

**DESIGN AND CONSTRUCTION OF A TOOL FOR DETECTING THE  
CONSUMPTION OF DATE FRUIT USING THE IMAGE PROCESSING  
METHOD BASED ON COLOR COMPOSITION AND SHAPE**

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**Abstract**

This journal reviews a fruit that is very popular in Indonesia, especially during Ramadan, namely dates. Dates have a myriad of benefits that not many people know. These dates have very good durability so they are not susceptible to decay. Therefore, in this study, researchers tried to develop an analysis of the feasibility of dates in terms of texture and based on their color using digital image processing. The image of dates was taken with a cellphone camera and processed using visual studio, which was then classified using the Matlab application. Digital image processing uses color features on dates.

**Keywords:** Dates, Image Processing, Rotten Dates, Fresh Dates, Color Composition, Edible Dates.

**1. Introduction**

Dates are a type of fruit that is very popular and often consumed by people in Indonesia, from young to old. Dates mainly contain simple carbohydrates (especially sugars, such as sucrose and fructose). Nearly 70% of dates consist of carbohydrates. Other nutritional content in dates includes: 7 grams of fiber, 2 grams of protein, 20% of daily potassium requirements, 14% of daily magnesium requirements, 18% of copper requirements, 15% of manganese requirements, 5% of daily iron requirements, 12% of vitamin B6 requirements daily. [1]

The large number of types and textures of dates sold on the market, and the limited knowledge they have, make it difficult for buyers to differentiate the quality and durability of dates. Even though it looks good for consumption and is suitable, naked testing often causes errors due to limited human vision and the high level of subjectivity of the tester. Therefore, a mobile application is needed which is expected to be able to test the type and texture of dates directly. To overcome the existing problems, a useful

application was created for the process of identifying the suitability of dates based on texture and color using the floating segmentation method with the Otsu Binarization algorithm and second order feature extraction with the Gray Level Co-Occurrence Matrix (GLCM).

The aim of this research is to produce an application that can be used to identify the suitability of dates using the development segmentation method with the Otsu Binarization algorithm and the Gray Level Co-Occurrence Matrix (GLCM) feature extraction method.

To avoid extensive discussion, this journal defines the limitations of the problem as follows:

1. The date palm image processing uses the floating segmentation method with the Gray Level Co-Occurrence Matrix (GLCM) feature extraction method.
2. The second order characteristics of GLCM used are correlation, entropy, energy, contrast, and homogeneity.

3. Benefit testing was carried out on red and green dates, including fresh and non-fresh dates (not suitable for consumption).
4. The application uses Matlab R2021a, image capture uses a web camera.

This research was carried out inseparable from the results of previous studies that had been carried out as comparison and study material. The results of previous research were used as a comparison in research regarding identifying the suitability of dates.

Based on the results of research regarding the Application for Identification of Date Palm Fruit Types using the Android-based GLCM Method by Mohammad Fandi, research was carried out to differentiate the types and characteristics of date palm fruit using the floating segmentation method with the Otsu Binarization algorithm and the Gray Level Co-Occurrence Matrix (GLCM) feature extraction method). [2]

Based on the results of research on image processing of dates, research on non-destructive measurements of total soluble solids (TSS) from dates uses near infrared (NIR) imaging. This research uses a segmentation method, namely floating with the Otsu Binarization algorithm to separate date objects from the image background. The segmentation process begins by changing the original image into a grayscale image which is then processed using the Otsu Binarization algorithm to obtain an object mask and the results by combining the masking with the original image. This segmentation process is also accompanied by a morphological closing process to remove holes in the object [3].

The basis of the research above is also guided by subsequent research, namely the classification of the suitability of dates using digital image processing techniques with AI methods. The image identification process consists of a data training process and a testing process. Then the image features will be extracted based on grayscale and RGB colors. The result of this process is information about the suitability of the dates. The results show that the accuracy of success is highest with an average of 72% from 100 date test data. [2]

Further research was carried out by classifying date palm types using RGB color and size feature extraction. The first step is taking

images using a camera for test and training data. The next process is that the results of image acquisition are divided into 3 color channels, namely red, green and blue, then each channel is converted into a gray level image. Then the image is subjected to a floating segmentation process using the Otsu Binarization algorithm to obtain masking of the object. The next process is feature extraction based on RGB color and size. The results obtained were that the system could only identify types of ripe dates (red and green) [2].

Dates are a product of the date palm tree which belongs to the Arecaceae family. The date palm tree is one of the oldest plants that is still preserved in the world, the harvest from this date palm tree is mostly a source of income in North Africa and the Middle East, although date palm trees also grow in several regions of the world. [3] Date palms are a fruit that has durability. which is very good so it is not susceptible to the process of decay. Therefore on In this study, researchers tried to develop an analysis of the suitability of dates in terms of texture and color using digital image processing.

