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Classification of Guarantee Types Using Leaf Feature Extraction with Minutiae and GLCM Using K-NN Method

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Abstract

Indonesia is a fertile area that has a sub-tropical climate that makes plants grow well in various parts of Indonesia. There are various variants of guava in Indonesia. Of the several types have differences including the structure of the fruit, tree and leaves. The focus of this research is to classify guava species based on leaf bone image using GLCM feature extraction, minutiae and shape extraction using the K-NN method. In this study using a dataset of 4 types of guava as many as 300 images, where each type of as many as 75 images. In the extraction process to get the leaf bone image in this study, there are several processes, namely preprocessing, grayscale image, binary image and morphology then only get the leaf bone image. After getting the extracted value, then the data is processed using the K-NN method. The highest accuracy in the K-NN method is at k1 = 92.42% with a standard deviation of 6.05% (micro average: 92.45%). Thus GLCM feature extraction, minutiae and shape extraction can potentially increase the level of accuracy in guava classification based on leaf bone images.

Keywords: GLCM, Guava, K-NN, Minutiae, Shape

Introduction

Indonesia is a fertile area that has a sub-tropical climate, so guava plants can thrive in various parts of Indonesia. Over time the guava plant continues to be developed using the grafting method because it has many advantages for human health because it has many vitamins that humans need. Guava fruit is mainly consumed fresh, contains pulp, many seeds also contain a lot of vitamin C, pectin and higher mineral content compared to other fruits, where the content is good for body health for both children and adults (Minah et al., 2021).

Of the several benefits of guava has many benefits, the vitamin content of guava which is often used by manufacturers with specific purposes, among others, drugs, types of drinks, beauty products, health products and so on. To overcome the problems above, the author analyzes if at the time the guava has not yet fruited or is in the nursery period, how to find out which type of guava is included in what type of category, if you do not understand where the origin of this type of guava comes from.

Previous research on the classification of guava quality using K-NN based on color and texture feature extraction for guava classification with an accuracy rate of 91.25% with the best neighbor value of K = 3 [(Prahudaya & Harjoko, 2017).

Future research on extracting leaf bone features and identifying plants using algorithms minutiae. And SOM kohonen with minutiae algorithm on afingerprint ato detect bony branches. Average success rate in classification using kohonen to determine plant leaf class have 94.386% accuracy rate (Wahyumianto &

Purnama,n.d.).

Researchanextaextractionaimageawithaus eamethodaGLCM and K-NN foraidentify the type of Orchid (Orchidaceae). The test results concluded that the success rate of identification of Orchidaceae or orchid flowers has an accuracy value of 80%awith average valuea77%. K value is influentialain levelasuccess, the greater the value of K accuracyagetting smaller (Pamungkas, 2019).

Subsequent research identifies about herbal medicinal plants based on leaf images by using algorithm GLCM and K-Nn with extracting features on image of herbal medicinal plant leaves and classify it based on distance closest between test data and training data. By having an accuracy rate of 83.33% [(Ni'mah et al., 2018).

In this case the author tries to overcome this problem by classifying the type by taking samples from the image of the leaves and leaf bones. With the algorithm used with minutiae feature extraction, shape features and GLCM then classify them using the K-NN (K-Nearest Neighbor) method.

Material and Method

A. Dataset

Researchers used a guava leaf image dataset that we obtained from several sources that have guava plants with each source being different. Researchers collected data of 300 images of each type as many as 75 images, of 4 types of guava leaves. The data is divided into 4 types, namely bangkok types, red seeds, Sunday market seeds and crystals. We use the data as training data and testing data. The testing data is 200 images, while the training data is 100 images. Can be seen in figure 1, 2, 3, and 4.

B. Research Design

In this research, the K-Nearest Neighbor method approach and by using features that can be obtained from the result of extracting texture features from Minutiae, shapes and GLCM. The following is the proposed scheme: (Figure 5)

The feature extraction approach used is shape and texture. Shape features consist of: perimeter, area, diameter, roundness, width and slenderness. Then the minutiae feature extraction consists of bifuraction and termination (Thai, 2003). While GLCM is to find the binary value of the angle used to get the value, while the resulting attributes are contrast, correlation, energy and homogeneity, then the data is normalized so that there is no dominating data.

Result and Discussion

1. Design System

The stages of the classification process used in this study go through several stages of the internal process to obtain the value of each image, the system flow diagram can be seen in

Figure 1. Types of Bangkok

Figure 2. Types of Red Seeds

Figure 3. Types of kristal

Figure 4. Types of Sunday market

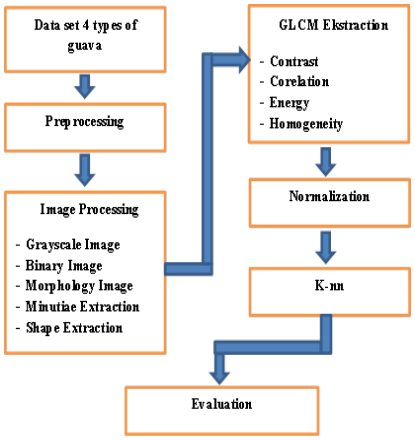

Figure 5. Flowchart of Proposed Method

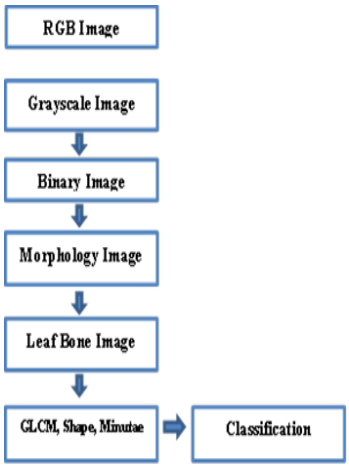

Figure 6. System Design

Figure 6.

