Tree species detection model for agroforestry

Anonymous CVPR submission

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1. Introduction

Trees are a large carbon pool for our planet. They play a vital role in offseting anthropogenic carbon emissions and attenuating the effects of climate change. We can grow this pool through afforestation and deferred deforestation, oftentimes supported through carbon offset payments by sectors emitting carbon to the landowners growing these forests. [2, 1, 3]

One high-potential opportunity for afforestation is through the transition of pastureland operations to silvopasture operations. Silvopasture is simply the agricultural practice of combining tree cropping with livestock management.

In order for a payment system like this to work, we need a highly accurate estimate of the amount of carbon stored in trees. Fortunately, decades of research has been invested into tree growth projections and today, allometric equations are readily available for many tree species, which can accurately estimate above and below-ground tree biomass as a function of tree height, tree diameter, species, and local climate.

This research develops a novel dataset of tree photographs and trains a deep learning model to identify tree species from images in the silvopasture setting. These tools will be combined with a broader suite of tools being developed to accurately estimate tree carbon from phone-based measurements to enable carbon payments on agricultural operations transitioning to silvopasture. In the future, these phone-based measurements will be used to augment and improve the models developed in this paper.

1.1. Problem statement

In this paper I compile a novel dataset of high-fidelity tree photographs, taken in profile perspective. The dataset contains classified images of the 7 most common trees used in silvopasture in the southeastern US, where pilot projects for this silvopasture transition are underway. I then train a deep learning model to predict tree species from profile-vew tree photographs

	N
Harvard Arboretum Arbor Day Foundation Bing image search	
Total	

Table 1. Number of images scraped from each data source

	N
Black Locust Black Walnut Honey Locust Loblolly Pine Northern Red Oak Pecan Chinese Chestnut	
Total	

Table 2. Number of images scraped for each tree species

2. Dataset

This paper develops a novel dataset of high-fidelity tree photographs, taken in profile perspective. These photographs are compiled from images scraped from the internet and augmented with reflections and random croppings of each image. All images are center-cropped and scaled for use in a deep learning model. Lastly, the dataset is filtered, using a pretrained deep learning model, to only those images with high likelihood of being trees.

2.1. Image scraping

PLACEHOLDER

2.2. Dataset augmentation

PLACEHOLDER

2.3. Image cropping and scaling

PLACEHOLDER

	N (%) transformed	Mean % transformed
Cropping Upscaling Downscaling		

Table 3. Image cropping and scaling transformations

	Top-1	Top-5	F_2
KNN Logistic SVM FC Net			

Table 4. Preliminary performance results of baseline models

2.4. Image filtering with neural nets

PLACEHOLDER

3. Technical approach

PLACEHOLDER

4. Preliminary results

PLACEHOLDER

References

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[2] A. Alpher and J. P. N. Fotheringham-Smythe. Frobnication revisited. *Journal of Foo*, 13(1):234–778, 2003. 1

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