A Comparison of Deep Learning Methodology for Predicting Palm Oil Trees

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Key words: Geoinformation/GI; Photogrammetry; GeoAI

SUMMARY

Indonesia is the largest country of palm oil production in the world. According to the Central Statistics Agency 2020, Indonesia's CPO (Crude Palm Oil) production reached 44.8 million tons. Many Indonesian CPO is supported by the distribution of CPO in various provinces in Indonesia, such as Riau, North Sumatera, Central Kalimantan, East Kalimantan, and West Kalimantan. From these backgrounds, the appropriate method for palm oil tree counting is needed to find high accuracy and applicability for business actors to estimate the yield figures and predict market needs.

In optimizing palm oil tree counting vastly and efficiently, it is necessary to develop artificial intelligence for spatial analysis support. Artificial Intelligence or GeoAI is the technology to supports palm oil tree counting by learning from data training in machines and automatically detecting the object. Furthermore, it will compare the object detection deep learning efficiency to view the suitable method. Several object detection methods were compared, such as faster R-CNN, YOLOv3 (You Only Look Once), Retina Net, and Mask R-CNN. Using a DJI Phantom 4 multispectral drone with a spatial resolution of 5 cm, the researcher collected the data from drone acquisition generated by PT. Aria Agri Indonesia. The research location focused on the Central Kalimantan area with 15 hectares, and the data was processed by ArcGIS Pro software. Based on model testing results, it is successfully tried the faster R-CNN method detected 3666 palm oil trees with a confidence threshold of 0,5 is equal to a 50% confidence threshold, YOLOv3 detected 7739 palm oil trees with a confidence threshold of 0,5 is equal to a 50% confidence threshold, Single Shoot Detector detected 1650 palm oil trees with a confidence threshold of 0,73 is equal to a 73% confidence threshold, and Retina-Net detected 1848 palm oil trees with a confidence threshold of 0,74 is equal to a 74% confidence threshold, and mask-RCNN detected 2728 palm oil trees with a confidence threshold of 0,9 is equal to a 90% confidence threshold. The manual digitization used for the data validation and the total of palm oil trees is 1667. Single Shoot Detector is the closest

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result to manual digitization for the deep learning object detection method.

Keywords: Palm Oil, Tree Counting, Faster R-CNN, YOLOv3, Single Shoot Detector, Retina-Net, Mask R-CNN

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