## 2. Research of Methodology

The research that the author conducted was using the Matlab R2021a application.

### 1. Energy

Energy is a feature that can be used in texture analysis to measure the concentration of intensity pairs in a defined cooccurrence matrix as follows:

$$Energi = \sum_i \sum_j p^2(i, j) \quad (2.1)$$

With  $p(i, j)$  representing the value in row  $i$  and column  $j$  in the co-occurrence matrix.

### 2. Contrast

Contrast shows the size of the spread (moment of inertia) of the image matrix elements. If it is far from the main diagonal, the contrast value is large. Visually, contrast value is a measure of variation between degrees of gray in an image area.

$$Kontras = \sum_k k^2 \left[ \sum_i \sum_j p(i, j) \right]_{=|i-j|} \quad (2.2)$$

With  $p(i,j)$  representing the value in row  $i$  and column  $j$  in the co-occurrence matrix.

### 3. Correlation

Correlation shows a measure of the linear dependence of the degree of gray in the image so that it can provide an indication of the existence of a deep linear structure image.

$$Korelasi = \frac{\sum_i \sum_j (i,j) \cdot p(i,j) - \mu_x \mu_y}{\sigma_x \sigma_y} \quad (2.3)$$

With:

$\mu_x$  : average of  $p(i)$

$\sigma_x$ : reverse deviation of  $p(i)$

$\mu_y$  : average of  $p(j)$

$\sigma_y$ : reverse deviation of  $p(j)$

$p(j)$

$p(i,j)$  : value in row  $i$  and column  $j$  in the matrix co-occurrence

### 4. Entropy

Entropy indicates a measure of the irregularity of shape. The entropy value is large for images with transitions The degree of gray is even and has a small value if the image structure is irregular (variable).

$$Entropi = - \sum_i \sum_j p(i,j) \cdot \log p(i,j) \quad (2.5)$$

With  $p(i,j)$  representing the value in row  $i$  and column  $j$  in the co-occurrence matrix.

### 5. Homogeneity

Homogeneity is to measure the homogeneity of intensity variations in the image. The homogeneity value increases when the intensity variations in the image decrease and vice versa.

$$Homogenitas = \sum_i \sum_j \frac{p(i,j)}{1 + |i - j|} \quad (2.6)$$

## 3. RESULT

In this system design, research tools and materials, image processing stages, and application interface design for identifying date palms are discussed

### a. Tools and materials

The tools and materials that will be used in this research are as follows.

1. Computer with Intel Core I5 3.6Ghz processor and 8GB RAM.
2. Windows 10 Pro Operating System.
3. Huawei P30 Android
4. Dates.

### b. Application Design Algorithm

#### 1. Home Page

The main application page is the page that contains the main menus of the application. Figure 2.1

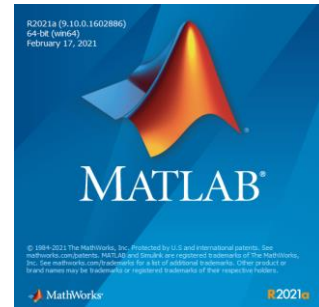


Figure 1. Main page of the Matlab R2021a application

#### 2. Select Image page

The select image page is a page used to select a date image via a smartphone camera and save the captured image in the directory to be processed.

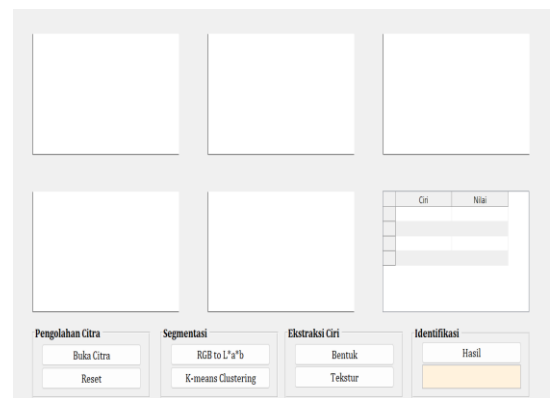


Figure 2. Analysis Application Main Page - Select Image

#### 3. Image Preview Page

Image preview page is a page used to display the selected date image. Figure 2.3 shows the image preview page display.

