Title:
A High Performance Computing Approach to Tree Cover Delineation in 1-m NAIP Imagery using a Probabilistic Learning Framework

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(Poster) Abstract:
Tree cover delineation is a useful instrument in deriving Above Ground Biomass (AGB) density estimates from Very High Resolution (VHR) airborne imagery data. Numerous algorithms have been designed to address this problem, but most of them do not scale to these datasets, which are of the order of terabytes. In this paper, we present a semi-automated probabilistic framework for the segmentation and classification of 1-m National Agriculture Imagery Program (NAIP) for tree-cover delineation for the whole of Continental United States, using a High Performance Computing Architecture. Classification is performed using a multi-layer Feedforward Backpropagation Neural Network and segmentation is performed using a Statistical Region Merging algorithm. The results from the classification and segmentation algorithms are then consolidated into a structured prediction framework using a discriminative undirected probabilistic graphical model based on Conditional Random Field, which helps in capturing the higher order contextual dependencies between neighboring pixels. Once the final probability maps are generated, the framework is updated and re-trained by relabeling misclassified image patches. This leads to a significant improvement in the true positive rates and reduction in false positive rates. The tree cover maps were generated for the whole state of California, spanning a total of 11,095 NAIP tiles covering a total geographical area of 163,696 sq. miles. The framework produced true positive rates of around 88% for fragmented forests and 74% for urban tree cover areas, with false positive rates lower than 2% for both landscapes. Comparative studies with the National Land Cover Data (NLCD) algorithm and the LiDAR canopy height model (CHM) showed the effectiveness of our framework for generating accurate high-resolution tree-cover maps.

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