ABSTRACT

With the increasing productivity in agriculture, it has become very much essential to look for an advanced non-destructive technique for quality assessment to minimize the losses from farm to fork. Recently deep learning has outperformed the task of recognition and classification of fruits and vegetables automatically from images. Being a highly demanding perishable produce Tomato is chosen as the vegetable of interest. Tomato suffers tremendous loss in the supply chain which accounts for 40% of the total production. This can be largely reduced if there is a recognition system that can predict its quality and shelf-life from image as input. This work thus attempts to develop an automatic quality prediction technique based on deep learning. Quality prediction includes estimation of current state of tomatoes, estimation of internal quality parameters and their shelf-life. To predict the current state of tomato as edible and spoilt, a customized CNN model was developed. Secondly to predict the ripening stage of tomato as mature green, intermediate and advanced, different transfer learning models (VGG, Inception and ResNet) were trained iteratively with varying epoch and batch size and compared for highest classification accuracy. The model with highest classification accuracy in ripening stage detection was considered for estimation of physic-chemical properties and shelf-life of tomatoes from its surface characteristics. Further the developed models were deployed into a mobile app for quality inference of tomatoes from image input. The highest accuracy of 99.70% was achieved at epoch 20 and batch size 32 in classifying tomatoes into edible and spoilt. On comparison of different transfer learning models for ripening stage classification, VGG 19 performed best at epoch 50 and batch size 32 with an accuracy 97.37%. In estimating the physico-chemical properties of tomatoes VGG 19 outperformed with an accuracy of 92%. VGG 19 was successful in predicting the shelf-life of tomatoes with an accuracy of 81%.The testing and the use of the application, in addition to the high recognition rate, consumes less computation time and was able to make prediction in real-time (<0.67 sec). Thus, this application can be a viable solution in tomato quality inference.