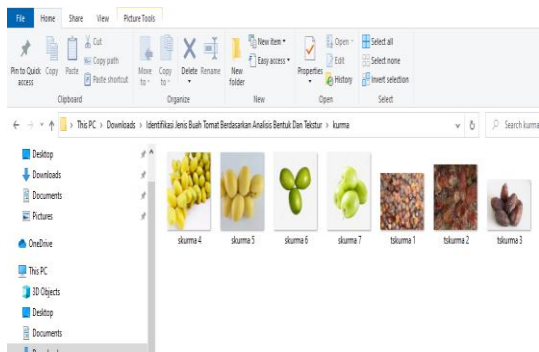


Figure 3. Image Preview Page

4. Identification Results Page

The identification results page is a page used to display the original image, the image after going through the image processing process, and analysis of the results of identifying the type of date palm. The following image shows the results analysis and identification of images that have been processed.

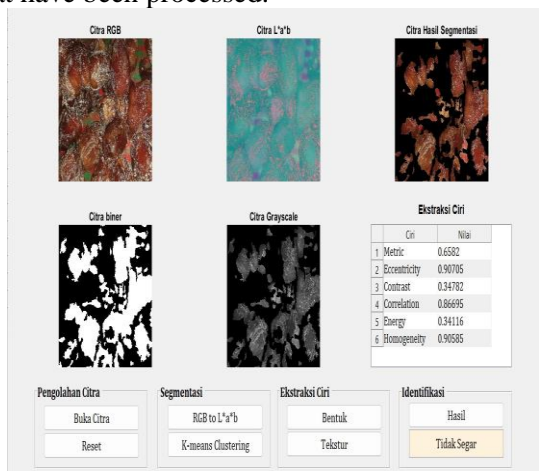


Figure 4. Results of Identification of Unfresh Dates

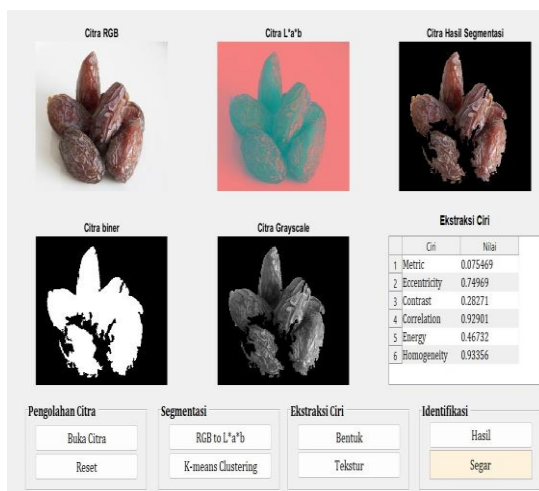


Figure 5. Results of Identification of Fresh Dates

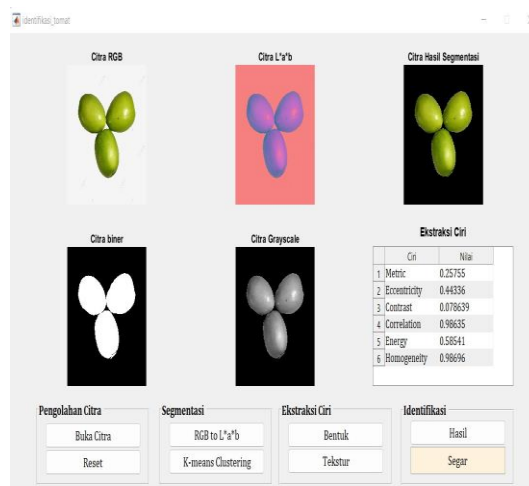


Figure 6. Results of Identification of Fresh Dates

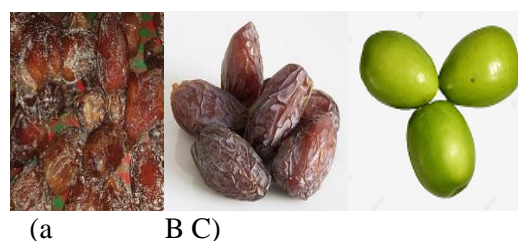


Figure 7. Date Palm Image Data (a) Not Fresh Dates (b) Fresh Dates (c) Fresh Dates

The steps taken are as follows [4]

1. The initial stage in the classification that will be carried out is the color space transformation process from Red, Green, Blue images to  $L^*a^*b$  images. This is done so that the color content can be identified digitally.
2. The next process is image segmentation using thresholding techniques. This process converts image data into binary data to facilitate the feature extraction process. The output of this process is a binary image, where the desired object has a value of 1 (white), while the background value is 0 (black).
3. The resulting image segmentation has successfully separated the object from the background, so the binary image obtained can be used as masking to carry out the next process.
4. After the image is converted into binary, it will be easier to obtain objects in the image. From the binary image, feature extraction is carried out using HSV. It aims to easily group image characteristics based on hue and saturation.

