Mango Fruit Sortation System using Neural Network and Computer Vision

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Abstract

Mango has different colors and sizes that indicate the level of maturity. Mango maturity level often makes farmers confused when choosing a mango that has a good maturity. Sometimes, mango farmers still use manual methods to distinguish mango maturity, while the way that human labor is often inaccurate and different in its determination. The difference is due to the different perceptions of each person. From these problems then the need of machine sorting system on agriculture is felt important. Therefore, researchers will conduct research on mango sortation system. Mango has many types such as "Harum Manis", "Apple", "Gincu", etc. In this study type of mango that will be studied is mango "Gincu" because has a good color distribution. The goal of the research is to create a system that can sort mango that ripe or unripe. The method that used to do this research is separated into few step: problem identification, algorithm development, implementation and evaluation. The system is made using C language, Computer Vision and ANN (Artificial Neural Network) so the system can detect the color of mango that has been ripe or unripe. The output of this research will be compared to related research. The final output of this research is the system can detect the ripe or unripe mango with 94% accuracy.

1. Introduction

Fruit is one of the foods needed by the body. Fruit has vitamins and antioxidants that can improve regeneration cell, prevent certain diseases, and various benefits. All the benefits of fruit are obtained from the fruit that has the

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best quality. The best quality fruit is obtained by sorting process as the sort of fruit maturity level. Fruit maturity can be seen from skin color and size. Color becomes one of the easily recognizable traits to determine whether the fruit is ripe, undercooked, or raw. The principle that can be applied to the sorting system is color extraction. There are several previous studies that discuss the measurement of the maturity level of fruit by color.

In determining the maturity of the fruit can be through the color identification using three colors of red, yellow and green[1]. Red and yellow represent the ripe fruit, while the green represents the immature fruit. They are making a system that can check the fruit maturity viewer and star fruit sorter and do 50 times test on color paper and get 100% success, in star fruit get error of 14%, in tomato get error 4% and at Bananas get 8% error. Another case, that determines the maturity of color based on the composition of color[2]. The apple to be made histogram then compared[2]. The resulting information is the percentage of similarity and classification of fruit arrivals which include raw (18% -100%), half-cooked (12% -17%), and mature (0% -11%). Determine fruit maturity by recognizing the cucumber maturity in terms of fruit skin texture and [to] know the value of accuracy after the system is tested and its accuracy rate reaches 75%[3]. Based on the research that has been done can be seen that the sorting done on star fruit, tomatoes, bananas, apples, and cucumbers. In this study the fruit to be studied is Mango. Mango has many types such as "Harum Manis", Apple, "Gincu", etc. In this study type of mango that will be studied is mango "Gincu" because has a good color distribution.

Mango is tropical fruit and the tropical fruit ripeness condition we can see it from the fruit color[4], so we can use the colors of the mango fruit to measuring the ripeness level. Mango maturity level often makes farmers confused when choosing a mango that has a good maturity. Sometimes, mango farmers still use manual methods to distinguish mango maturity, while the way that human labor is often inaccurate and different in its determination. The difference is due to the different perceptions of each person. From these problems then the need of machine sorting system on agriculture is felt important. Therefore, we will conduct research on mango sortation system and build a system that can sort mango fruit automatically using neural network and computer vision that can sort mango with four category that is large – size ripe mango fruit, small – size mango fruit, large – size unripe mango fruit, and small – size unripe mango fruit. And why we use computer vision method and neural network method because computer vision can extract the fruit information from the image[5]. And neural network method can make the system to process the information like a human[6]. The objective of this paper was determined how to choose mango fruit with the good ripeness automatically with high accuracy.

2. Material and Method

2.1 Artificial Intelligent (AI)

Based on Russel and Norvig[7], there are 8 definitions of artificial Intelligence that can be categorized based on 4 approaches: (1) Thinking humanly: AI is described as a new attempt to make computers able to think, a machine that has a full mind and feel, or in other words can also be called an activity that adopts the way people think, such as decision making, problem solving, Learning, and so forth; (2) Thinking rationally: AI is described as a study through computational modeling, where this AI study can make everything possible to perceive and have reason to do; (3) Acting humanly: AI is described as an art to make machines able to display functions that require intelligence when used by humans; (4) Acting Rationally: AI is described as a study of the design of intelligent agents and AI focused on intelligent behavior.

2.2 Computer Vision

Computer vision is a branch of the study of the science of artificial intelligence that aims to help make the right decision about the description of objects and scenes that exist in an image[8]. The purpose of computer vision is to extract useful information from images[5]. OpenCV is open source computer vision library that available from *htttp://SourceForge.net/projects/opencvlibrary*[9]. The OpenCV structure consists of basic image processing and higher-level computer vision algorithms. Image processing is a process for extracting visual information needed to perform manipulation, navigation, and recognition tasks[7]. An image is a two-dimensional space that generally represents the projection of several objects in three-dimensional space[10]. An image is composed of each set whose numbers can be specified. Each element is in the corresponding location and has a value of[11]. Image segmentation is an operation to divide an image into several parts representing an object[8]. Detection is a method to identify an image that has a dominating object[12]. Thresholding is a method to convert gray scale image into binary image so that object is separated from its background[13]. Image resizing or scaling aims to analyze an image by minimize or enlarging. In