Identification of jasmine flower (*Jasminum sp.*)
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Identification of jasmine flower (Jasminum sp.) based on the shape of the flower using sobel edge and k-nearest neighbour

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Abstract. People often wrong in knowing the type of jasmine by just looking at the white color of the jasmine, while not all white flowers including jasmine and not all jasmine flowers have white. There is a jasmine that is yellow and there is a jasmine that is white and purple. The aim of this research is to identify Jasmine flower (Jasminum sp.) based on the shape of the flower image-based using Sobel edge detection and k-Nearest Neighbor. Edge detection is used to detect the type of flower from the flower shape. Edge detection aims to improve the appearance of the border of a digital image. While k-Nearest Neighbor method is used to classify the classification of test objects into classes that have neighbouring properties closest to the object of training. The data used in this study are three types of jasmine namely jasmine white (Jasminum sambac), jasmine gambir (Jasminum pubescens), and jasmine japan (Pseuderanthemum reticulatum). Testing of jasmine flower image resized 50 x 50 pixels, 100 x 100 pixels, 150 x 150 pixels yields an accuracy of 84%. Tests on distance values of the k-NN method with spacing 5, 10 and 15 resulted in different accuracy rates for 5 and 10 closest distances yielding the same accuracy rate of 84%, for the 15 shortest distance resulted in a small accuracy of 65.2%.

1. Introduction
Jasmine (Jasminum sp.) is a famous ornamental flower with a fragrant aroma and one raw material for perfumes and commodities of high economic value. Around the world is known to 200 types of jasmine but often cultivated and known in Indonesia only some types, including jasmine white (Jasminum sambac), jasmine gambir (Jasminum officinale), Jasmine Star (Jasminum multiflorum), jasmine king (Jasminum rex) jasmine australia (Jasminum simplicifolium), japanese jasmine (Pseuderanthemum reticulatum), jasmine primrose (Jasminum menshi), and japanese jasmine (Pseuderanthemum reticulatum). The data used in this study are three types of jasmine namely jasmine white (Jasminum sambac), jasmine gambir (Jasminum pubescens), and jasmine japan (Pseuderanthemum reticulatum). Edge detection (edge detection) is used to detect the type of interest from the flower shape. This process aims to improve the appearance of the border on a digital image. Another purpose of edge detection is to identify an area in a digital image where there is a major change in intensity. With edge detection on an image processing system will find surface or line marks that arise from the object [3].

The k-Nearest Neighbor (k-NN) method is used for classifying the classification of a test object into a class that has the closest neighbor property to the training object. In this study, the k-nearest neighbor classification uses the closest distance calculation with the euclidean distance method. The classification with k-Nearest Neighbor aims to select the training image with the smallest distance to the tested image [9]. Previous studies of the classification of Japanese cinnamon flower (Adenium sp.) Based on crown
image using color feature extraction and edge detection 96% percentage based on the combined features of sobel edge detection and histogram hue [2]. Detection of interest type using the value of HSV from the image of the crown of flowers managed to detect objects with an average of 86.67% [8]. Research on the introduction of flower type based on color features using artificial neural network and fuzzy with the average result accuracy of 94.44% [1]. Based on previous research, this research was conducted with the aim of identification of jasmine flowers based on flower shape using extraction of sobel edge detection feature and classified using k-NN.

2. Methods
Methods in this study consisted of data, pre-processing, form extraction by using the Sobel operator that was introduced by Irwin Sobel in 1970. The advantage of this sobel operator is its ability to reduce noise before performing edge detection calculations [10], color extraction, identification and trial as shown in Figure 1.

```
Start
       ↓
Image Acquisition
       ↓
Preprocessing
       ↓
Form Extraction of Sobel Operator
       ↓
RGB color extraction
       ↓
KNN Identification
       ↓
Trials
       ↓
Finish
```

**Figure 1.** Image processing.

The algorithm of the sobel method [7] in detecting the edge of a digital image in the form of grayscale image is as follows:
1. Convolute grayscale image with horizontal Sobel ($S_x$) kernel is matriks transform of sobel kernel vertikal ($S_y$) and Sobel kernel vertikal ($S_y$)

$$S_y = \begin{bmatrix} 1 & 2 & 1 \\ 0 & 0 & 0 \\ -1 & -2 & -1 \end{bmatrix}$$

2. Calculate the Gradient by the formula $G = \sqrt{S_x^2 + S_y^2}$

3. The output image is the result of a large gradient ($G$).

2.1. Image Acquisition

Flower image acquisition phase is data collection of flowers taken in BALITRO. Flowers taken there are 3 types of jasmine white (Jasminum Sambac), jasmine Japan (Pseuderathemum Reticulatum), and jasmine gambir (Jasminum Pubescens) with each flower taken 3 petals of the same type. Image acquisition performed a total of 33 times on each type of flower using a camera phone with a pixel quality 5MP during the day centered on the petals and black paper background. Total data of jasmine flowers as much as 99 which divided into 90 data train and 9 test data. Examples of the types of flowers identified are shown in Figure 2.

