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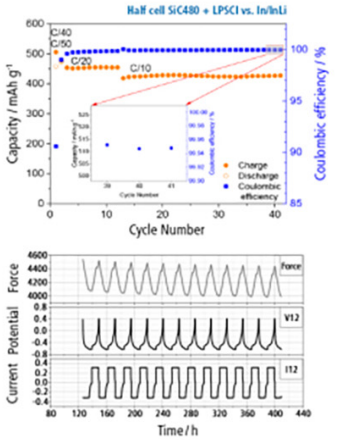
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Identification Growth Quality of Red Onion during Planting Period using Support Vector Machine

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Abstract. Shallot (*Allium ascalonicum L*) is a type of horticultural crop which is one of the leading vegetable commodities that is widely cultivated by farmers in Indonesia. Identification of the quality of growth of onions can be known from the size, colour and texture. This study focuses on identify the quality of the growth of shallots using Support Vector Machine (SVM) classifier. The data used in this study are 100 images of 48-day-old *Bauji* variety onions divided into two classes, good quality onions and poor quality onions. The pre-processing produce higher quality images based on edge detection, dilation, erosion and colour channel changes for feature extraction. Feature extraction based on HSI colour and GLCM texture to identify the quality of the onion Furthermore value of the feature extraction will be input calculation from the SVM classifier. The experiment shows that the best result can be using combination HSI and GLCM features with accuracy 82%.

1. Introduction

Shallot (Allium ascalonicum L) is one of the leading vegetable commodities that has been cultivated intensively by farmers in almost all regions of Indonesia. This commodity has high economic value and has an attractive market prospect. Shallots have many benefits, not only as a seasoning associated with aroma but are also used as traditional medicines such as cough (sputum spray), shortness of breath, fever, colds, and appetite enhancer[1]. The quality of onion growth can be determined by its size, colour and texture. Good quality onion bulbs have a characteristic hard solid texture, the colour looks bright and does not look black spots as a sign of disease, medium size tubers that have a diameter of 1.5 - 1.8 cm or 5 - 10 grams[2]. The process of identifying the quality of growth in onion bulbs can be done manually by humans in the form of visual analysis by paying attention to the physical and colour of the onion bulbs. The external quality of fruits and vegetables is generally evaluated by considering the color, texture, size, shape, and vision defects[3]. The identification process as above has several weaknesses including accuracy, differences in perception about the quality of onion tubers due to human visual limitations and the time required is relatively long. Previous study implemented digital image processing for the classification of fruit and vegetable quality. Among the studies conducted by [4]to classify sweet onions based on internal defects using image processing and artificial neural networks. In this problem the Bayesian method is used to select prominent features in the internal defects of the onions and the neural classification works to sort the onions into two classes (good and broken). Implementation of digital image processing uses image segmentation methods for sorting and evaluating apples using the support vector machine algorithm and the Otsu method [5]. In order to measure object quality through digital image classification the features GLCM are implemented such as beef freshness quality

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research[6]. The combination of GLCM and HSI features in the context of image classification is done to improve the quality of classification with low variations in egg candling images[7]. Milkfish classification with a tendency for low image variation is implemented by a combination of GLCM and HSI[8]. Support Vector Machine (SVM) classifier is a robust classifier by prioritizing hyperplane that can separate two data sets from two different classes, with the combination of GLCM and HSI features in textile image classification research allowing classification with varied images[9]. The aim of research to develop identification growth quality of red onion during planting period using support vector machine based combination of GLCM and HSI from the results of the image of onions that have been upgraded through pre-processing.

2. Relate work

Research of onion quality classification based machine vision has made by [10] to detect disease using deep learning algorithm. Intake of healthy fruits and vegetables is vital as they are the source of energy for all living beings, [11]have put forward a reliable mechanism for detecting the defects in fruits by detect and segregate low and best quality fruits using GLCM and SVM Classifier. HIS feature extraction has implemented by [12] to classify freshness tomato maturity. GLCM characteristics extract texture values from image object variations, while HSI extracts colour intensity from images, the combination allows identification of image quality onions.

