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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

HUM -5151 Research Methodology and Technical Communication
(Technical Communication Component)

Synopsis (Research Article)

Title	:	Vegetable (Tomato) Defect Detection Using Machine Learning Approach
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Specialization	:	CSE
Base Paper Title	:	Analysis and Detection of Tomatoes Quality using Machine Learning Algorithm and Image Processing
Research Area	:	Image Processing, Soft Computing Methods, classification
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Abstract

Introduction: In the science of agriculture, automation helps to improve the country's quality, economic growth, and productivity. The fruit and vegetable variety influences both the export market and quality assessment. The market value of vegetables and fruits is a key sensory feature, which affects consumer preference and choice. Detecting defects in vegetables like tomatoes using image processing and soft computing approaches involves a combination of traditional computer vision techniques and machine learning methods. A dataset of images containing both healthy and defective tomatoes is gathered. Ensure that the dataset covers various types of defects like cracks, rot, and spots.

Motivation: By implementing Machine learning and image processing to detect the defect vegetables help in the improving the economic demands.

Methodology: The images are annotated to label each tomato as "healthy" or assign a specific defect label based on the type of defects. The images are resized and standardized to ensure that they have the same dimensions. Enhance the images using techniques like contrast adjustment, noise reduction, and histogram equalization to improve defect visibility. Extract relevant features from the preprocessed images. Common image features for defect detection include color, texture, and shape features. Apply image segmentation techniques to isolate individual tomatoes or regions of interest (ROIs) within the images. Use thresholding, edge detection (e.g., Canny edge detection), or region-based methods to segment defects from healthy areas. Apply soft computing techniques like fuzzy logic or rule-based systems to make decisions based on the extracted features. For example, you can define rules like "if the number of spots is above a threshold, classify it as a 'spot defect.'" To improve accuracy, you can complement the traditional image processing methods with machine learning models. Train a classifier (e.g., SVM, Random Forest, or neural networks) using the extracted features and the corresponding defect labels. Evaluate the classifier's performance using cross-validation or a separate test dataset.

Result: Here the system takes the common image features for defect detection include color, texture, and shape features and gives the label to tomato based one the observation made.

Conclusion: The look of fruits and vegetables is the most significant characteristic because it influences market value, consumer preference, and priority. The pre-processing, segmentation, feature extraction, and classification approaches that concentrate on fruit and vegetable quality based on colour, texture, size, shape, and flaws are implemented in this work.