![Figure 2. Type of jasmine flowers.](image)

2.2. Pre-processing and Identification

Image processing aims to process information contained in an image as the need for automatic object recognition and analysis [4]. The initial stage to get the information that the preprocessing stage color image will be resized to a uniform size resize the image into four types, namely the pixel size 30 x 30, 50 x 50, 100 x 100, and 150 x 150 and edge detection is performed to detect the type of flower from the characteristic of the flower shape. This process aims to improve the appearance of the border on a digital image. Another purpose of edge detection is to identify an area in a digital image where there is a major change in intensity. With edge detection in an image processing system (computer-based) will find any signs of surface or contour arising from the object [3] as shown in Figure 3.

![Figure 3. Difference of resizing size.](image)
Resized images 50 x 50 are calculated values of Red, Green, and Blue (RGB), RGB skewness value, RGB kurtosis and RGB variance that will be stored as training data. For identification using image of test data to be calculated using k-Nearest Neighbor (k-NN) method with value $k$ is 5. The $k$-Nearest Neighbour method is used to categorize test object into a class that has the closest neighbouring property (Neighbourhood) to the training object. In this study, the $k$-nearest neighbour classification uses the closest distance calculation with the euclidean distance method. Classification with $k$-Nearest Neighbour aims to select the training image with the smallest distance to the test image [9]. The $k$-NN algorithm is as follows [5].

1. Determine the value of $k$.
2. Calculate the distance between the new data into each labelled data.
3. Determine the labelled data $k$ that has the most minimal distance.
4. Classify the new data into the labelled data of the majority.

When compared with other classification methods, this method has a high enough degree of accuracy because the incoming data will be classified based on similarity of traits that exist from previous data that has been classified. However, the $k$-NN algorithm needs to determine the value of the parameter $k$ (the number of nearest neighbours) and the learning based on the distance is unclear as to what kind of distance to use and which attribute should be used to obtain the best result [6].

3. Result

The results of feature extraction of color from the image with a pixel size of 50 x 50 generates RGB values, RGB skewness, RGB kurtosis, and RGB variance and will be saved into a data sheet that will become a reference as training data. The results of the color extraction process are shown in Figures 4 and 5.

![Figure 4. RGB color extraction results.](image-url)
The result of feature extraction using edge detection with a sobel operator will result in a binary value. Number 1 is the value of the edge of the image of jasmine and the number 0 is the value of the background image jasmine. The results of sobel edge detection process is shown in Figure 6.

![Image of edge detection results](image)

**Figure 6.** The results of edge detection sobel.

An example of the identification results is shown in Figure 7.

![Image of identification results](image)

**Figure 7.** Results of identification of white roses.

The test conducted on 9 test data and produce valid data as much as 7, and the data is invalid 2. The factor of possible testing failure is the color of the jasmine white flowers that are similar to jasmine gambier flowers and the shape of the jasmine white flowers are almost similar to jasmine japan flowers.
From the validation test on the identification of jasmine flower using RGB color feature extraction method and extraction of the characteristic of the sobel operator and the identification method k-Nearest Neighbor obtained the accuracy level with 84% percentage with k = 5 and 10 value, while for the value k = 15 obtained accuracy of 65.2%. Test results with k values of 5 and 10 are shown as in Table 1.

| No | Picture of Flowers | Result of Identification | Description |
|----|-------------------|--------------------------|-------------|
| 1  | Jasmine White     | Jasmine White            | Matching    |
| 2  | Jasmine White     | Jasmine White            | Matching    |
| 3  | Jasmine White     | Jasmine White            | Matching    |
| 4  | Jasmine Japan     | Jasmine Japan            | Matching    |
| 5  | Jasmine Japan     | Jasmine White            | No Matching |
| 6  | Jasmine Japan     | Jasmine Japan            | Matching    |
| 7  | Jasmine Gambir    | Jasmine White            | No Matching |
| 8  | Jasmine Gambir    | Jasmine Gambir           | Matching    |
| 9  | Jasmine Gambir    | Jasmine Gambir           | Matching    |

Testing validation there are nine test data that is three test data of jasmine white, three test data of japan jasmine and three test data of jasmine gambir using confusion matrix. The image of jasmine white is well detected, while jasmine japan image produce two detected images into its type and one image is detected into the type of jasmine white, this is because jasmine japan has oval shaped petals that are almost similar to the petals shape of jasmine white, jasmine gambir image produce two images into its type and one image is detected into jasmine white, this is because jasmine gambir have the same colour with jasmine white. Validation results are shown in the Table 2.

| Test data     | Train Data |
|---------------|------------|
|               | Jasmine White | Jasmine Japan | Jasmine Gambir | Total |
| Jasmine White | 3           | 0             | 0             | 3     |
| Jasmine Japan | 1           | 2             | 0             | 3     |
| Jasmine Gambir| 1           | 0             | 2             | 3     |
| Total         | 5           | 2             | 2             | 9     |

4. Conclusion
Identification of jasmine flowers (Jasminum sp.) using RGB color feature extraction takes on RGB value, RGB skewness, RGB kurtosis, and RGB variance, while for edge detection using a sobel operator. The image used consisted of 90 training data and 9 test data. Image taken using a camera phone with a 5MP quality. Image preprocessing is done to equalize the size to the pixel size of 30 x 30, 50 x 50, 100 x 100 and 150 x 150 pixel generates an accuracy rate of 84%. The k-NN method for identification with
$k$ values of 5, 10 and 15 yielded different accuracy rates for 5 and 10 of the closest distance resulted in the same accuracy of 84%, for the nearest 15 resulted in a small accuracy of 65.2%.

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