Mobile Application for Classifying Palm Oil Bunch using RGB and Artificial Neural Network

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Highlights: This project presents palm oil bunch ripeness classification application based on RGB colour model using Artificial Neural Network (ANN) and developed by using MATLAB for data set training purpose using Backpropagation techniques which it is a part of ANN. An Android application is constructed to test the capability of the trained ANN model in order to classify the ripeness of the palm oil bunch correctly. The captured image of the palm oil bunch is resized and its RGB colour components are extracted to get the individual mean of Red, Green and Blue value as the data set. Further, the data set is normalized and colour conversion techniques are applied. After the conversion, the data set then trained by using ANN. A graphical user interface system is developed in MATLAB for training and Android that classifies the ripeness of the palm oil bunch. The proposed model has an accuracy of 96%.

Key words: *Palm Oil Bunch, RGB, Artificial Neural Network, Android, MATLAB, Backpropagation*

Introduction

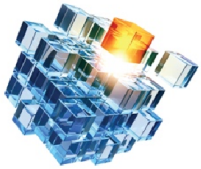
Malaysia is known as the second largest producer of palm oil in the world [1]. Currently, process of classifying the ripeness of palm oil bunch at the plantation is done

manually by human grader. This conventional method is subjective, inefficient and inconsistent because human grader has different techniques, expertise and experience which may vary from each other. Hence, this method affects the quality of palm oil production and also takes longer time to complete the grading process. This method can be replaced with technology-based alternative because it may reduce human effort, increase productivity, and more reliable compared to conventional method. In this project, a new method was introduced by developing Android mobile application which employs Artificial Neural Network (ANN) to classify the palm oil bunch based on RGB colour model by using the image that has been captured by the mobile phone. The purpose of this mobile application is to distinguish between the four different classes of palm oil bunch which are unripe, half-ripe, ripe, and overripe.

Content

This project is attempted to improve current manual classification technique and innovate the existing similar system such as Mango Grading Using Machine Vision System [2], Palm Oil Bunch Using Photogrammetric Grading and [3]. The existing systems as mentioned are lack of important part which those systems have their own limitations. The systems require hardware and other huge components such as conveyor, chamber, and personal computer to run the application. Moreover, the maintenance is high and needs a lot of effort in grading process. This may lead to inefficiency of use because the human grader needs an instant action to grade the palm oil bunch.

In this research, it utilizes almost all main specifications that can be provided by a high-end smartphone. All



main factors like multi-core processors, high capacity of RAM size and high quality picture made the development of this application is possible. High-end smartphone mostly has been equipped with minimum 12 megapixel camera with appropriate sensor and aperture size for low light and sunlight condition. Once a particular palm oil bunch picture taken, the image will be stored in the memory. In graphics domain, the image is known as a bitmap which it is used to store digital images and form an image. In this proposed solution, the application has full colour images as the application must produce a result based on colour of the captured image. The image's colour information can be described by RGB colour model. The colour of each pixel is determined by the combination of the Red, Green, and Blue intensities stored in each colour plane at the pixel's location. Graphics file formats store RGB images as 24-bit images, where the Red, Green, and Blue components are 8 bits each and have its own values which from 0 to 255 [4]. Figure 1 illustrates the process of RGB colour information extraction after the palm oil bunch is captured. Based on Figure 1, the R,G,B mean is extracted from the image by dividing each of them with the total pixels of the image. The mean then is normalized to get the small value for colour conversion as data set for training on MATLAB and testing on Android application.

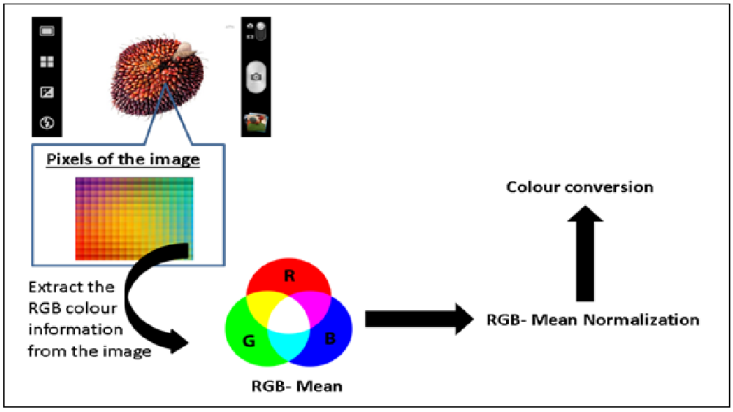


Figure 1: RGB colour information extraction process

This project use ANN as it is known as computational model which use the way of human neural networks to solve problems. ANN works to solve the problems by learning process through synapses weight [5]. This project applied Backpropagation technique as one of supervised learning algorithms used to solve complex problems in ANN. Backprogation learns by processing a set of training data or samples iteratively. There are two phases in Backpropagation which, firstly, input layer pattern training is presented to the network input layer. The network propagates the input pattern from input layer to hidden layer until output pattern is generated in the output layer. If the actual output pattern does not achieve by targeted output pattern then the error is calculated and then will propagated backwards through the network starting from the output layer to input layer. The weights are then adjusted as the error is propagated. Second phase, the input value is passed through the activation function. Neurons in the Backpropagation network use a sigmoid activation function which it guarantees that the neuron output is in the range of 0 until 1 only. Figure

2 illustrates the ANN model which use Backpropagation techniques where it clearly states the process, input layer, hidden layer and output layer.

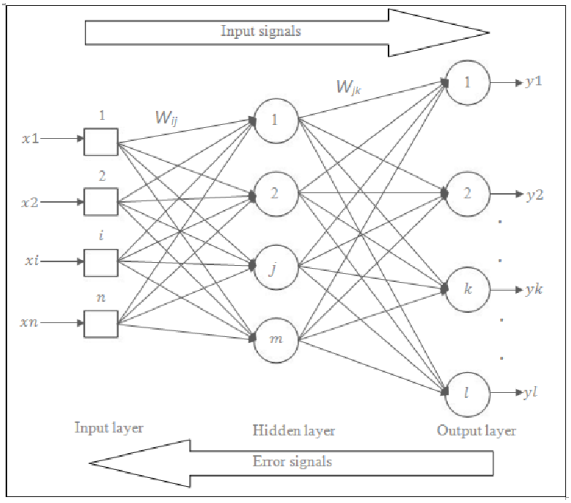


Figure 2: ANN Model

The project may give benefits to community as it can be used in any purposes regarding colour classification as the method involved in this project can be modified and reuse to satisfy any other object rather than palm oil bunch. The project has its own strengths and advantages based on the method, hardware and software used.

The first contribution of this project is on image processing and colour classification domain which used RGB colour model to extract the image RGB information on mobile application. Currently, colour classification by

using image processing is widely used in order to recognize some unknown parameters. RGB colour model is chosen because the aim of this research is to classify the colour of an image and RGB colour model recognize the colour. The colour conversion techniques removed the lighting conditions problem as lighting condition can affect the RGB extraction.

Secondly, the ANN which is Backpropagation techniques is used to learn the colour information during training phase. In this research project, it is proven that neural network can adapt to new scenarios where it can learn new data, it is fault tolerant as it make iteration in learning until reached the sum square error.

Furthermore, due to some drawbacks on existing system that have been stated earlier, it will give an advantage for this research project which this mobile application can be used directly without any delay and low maintenance.

This project can be commercialized and may give profit to the organization that required any colour classification techniques as the method to grade or differentiate any object of interest.

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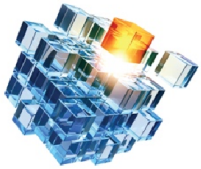

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