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The evaluation of Spectral Vegetation Indices for Classification of Nutritional Deficiency in Rice Using Machine Learning Method

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[Abstract]

Detection of stress responses in crops is important to diagnose crop growth and evaluate yield. Also, the multi-spectral sensor is effectively known to evaluate stress caused by nutrient and moisture in crops or biological agents such as weeds or diseases. Therefore, in this experiment, multispectral images were taken by an unmanned aerial vehicle(UAV) under field condition. The experiment was conducted in the long-term fertilizer field in the National Institute of Crop Science, and experiment area was divided into different status of NPK(Control, N-deficiency, P-deficiency, K-deficiency, Non-fertilizer). Total 11 vegetation indices were created with RGB and NIR reflectance values using python. Variations in nutrient content in plants affect the amount of light reflected or absorbed for each wavelength band. Therefore, the objective of this experiment was to evaluate vegetation indices derived from multispectral reflectance data as input into machine learning algorithm for the classification of nutritional deficiency in rice. RandomForest model was used as a representative ensemble model, and parameters were adjusted through hyperparameter tuning such as RandomSearchCV. As a result, training accuracy was 0.95 and test accuracy was 0.80, and IPCA, NDRE, and EVI were included in the top three indices for feature importance. Also, precision, recall, and f1-score, which are indicators for evaluating the performance of the classification model, showed a distribution of 0.7-0.9 for each class.

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