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AN EFFICIENTNET MODEL FOR CLASSIFYING HARDWOOD TREE CROWNS USING UAS-RGB IMAGERY

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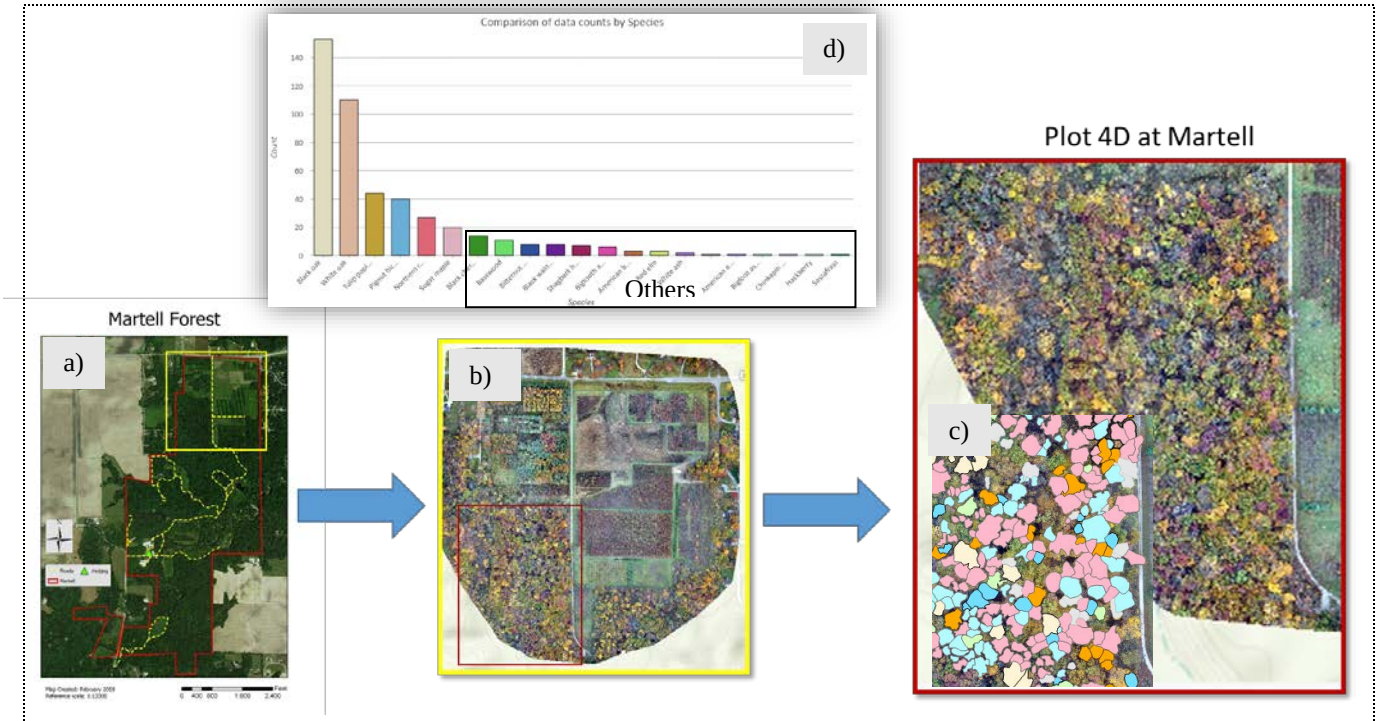

Figure 1. Study area description: a) Martell forest maintained by Purdue University; b) Segmented view of the study area in the northern region of Martell; c) Ground segmented tree crowns d) Species composition

Background: In forestry, tree species classification, detection and counting are necessary for forest management and strategy planning. Tree species classification of mixed hardwood forests is important for understanding species composition and diversity. Knowledge on species composition will provide information of dominant trees and give an insight on successional species. Currently, high spatial resolution imagery collected from Unmanned Aerial System (UAS) is commonly used in forestry applications for its cost-time-efficiency.

Introduction: Deep learning is a popular machine learning technique for image classification which has grown rapidly in the past few years. This is partly because of the development of Graphic Processing Units (GPUs) that process large amount of data efficiently. This type of supervised learning is becoming popular in remote sensing based forest studies. Our objective is to classify six different tree species (Tulip poplar, Black oak, White oak, Red oak, Sugar maple and Hickory [Shagbark, Bitternut and Pignut]) using a deep learning model (EffiecientNet-B0).

Methodology: We conducted multiple flights during fall 2020 and spring 2021 season over a hardwood forest in Martell, West Lafayette. Once the datasets were collected, we conducted field surveys to identify each tree species in the area. From the collected datasets, data from October 28 was used for classification as it displayed high spectral variation between the trees. After we collected ample ground truths in the area, EffiecientNet-B0 was trained to classify 6 tree species.

Results: Key preliminary outcomes that came from this study:

- Ground truth species collection indicates more occurrence of oak species compared to others.
- Although, study area comprises of ~1000 trees, the species distribution is not uniform.
- The model classified each tree species with a test accuracy of 78%.

FOR FURTHER READING:

- Liu, J., Wang, X., & Wang, T. (2019). Classification of tree species and stock volume estimation in ground forest images using Deep Learning. Computers and Electronics in Agriculture, 166, 105012.
- Natesan, S., Armenakis, C., & Vepakomma, U. (2019). RESNET-BASED TREE SPECIES CLASSIFICATION USING UAV IMAGES. International Archives of the Photogrammetry, Remote Sensing & Spatial Information Sciences.
- Hartling, S., Sagan, V., Sidike, P., Maimaitijiang, M., & Carron, J. (2019). Urban tree species classification using a WorldView-2/3 and LiDAR data fusion approach and deep learning. Sensors, 19(6), 1284.