3. Methods

Onion growth quality classification developed in our research has several stages; they are pre-processing, feature extraction, and classification. The proposed schema has shown in figure 1. The onion data collection was taken in the onion farming area in *Pasuruan* East Java Indonesia using a digital canon camera. Onion images measuring 450 x 300 pixels are 100 data in JPG format, 25 good quality onion data and 25 poor quality onion data. The process of taking pictures is done in a black box with the lighting of two 8 watt T5 lamps so that the image gets good light.

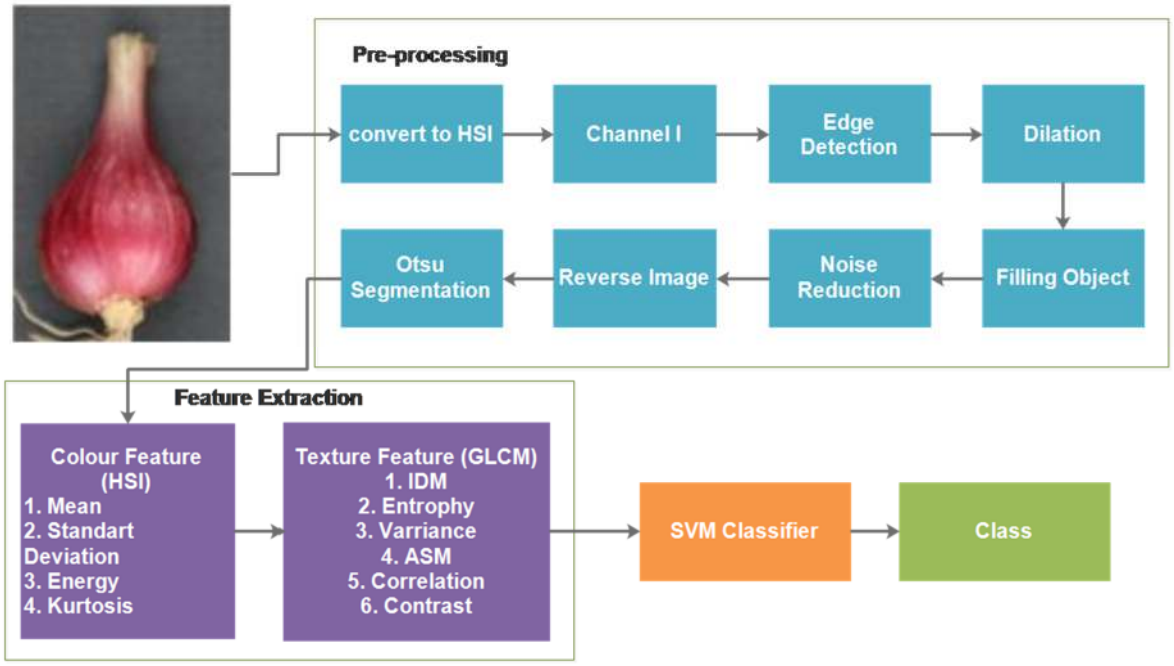


Figure 1. The Process Schema Onion Growth Quality Classification

Sampling onion data Figure 2.a below is a good quality image of onion, good quality onions can be seen if the colour is bright with the skin glowing not visible black spots as a sign of disease, its texture is solid and the size of the tuber is between 1.5 - 1.8 cm. The sampling in Figure 2.b is an image sampling

of the poor quality of the onion where the onion has a matted texture that is not dense, the colour does not look bright red and shiny and shows signs of disease.

3.1. Pre-processing

The data representation of Figure 1 onion recognition pre-processing begins with the RGB object used is the image of the onion containing RGB color elements (Red, Green, Blue) and then the HSI kernel separation process will then be carried out the HSI channel separation process (H is a hue component, S is the saturation component and I is the intensity component). At this stage the selected channel is channel I because according to vision, the most obvious in its representation is channel I. Channel separation aims to determine the results of each image and find out the value per character. The image of the colour channel I then performed Edge Detection which aims to mark or produce the edges of objects that become detailed images. In order to thicken the edges of objects in the image edge detection is done. The area in the image that is bounded by the edge then Filling the object aims to fill in order to obtain a solid object segment. Noise reduction to erode noise in the image due to imperfect splashing. Reverse image to get a reversing image using the imcomplement function of a grey level image is negative from that image (photographic negative). Negative image in the next process is processed Image Segmentation through otsu to separate the background to process significant areas during object evaluation.



