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Deep forest cover classification of consecutive landsat imageries over Borneo

AZALEA KAMELLIA ABDULLAH[1,*], MOHD NADZRI MD REBA[2,3], NUR EFARINA JALI[1], SIKULA MAGUPIN[4], DIANA ANTHONY[4]

[1] World Wildlife Fund for Nature-Malaysia (WWF-Malaysia), Malaysia
[2] Geoscience and Digital Earth Center (INSTeG), Research Institute for Sustainable Environment (RISE), Universiti Teknologi Malaysia, Malaysia
* Corresponding author email address: azaleakamellia.a@gmail.com

Abstract: Forest cover represents the spatial distribution and arrangement of aboveground canopy extent formed from the collection of plant crowns over a region. The contiguity is attributed to forest ecosystem conditions and defined for a healthy supply of ecosystem services. Mapping the forest cover is significant in generating the baseline information to support the sustainable management of natural resources and thus valuable for supporting the 12th and

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15th targets of the Sustainable Development Goal (SDG). Conventional in-situ mapping is less favourable considering the difficulty to estimate the spatial extent and thus integrating attributes in regular updates which can be impractical for long period measurement. Therefore, satellite remote sensing offers a reasonable mapping routine at a better economy and prompt deliverable extraction. Yet, satellite image processing is inevitable to persistent cloud cover, missing pixels, mixed pixel problem, undiscernible normality in training data, Hughes phenomenon, and complex classification routines among others. As a result, this requires massive time and considerable skills to achieve high accuracy mapping. Recent advancement by deep learning image classification algorithms such as Convolutional Neural Networks (CNN) attains higher accuracy mapping with low human interruption. Deep learning enables the accommodation of complex mechanisms and non-linearity into the training model to promote better accuracy during the classification process and faster processing time over a large amount of data. This study aims to classify and assess the accuracy of forest cover over Borneo using deep learning classifiers and thus to predict the forest cover extent regarding the impact of deforestation variables. The deep learning functional model is developed from training samples from the reflectance data of Landsat-8 OLI/TIRS and Landsat 7 ETM+ acquired from 1999 to 2020. About 6,106 scenes with cloud cover less than 25% at 30-meter spatial resolution were analysed. The neural network is trained by digitally identified features of forest cover and deforestation variables using several band combinations. The record of deforestation variables is used to assess the accuracy of the forest cover map and generate the prediction model of the forest ecosystem provisional resources. As a result, this study presents the 10-year forest cover evolution and the predicted spatial extent for the next decade. It highlights the potential of deep learning on the long-term measurement of forest cover monitoring for efficient assessment towards sustainable forest management.

Keywords: Forest cover, satellite remote sensing, deep learning classification