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Gender recognition of Luffa flowers using machine learning

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Abstract

Automatic flower gender identification could be introduced to large farmlands to help artificial pollination of imperfect flowers. Incomplete flowers contain either male or female organs but not both. In this paper, we present a computer aided system based on image processing and machine learning to identify the gender of a Luffa flower automatically. A pre-trained machine learning model is used for gender segmentation of flowers. The system is developed using Tensorflow Machine Learning Tool, which is an open-source software library for Machine Intelligence. The network was selected as the Google's Inception model and a dataset was prepared after capturing flower images from a Sri Lankan Luffa farm. The system was tested using two datasets. The first contained the captured original images and the second was prepared by cropping each image to extract male and female floral organs, stamen and pistil respectively. The prototype system classified the flowers as either male or female at 95% accuracy level. The experimental results indicate that the proposed approach can significantly support an accurate identification of the gender of a Luffa flower with some computational effort.

Keywords: Convolutional neural networks, Image classification, Image processing, Flower recognition

Introduction

The concept of automatic gender identification of imperfect flowers and artificial pollination using Unmanned Aerial Vehicles (UAVs) was developed at CQUniversity Sydney Campus in 2015 (de Silva & Venugopal, 2016). The work presented in this paper is our first attempt in this direction. The results of this research may be useful in the crop farming industry where the farmers owning hectares of farmland could artificially pollinate the flowers using UAVs. This will not only save money and time but also would increase the productivity. The objective of this research is to use artificial intelligence to identify the gender of a Luffa flower from its image. Images of male and female Luffa flowers are used to first train the algorithm and then the rest of the images are used for testing. This system is suitable for identifying the gender of Luffa flowers in large farms. Luffa is well grown in low country dry zone, intermediate zone as well as wet zone in Sri Lanka. It is an edible vegetable, used in indigenous medicine and mature fruit is used as a bath brush or sponge, and as a pesticide in some countries (Nanayakkara, 2014). The female flowers are the solitary large stemmed ones. The males are located in clusters of buds with thin stems. Both flowers are large and yellow (Blumenstock, 2015). It is naturally cross pollinated through bees. Otherwise, manual pollination is done by picking up male flowers and transferring pollens to female flowers using cotton buds (Nanayakkara, 2014). However, this process is less efficient in a large farm. Automatic artificial pollination could be adapted to increase the production, and determining the gender of each flower is critical.