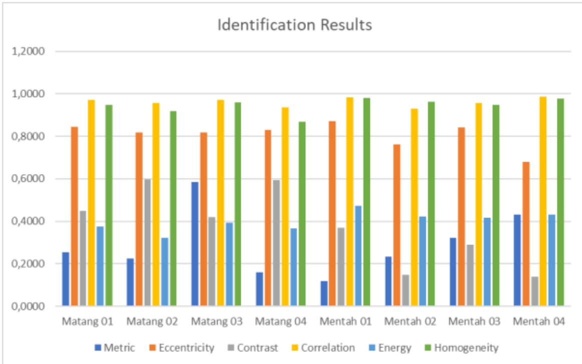

Figure 7. Bar chart of identification results

CONCLUSION

The segmented image will be converted into a Binary image for shape extraction and then converted into a Greyscale image for texture extraction. Unique features that distinguish a image from others in given set. Carrying out a trial of the canny edge detection method to obtain edge shapes from the Raja Banana's image, if it is necessary to improve the performance of the method, the researcher will carry out improvements.

BIBLIOGRAPHY

Chithra, P. L., Supervisor, R., & Henila, M. (n.d.). DEFECT IDENTIFICATION IN THE FRUIT APPLE USING K-MEANS COLOR IMAGE SEGMENTATION ALGORITHM. International Journal of Advanced Research in Computer Science, 8(8). https://doi.org/10.26483/ijarcs.v8i8.4735

Enggari, S., Ramadhanu, A., & Marfalino, H. (2022). Peningkatan Digital

JURNAL IPTEKS TERAPAN
Research of Applied Science and Education V17.i4 (959-965)

ISSN : 1979-9292

E-ISSN : 2460-5611

Image Processing Dalam Mendeskripsikan Tumbuhan Jamur Dengan Segmentasi Warna, Deteksi Tepi Dan Kontur. Jurnal Teknologi Dan Sistem Informasi Bisnis, 4(1), 70–75. https://doi.org/10.47233/jteksis.v4i1.358

Juita, & Issn, -. (2017). Deteksi Kematangan Buah Pisang Berdasarkan Fitur Warna Citra Kulit Pisang Menggunakan Metode Transformasi Ruang Warna HIS (Banana Fruit Detection Based on Banana Skin Image Features Using HSI Color Space Transformation Method). In Banana Fruit Detection … | Indarto.

Kaur, H., Sawhney, B. K., & Jawandha, S. K. (2018). Evaluation of plum fruit maturity by image processing techniques. Journal of Food Science and Technology, 55(8), 3008–3015. https://doi.org/10.1007/s13197-018-3220-0

Khandarkar, S. S., Wadhankar, V. R., & Dabhade, D. S. (2008). Detection and Identification of Artificially Ripened Fruits Using MATLAB. International Research Journal of Engineering and Technology, 484. www.irjet.net

Permadi, Y., & Murinto, . (2015). APLIKASI PENGOLAHAN CITRA UNTUK IDENTIFIKASI KEMATANGAN MENTIMUN BERDASARKAN TEKSTUR KULIT BUAH MENGGUNAKAN METODE EKSTRAKSI CIRI STATISTIK. Jurnal Informatika, 9(1). https://doi.org/10.26555/jifo.v9i1.a2044

Pongprasert, N., Srilaong, V., & Sugaya, S. (2020). An alternative technique using ethylene micro-bubble technology to accelerate the ripening of banana fruit. Scientia Horticulturae, 272. https://doi.org/10.1016/j.scienta.2020.109566

Sularida, N., Sari, J. Y., Purwanti, I., & Purnama, N. (2018). Identifikasi Tingkat Kematangan Buah Pisang Menggunakan Metode Ektraksi Ciri Statistik Pada Warna Kulit Buah. 98 ULTIMATICS, X(2).

Veling, Prof. S. (2019). Mango Disease Detection by using Image Processing. International Journal for Research in Applied Science and Engineering Technology, 7(4), 3717–3726. https://doi.org/10.22214/ijraset.2019.4624

Widagdho Yodha, J., & Wahid Kurniawan, A. (2014). PERBANDINGAN PENGGUNAAN DETEKSI TEPI DENGAN METODE LAPLACE, SOBEL DAN PREWIT DAN CANNY PADA PENGENALAN POLA (Vol. 13, Issue 3)