5. The image below is an example of the results of RGB to HSV image transformation. in the following image.

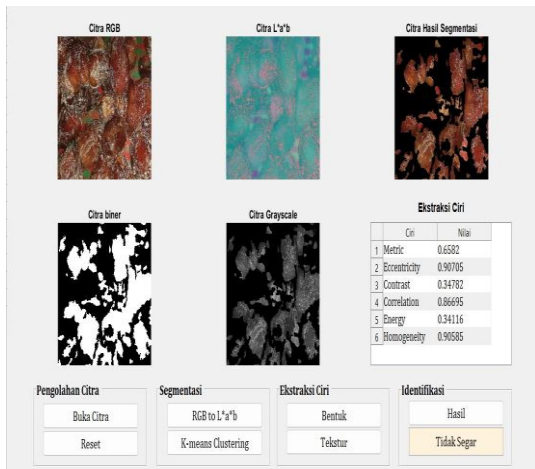


Figure 8. Results of Identification of Unfresh Dates

	Ciri	Nilai
1	Metric	0.6582
2	Eccentricity	0.90705
3	Contrast	0.34782
4	Correlation	0.86695
5	Energy	0.34116
6	Homogeneity	0.90585

Figure 9. Extraction Characteristics of Not Fresh Dates

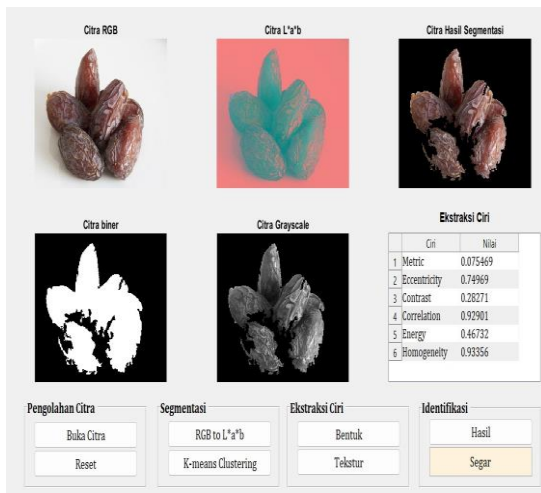


Figure 10. Results of Fresh Date Identification

Ekstraksi Ciri		
	Ciri	Nilai
1	Metric	0.075469
2	Eccentricity	0.74969
3	Contrast	0.28271
4	Correlation	0.92901
5	Energy	0.46732
6	Homogeneity	0.93356

Figure 11. Extraction Characteristics of Fresh Dates

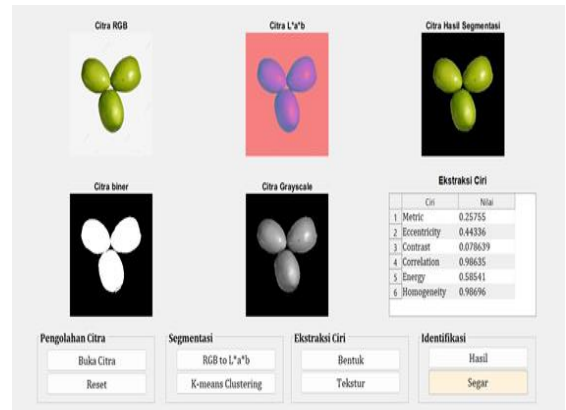


Figure 12. Results of Fresh Date Identification

Ekstraksi Ciri		
	Ciri	Nilai
1	Metric	0.25755
2	Eccentricity	0.44336
3	Contrast	0.078639
4	Correlation	0.98635
5	Energy	0.58541
6	Homogeneity	0.98696

Figure 13. Extraction of Fresh Date Palm Characteristics

In the Date Characteristic Extraction Table, rows 1 and 2 are Metric and Eccentricity values which are parameters of shape analysis, while rows 3, 4, 5 and 6 are contrast, correlation, energy and homogeneity values which are parameters of texture analysis.

#### 4. CONCLUSION

The process of designing an application for identifying fresh or not fresh dates is carried out by converting the RGB image into a gray level image, floating segmentation using the Otsu and Binary Inv algorithms, closing morphology, Binary segmentation, extracting second order statistical features with GLCM, and identifying by comparing the values GLCM parameters. The application was successfully used to detect the types of Ajwa dates, Sukari dates, and Deglet Nour dates using the average value of all angles of the co-occurrence matrix (0°, 45°, 90°, and 135°) of each parameter (energy, contrast, correlation, entropy, and homogeneity) in the GLCM method. Based on the 5 GLCM parameters, there are 2 parameters that have different value ranges for each type of date, namely entropy and correlation. From these two parameters, a graph of the distribution of date type identification results can be created for classifying date types.

The suggestions for further research are to get optimal results, the image taking process should be carried out with good lighting with a better success rate. 2. To increase the number of training data images and test data images to obtain the right level of success and accuracy.

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