

Abstract

Forests play a crucial role in mitigating climate change by acting as carbon sinks, yet traditional methods of carbon stock estimation, reliant on manual tree measurements, are costly, time-consuming, and geographically limited. Recent advancements in remote sensing technologies, such as the combination of Unmanned Aerial Vehicles (UAVs) and Google Earth Engine (GEE), offer a promising alternative by integrating high-resolution local observations with global-scale data. Using the power of Convolutional Neural Networks (CNNs), this study suggests an integrated method for classifying carbon stocks by fusing textural parameters like homogeneity and entropy with spectral indices like Green Chromatic Coordinates (GCC) and Excess Green Index (ExG). CNNs are used to capture the spectral richness and structural complexity of vegetation because of their propensity to extract hierarchical spatial characteristics. The research compares the performance of various feature combinations—color-based, texture-based, and mixed features—using a hybrid framework of UAV and GEE data. It is anticipated that the results will demonstrate how spectral and textural features work together to increase classification accuracy. In addition to tackling major issues in carbon stock estimation, this scalable and integrated framework is made to adapt to a variety of forest ecosystems and aid in the creation of conservation policies and the mitigation of climate change.