

A comparative study on dimensionality reduction of dielectric spectral data for the classification of basal stem rot (BSR) disease in oil palm

Basal stem rot (BSR) disease in oil palm is caused by *Ganoderma boninense* fungus. This plant disease is deemed highly destructive and would cause substantial economic loss. The use of spectroscopy technique with the capacity to deal with a large amount of spectral data has gained growing attention as a robust method, particularly to identify the symptoms of plant disease in its initial stage. The dimensionality reduction is pivotal in the use of spectroscopy technique due to its improved prediction performance and optimum processing. Considering that, this study assessed the feasibility of utilising dielectric spectral properties to classify the severity levels of BSR disease in oil palm across a frequency range of 100 kHz–30 MHz. The support vector machine-feature selection (SVM-FS) and principal component analysis (PCA) were applied as data reduction methods. After selecting the optimum number of significant frequencies, this study proceeded to assess the effectiveness of the support vector machine (SVM) and quadratic discriminant analysis (QDA) classifiers in identifying the four different levels of BSR disease. The performance of both classifiers with and without data reduction methods was subsequently compared in terms of the classification accuracy, while the whole spectrum data served as part of the control method. The resultant outcomes revealed that the use of QDA classifier with PCA recorded the highest classification accuracy (up to 96.36%). As for the case of without using data reduction methods, the SVM classifier recorded the highest classification accuracy at only 79.55%. Conclusively, this study proved the significance of dimensionality reduction of dielectric spectral data for the classification of BSR disease in oil palm.

Keyword: Dielectric spectral data; Dimensionality reduction; Support vector machine-feature selection; Principal component analysis; Support vector machine; Quadratic discriminant analysis