

Census and Mapping of Oil Palms Over Satellite Dataset Using Deep Learning Model

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Abstract : Conduct of accurate reliable mapping of oil palm plantations and census of individual palm trees is a huge challenge. This study addresses this challenge and developed an optimized solution implemented deep learning techniques on remote sensing data. The oil palm is a very important tropical crop. To improve its productivity and land management, it is imperative to have accurate census over large areas. Since, manual census is costly and prone to approximations, a methodology for automated census using panchromatic images from Cartosat-2, SkySat and World View-3 satellites is demonstrated. It is selected two different study sites in Indonesia. The customized set of training data and ground-truth data are created for this study from Cartosat-2 images. The pre-trained model of Single Shot MultiBox Detector (SSD) Lite MobileNet V2 Convolutional Neural Network (CNN) from the TensorFlow Object Detection API is subjected to transfer learning on this customized dataset. The SSD model is able to generate the bounding boxes for each oil palm and also do the counting of palms with good accuracy on the panchromatic images. The detection yielded an F-Score of 83.16 % on seven different images. The detections are buffered and dissolved to generate polygons demarcating the boundaries of the oil palm plantations. This provided the area under the plantations and also gave maps of their location, thereby completing the automated census, with a fairly high accuracy ($\approx 100\%$). The trained CNN was found competent enough to detect oil palm crowns from images obtained from multiple satellite sensors and of varying temporal vintage. It helped to estimate the increase in oil palm plantations from 2014 to 2021 in the study area. The study proved that high-resolution panchromatic satellite image can successfully be used to undertake census of oil palm plantations using CNNs.

Keywords : object detection, oil palm tree census, panchromatic images, single shot multibox detector

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