

Automated Tree Canopy Cover Mapping Using Google Earth Engine, Machine Learning, and High-Resolution Imagery

Accurate mapping of tree canopy cover is crucial for understanding and quantifying the various goods and ecosystem services that trees and forests provide to the society. Forests not only produce timber, pulp and wood chips, it sequesters carbon, maintains land use dynamics, and regulates ecosystem health. The canopy cover map could be useful for tracking environmental changes, conserving biodiversity, and supporting strategic planning. However, keeping these maps updated periodically requires time and resources. Various approaches that involve extensive manual efforts for measuring and labelling data, aligning datasets with different resolutions, and processing high resolution National Agriculture Imagery Program (NAIP) Imagery which makes the process inefficient while conducting large scale mapping. Therefore, this paper explores a novel approach to automatically generate tree canopy maps by leveraging Google Earth Engine (GEE) and freely available high-resolution (60cm) NAIP multispectral aerial imagery from USDA. This approach involves automated labelling for the training and testing data using National Land Cover Database (NLCD). The study integrates features derived from NAIP imagery such as, Normalized Difference Vegetation Index (NDVI) and texture metrics, and topographic data into a machine learning model, e.g., Random Forests model that allows accurate canopy detection. Our preliminary results conducted in the Davidson County; the Random Forests classifier achieved accuracy of 84%. Future validation with independent datasets will corroborate its accuracy and reliability. This study demonstrated the effectiveness of integrating high-resolution aerial imagery, cloud computing, and machine learning approaches for large-scale canopy cover mapping, providing valuable information for large scale environmental monitoring and strategic planning.