Young and mature oil palm tree detection and counting using convolutional neural network deep learning method

ABSTRACT

Detection and counting of oil palm are important in oil palm plantation management. In this article, we use a deep learning approach to predict and count oil palms in satellite imagery. Previous oil palm detections commonly focus on detecting oil palm trees that do not have overlapping crowns. Besides this, there is a lack of research that builds separate detection system for young and mature oil palm, utilizing deep learning approach for oil palm detection and combining geographic information system (GIS) with deep learning approach. This research attempts to fill this gap by utilizing two different convolution neural networks (CNNs) to detect young and mature oil palm separately and uses GIS during data processing and result storage process. The initial architecture developed is based on a CNN called LeNet. The training process reduces loss using adaptive gradient algorithm with a mini batch of size 20 for all the training sets used. Then, we exported prediction results to GIS software and created oil palm prediction map for mature and young oil palm. Based on the proposed method, the overall accuracies for young and mature oil palm are 95.11% and 92.96%, respectively. Overall, the classifier performs well on previously unseen datasets, and is able to accurately detect oil palm from background, including plant shadows and other plants.