Computer vision system for egg volume prediction using backpropagation neural network

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Abstract. Volume is one of considered aspects in egg sorting process.A rapid and accurate volume measurement method is needed to develop an egg sorting system. Computer vision system (CVS) provides a promising solution for volume measurement problem. Artificial neural network (ANN) has been used to predict the volume of egg in several CVSs. However, volume prediction from ANN could have less accuracy due to inappropriate input features or inappropriate ANN structure.This paper proposes a CVS for predicting the volume of egg using ANN. The CVS acquired an image of egg from top view and then processed the image to extract its 1D and 2 D size features. The features were used as input for ANN in predicting the volume of egg. The experiment results show that the proposed CSV can predict the volume of egg with a good accuracy and less computation time.

1. Introduction

Indonesia is one of the top egg producing countries in the world. According to a data from Directorate General of Livestock, Ministry of Agriculture, Republic of Indonesia, Indonesia produced egg at about 1.43 billion kilograms in 2016 (http://www.pertanian.go.id/ap_pages/mod/datanak). The huge egg production should be followed by a rapid sortingsystem.Egg sorting is a process to classify egg based on internal and external qualities. There are several aspects used for assessing the quality of egg.Amongst the aspects is volume[1].

The using of computer vision system (CVS) is an appropriate solution for measuring the volume of egg. Several CVSs have been proposed for measuring the volume of egg, including 2D CVS and 3D CVS[2]. Although 3D CVS has a high accuracy, as proposed by Siswantoro, et al. [3], this system requires a high computational cost, due to the number of processed image.Soltani, et al. [1] have proposed a 2D CVS to predict the volume of egg based on pappus theorem and artificial neural network (ANN). The best prediction was achieved by using ANN with 28 neurons in hidden layer.In predicting the volume of egg using ANN,Soltani, et al. [1]used two features,the major and minor diameters of egg, as the input of ANN.By using only this two features, ANN may produce inaccurate prediction. This is because two eggs with same major and minor diameters but have different cross section area, may have different volume.Gonzalez, et al. [4] have proposed a 2D CVS to estimate the mass and volume of passion fruit using ANN combined with Principal Component Analysis (PCA) and Linear Discriminant Analysis (LDA). Color, texture, size, and shape were used to define a model for estimating mass and volume. Although the system used many features and used combination of LDA, PCA, and ANN to estimate volume, the system achievedonly 73%in terms of the correlation