Abstract

Measuring the carbon store in green spaces accurately is crucial for managing ecosystems and reducing the effects of climate change. In order to estimate carbon stock using high-resolution UAV (drone) images and satellite imagery from Google Earth Engine (GEE), this study presents a Convolutional Neural Network (CNN) technique improved with transfer learning. 8,762 GEE photos, 2,072 UAV images, and 10,834 mixed images from various Indonesian plot regions make up the collection. VGG19, ResNet50, MobileNet, and InceptionV3 were among the transfer learning models that were compared to a baseline CNN model. With a coefficient of determination (R^2) of 0.4011, MobileNet outperformed the baseline CNN by a wide margin for the drone dataset. VGG19 performed exceptionally well on the GEE dataset, with an R^2 of 0.7325 as opposed to the baseline CNN's R^2 of 0.6191. In the mixed dataset, VGG19 outperformed the baseline CNN with an R^2 of 0.7529, outperforming it by 0.6192. Even while all models had high Mean Absolute Error (MAE) and Root Mean Squared Error (RMSE) values, transfer learning models continuously improved prediction accuracy over the baseline. The integration of diverse data sources and advanced machine learning techniques demonstrates the potential for scalable and precise carbon stock estimation. Future work will expand the dataset and optimize model parameters to further improve robustness and accuracy.

Keywords— Carbon Stock Estimation, Convolutional Neural Networks, Transfer Learning, UAV Imagery, Google Earth Engine