2. Extraction Process

a. Preprocessing

The preprocessing process carried out in this study is to flatten the size of the guava leaf image with a pixel size of 400x400 by taking the image of the image position with the leaf bone at the top to facilitate the extraction process, then carry out the process of changing the bright white background.

b. RGB image processing

Is an image process from the preprocessing results which will then be processed and searched for its value through the extraction process, on the RGB image the image has been processed through the preprocessing process by changing the bright white background and with 400x400 pixels.

c. Grayscale image

Is an image process based on color combinations in pixels, thresholding is added to this grayscale process, the process is carried out to separate the foreground and background. The threshold value used in this study is 500, so pixels that have an intensity value of less than 500 will be changed to 0 (black) and those greater than 500 will be changed to 1 (white).

d. Binary Image

Where the binary image in this research process is used to find the GlCM value, shape features and minutiae.

e. Morphology Image

Morphology performs interior pixel removal operations. Sets the pixel to 0 if all four of its connected neighbors are the same 1.

f. Leaf Bone Image

It is an inverse condition from the morphological process, where this inverse condition functions to reverse the binary image from black to white image, where this extraction process is to find the leaf bone image process that is used to calculate the leaf bone branch value in minutiae.

3. Extraction Results

Feature extraction is a step to get information or different characteristics between an object and an objecton the seed leaf image for an even distribution of 400x400 pixel size to facilitate the next process step. The extraction process can be seen in Figure 7.

4. Attribute Value Results

a. Shape Feature Extraction

To distinguish objects that have different geometric shapes. As for some of the attributes used in this study as shown in Tables 1 and 2.

Mean while, the results of the extraction attribute values for the shape of roundness, slenderness and width can be seen in Table 2.

b. Minutiae Feature Extraction

Minutiae extraction is a step to extract ridges on fingerprint images, while in this study researchers tried to use this method to find the

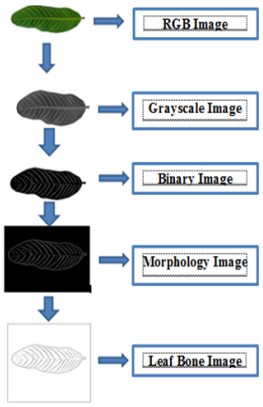

Figure 7. Extraction Results

Table 1. Extraction Results Form1

Type	Perimeter	Large	Diameter
Bangkok	751	34886	35,802.234
Red Seeds	641	25809	30,885,757
Kristal	688	27872	32,525,989
Sunday market	598	26080	27,964,620

Table 2. Extraction Results Form 2

Type	Round	Slim	Wide
Bangkok	0.59557	0.367556	356,033
Red Seeds	0.61339	0.356415	306.863
Kristal	0.56263	0.377722	323,261
Sunday market	0.69044	0.447778	277,650

Table 3. Minutiae Results

Type	Bifuraction	Termination
Bangkok	19	23
Red Seeds	26	23
Kristal	35	0
Sunday market	11	16

ridge values in guava leaf bone images. The resulting value in minutiae extraction can be seen in table 3.

c. GLCM Value

In this study, to determine the GLCM value in general to detect co-occurrence, the existing features are calculated with one pixel distance in four directions namely 0^0, 45^0, 90^0, 135^0 (Ni'mah et al., 2018). But in this study determine the value of co-occurrence with a rotational brick image because considered more suitable because of the type of extraction and the emphasis is on the pixels evenly with a distance of 0^0 pixels. Can be seen in table 4.

d. Application K-nn Metode

After getting the value of several extraction processes, the next step is to enter the value of the extraction result. Furthermore, the data will be tested using the K-NN (K – Nearest Neighbor) method (Yodha & Kurniawan, 2014). The results of the extraction into the excel file all values can be seen in table 4.5.

Conclution

In this research, we apply a combination of GLCM feature extraction, shape feature extraction and minutiae extraction using the K-NN method. From the combination of the three extractions, several trials have been carried out, where the first test stage was carried out by not combining the extractions, where the accuracy obtained was 88.29% GLCM, 87.27% form extraction, 75.06% minutiae extraction. Furthermore, after the trial, each GLCM extraction has the first rank of the 3 extractions, then for the second stage by combining 2 algorithms in order to know the accuracy value is higher or lower where the result is GLCM + Form = 91.06%, GLCM + Minutiae = 82.55%, Shape + Minutiae = 92.03%. Where from the results of the merger of the two extractions, Form and Minutiae have the highest accuracy from other combinations. For stage 3, a combination of the three extractions is carried out, namely between GLCM + Form + Minutiae to get 92.42% accuracy results. From some of these experiments, it can be concluded that the combination of the three extractions is the best result with the highest accuracy value compared to the combination of other extractions with an accuracy value of 92.42%.

Table 4. GLCM Results

Type	Contrast	Corelation	Energy	Homogeneity
Bangkok	0.00394	0.9885	0.65268	0.99802
Red Seeds	0.00569	0.9788	0.72553	0.99715
Kristal	0.00743	0.3175	0.98172	0.99628
Sunday market	0.00330	0.9880	0.72109	0.99834

Table 5. K-nn Test Results

GLCM	Shape	Minutuae	Accuracy
√	-	-	88.29%
-	√	-	87.27%
-	-	√	75.06%
√	√	-	91.06%
√	-	√	82.55%
-	√	√	92.03%
√	√	√	92.42%

Suggestion

In this research, can be further developed with various scientific steps with better extraction features and methods to get better accuracy values. Therefore, it is hoped that further research can improve the short comings that exist in this study.

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