(a) **(b)**

Figure 2. (a) good quality onion, (b) poor quality onion

3.2. Feature Extraction

In this study, according figure 1 feature extraction based on colour and texture to identify the quality of onions.

3.2.1 Colour (a colour image of one of the HSI colour components)

In colour extraction consists of standard deviations, energy, kurtosis and mean.

3.2.2 Texture (one of the colour components)

In this study the classification of texture features using the Grey Level Co-occurrence Matrix (GLCM) Inverse Different Moment (IDM), Entropy, Variance, Angular Second Moment (ASM) / Energy and Correlation (correlation). After doing the pre-processing process, the process is then continued by performing GLCM calculations. After that, the texture feature value extraction will be performed to get the value that will later be used as a reference. After getting the value of each calculation, the data normalization process will be carried out from the calculation. Normalization process is carried out to normalize large data into data with min value 0 and max value 1. To make it easier to process the data to the system.

3.3. Classification

The training method used in this study is the Sequential Training method. The flow of this method is as follows:

- The input data is in the form of training data and SVM parameter initialization.
- Calculates the RBF kernel, Hessian Matrix and Max Gamma.
- Iterate for each data to get the value of Ei, δα and update the value of αi.
- Checking the value | δα | <ε, if the iteration is stopped correctly or the iteration has reached the maximum iteration.
- Determine the maximum value of alpha class in the form of class +1 and class -1. Data of class +1 and class -1 have the highest alpha value which is used to calculate the values of $w.x^{+}$+ and $w.x^{-}$.
- Calculates the kernel between training data with +1 class data which has the highest alpha value $(K(x,x^{+}))$ and training data with class -1 data which has the highest alpha value $(K(x,x^{+}))$
- Calculates the values of $w.x^{+}$and $w.x^{-}$.
- Calculate the value of bias
- The resulting output value is a bias value.

4. Results and Discussion

In the test scenario there are several image data treatment processes. Starting with taking some images to be used as a training database, to capture images to be used as test data. The images used in this research 180 images, namely:

- There are 50 training data, divided into 25 images of good quality onion training, 25 images of poor quality onion training.
- There are 50 test data, divided into 25 images of good quality onion training, 25 images of poor quality onion training.

The next stage is testing 50 test samples, the first process is taking pictures using a digital camera with a resolution of 24.2 Mega Pixel, before the image is tested using Matlab, the image will first be processed resizing 50% so that the obtained image dimensions 450 x 300, this process is carried out in order to speed up the process of executing data. In this research will use a calculation using the results of a percentage that is adding up the results of data onions recognized by the system then dividing by the overall results of the onion data that has been tested then the results are multiplied by 100%. Calculation formulas use percentage results:

$$\frac{number\ of\ classified\ image}{number\ of\ testing\ image} \text{ x } 100\ \% = accuracy \qquad (1)$$

Table 1. Accuracy Testing Data

Data	Number Data	Accuracy
Detected	46	92 %
Not Detected	4	8 %

Based on the above accuracy results, it can be seen that 46 test images that have been tested show that the system performance with this method is quite good. This is proven by a fairly high level of accuracy, namely 92% for the types of onions detected and 8% for the types of onions that were not detected.

5. Conclusion

In this research using two tests, namely testing on the colour and texture of GLCM. In the colour testing is used to determine and distinguish the input image in the form of good quality onions and poor quality onions. 10 feature values from the 50 training data along with class values are input to form *svmtrain* on *svmclassify*. SVM algorithm performs the process by finding the best hyperplane of two data classes in the input space. And in this study used a linear kernel to predict the test class through the test data

used. test results of onion image Test data as many as 50 images with 46 images detected and not detected as many as 4 images so that it can be calculated that the accuracy of the test image is 92% for detected onions and 8% for undetected onions. Identification of the type of quality of onion growth in this study can be continued by given other special features so that specific characteristics of the object are obtained. This research can be developed with the same data can be done using other platforms with different operating systems such as Android and IoT-based image processing.

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