Automated fruit grading using optimal feature selection and hybrid classification by self-adaptive chicken swarm optimization: grading of mango

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Abstract

Post-harvest grading is an essential and important process that affects the fruit quality, evaluation, health-intensive, and export market. Even though the sorting and grading can be performed by the human as going on, it is tedious, labor-intensive, slow, and error-prone. Hence, smart automation is required for the same. Computer vision advancements touching every area where there even a minimal chance of smart automation. In this paper, intelligent automation for mango fruit grading designed and developed. Initially, the fruit segmentation is done by the active contour model, and the abnormality segmentation is performed using enhanced fuzzy-based K-means clustering approach followed by features: discrete Fourier transform (DFT), local binary pattern (LBP), and gray-level co-occurrence matrix (GLCM) and shape features extraction. The self-adaptive chicken swarm optimization (SA-CSO) has been used to reduce and optimize features vector. The quality of the fruits has finally categorized based on surface defect and maturity classification. Hence, for defect classifications, optimal abnormality segmented features have been fed to the K-nearest neighbors (KNN). The optimally selected fruit segmented features are subjected to a fuzzy classifier and the fruit segmented images are subjected to a convolutional neural network (CNN). As an improvement, the proposed SA-CSO is used to optimize the hybrid classifier for maximizing the accuracy of classification. The maturity is classified using the hybrid fuzzy classifier and CNN as ripe, partially ripe, and unripe. Finally, the defect and maturity output have been used to decide the quality as good, average, and bad. The comparative analysis of diverse performance metrics proves the effectiveness of the proposed model over other traditional algorithms.