Evaluation of RapidEye, Sentinel-2 and Landsat-8 Imageries in Rice Terrace Extraction using Machine Learning Algorithms

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Abstract: Rice terraces which practiced widely in parts of Asia-Pacific are agriculture production in high, steep-slope areas which reduces soil erosion and landslide hazard, control water resource. In previous studies of rice terraces, remote sensing data has been reported as valuable data to identify rice terraces area. However, most of these studies have been focused on high and very high spatial resolution remotely sensed. In this study, we investigated the capability of three medium remote sensing data: RapidEye, Sentinel-2, and Landsat-8 on rice terraces extraction. Moreover, both pixel-based analysis (PBA) and object-based analysis (OBA) approaches were carried out to classify rice terraces using powerful machine learning classifiers: Feed-forward neural network, Random Forest, and Support Vector Machine algorithms. All three remoted sensed data obtained high accuracy of rice terraces classification at PBA, ranging from 90.3% to 92%. OBIA shown lower accuracy than PBA; in general, the accuracy decreased when segmentation threshold increased. All of OBA cases of RapidEye classifications obtained higher 85% accuracy, while Sentinel-2 data acquired lower than RapidEye but higher than 80%, and Landsat-8 image showed the lowest accuracy, even below 75%. The classification results carried out by three machine learning classifiers were quite similar.

Keywords: Rice Terrace, Machine Learning, Random Forest, Support Vector Machine, Feed-forward Deep Neural Network