Normal and Peaberry Coffee Beans Classification from Green Coffee Bean Images Using Convolutional Neural Networks and Support Vector Machine

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Abstract : The aim of this study is to develop a system which can identify and sort peaberries automatically at low cost for coffee producers in developing countries. In this paper, the focus is on the classification of peaberries and normal coffee beans using image processing and machine learning techniques. The peaberry is not bad and not a normal bean. The peaberry is born in an only single seed, relatively round seed from a coffee cherry instead of the usual flat-sided pair of beans. It has another value and flavor. To make the taste of the coffee better, it is necessary to separate the peaberry and normal bean before green coffee beans roasting. Otherwise, the taste of total beans will be mixed, and it will be bad. In roaster procedure time, all the beans shape, size, and weight must be unique; otherwise, the larger bean will take more time for roasting inside. The peaberry has a different size and different shape even though they have the same weight as normal beans. The peaberry roasts slower than other normal beans. Therefore, neither technique provides a good option to select the peaberries. Defect beans, e.g., sour, broken, black, and fade bean, are easy to check and pick up manually by hand. On the other hand, the peaberry pick up is very difficult even for trained specialists because the shape and color of the peaberry are similar to normal beans. In this study, we use image processing and machine learning techniques to discriminate the normal and peaberry bean as a part of the sorting system. As the first step, we applied Deep Convolutional Neural Networks (CNN) and Support Vector Machine (SVM) as machine learning techniques to discriminate the peaberry and normal bean. As a result, better performance was obtained with CNN than with SVM for the discrimination of the peaberry. The trained artificial neural network with high performance CPU and GPU in this work will be simply installed into the inexpensive and low in calculation Raspberry Pi system. We assume that this system will be used in under developed countries. The study evaluates and compares the feasibility of the methods in terms of accuracy of classification and processing speed.
Keywords : convolutional neural networks, coffee bean, peaberry, sorting, support vector machine
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