ABSTRACT

In Agriculture Sciences, detection of diseases is one of the most challenging tasks. Sometimes agricultural experts need to take help of various sources to identify the diseases of plants. The misinterpretations of plant diseases often lead to wrong pesticide selection, resulting in damage of crops. Hence the automatic recognition of the diseases at earlier stages is important as well as economical for the farmers point of view. For this, proper segmentation of diseased part from the leaf in an accurate way is of utmost importance to diagnose the disease at earlier stage. But, its accurate detection has become a challenging task due to presence of noise in the digitally captured image, variation in background, shape and brightness in diseased images.

Apple is one of the most important temperate fruit crops in terms of land use efficiency with better opportunities for higher returns, friendly environment and employment generation. However, during past two decades, marssonina blotch/ premature leaf fall caused by marssonina coronaria and apple scab disease has become a major bottleneck in successful apple cultivation in Himachal Pradesh and Uttarakhand states of India. In proposed work, diseased apple leaf images are considered for the segmentation and classification of marssonina coronaria and apple scab diseases. For this, the apple crop is extensively surveyed in Himachal Pradesh and Uttarakhand states which includes Rohru, Jubbal, Kotkhai and Gharwal regions to capture the diseased apple leaves images.

For the detection and classification of diseases from the apple leaves, a novel algorithm known as brightness preserving dynamic fuzzy histogram equalization (BPDFHE) has been proposed for enhancement of leaf images. The performance evaluation of proposed enhancement algorithm is then compared with the already existing enhancement techniques like histogram equalization and contrast limited adaptive histogram equalization using various performance metrics like clarity index, normalised absolute error, contrast improvement index and peak signal to noise ratio showing better results of proposed enhancement algorithm.

A novel algorithm for the segmentation of region of interest from the diseased leaves with live background is also proposed here which gives better results as compared to existing
segmentation algorithms. For this, performance parameters like jaccard index, dice coefficient and accuracy are evaluated. Simulated results demonstrate that the proposed segmentation algorithm is an efficient approach that can segment apple diseased leaves from live background more accurately; reaching an accuracy of 99.8%.

After the segmentation, textural features of segmented ROI, such as 1st order and 2nd order gray level co-occurrence matrix features are calculated. This includes mean, variance, skewness and kurtosis as 1st order textural features and contrast, correlation, energy, entropy, smoothness and homogeneity as 2nd order textural features. Finally, textural features of segmented region of interest is applied to four different classifiers out of which K nearest neighbour proved to give the most precise results giving an accuracy of 99.4%. 

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