Project # 4: Classification
*CSC 391: Computer Vision*
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My original dataset contained 100 images of plots of agriculture and 100 images of non-agriculture areas, taken from drone and satellite images. I divided this dataset into 90 training images for agriculture and 90 training images for non-agriculture, and 10 validation images for agriculture and 10 validation images for non-agriculture. This allowed me to determine which classifiers were better than others. Below are all the validation images I used – I tried to have a variety of images in my validation set to account for the variability in the entire dataset.

Positive Agriculture Validation Set
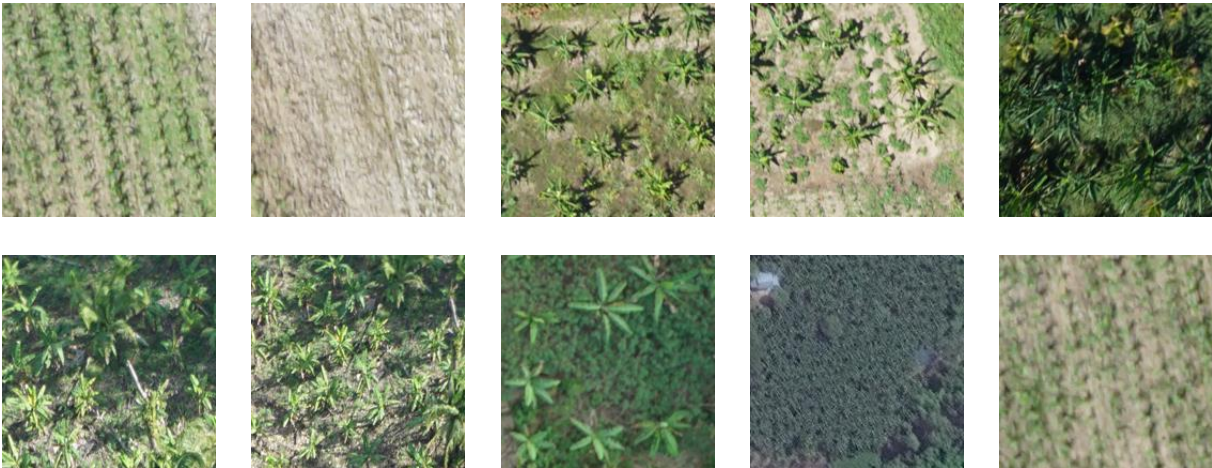
Negative Agriculture Validation Set
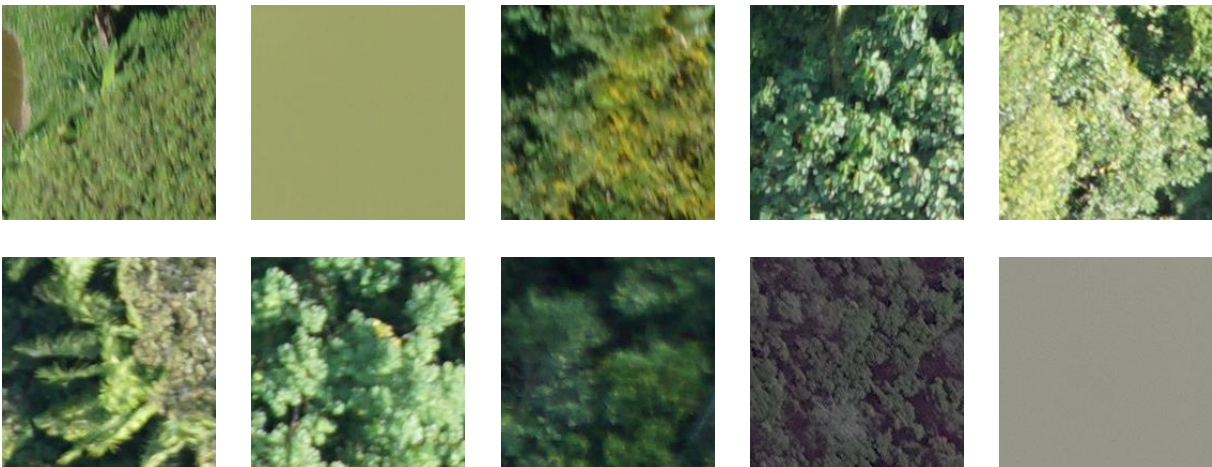
I used features derived from LBP and the Gabor filter for classification. The exact features I used were mean and standard deviation from each image after calculating the LBP, and mean and standard deviation from each image after applying the Gabor filter with theta=0 and frequency=0.10, theta=0 and frequency=0.40, theta=45 and frequency=0.10, and theta=45 and frequency=0.40. This resulted in 10 features calculated from each individual image.

I explored a variety of classifiers: a decision tree, random forest, K-nearest neighbors, linear SVM, radial basis function SVM, and poly SVM. I tried out these different classifiers since they are powerful and support multiple dimensions. Additionally, since I thought that the features visually seemed similar within classes, perhaps I would have success with K-nearest neighbors and SVMs due to classes' points being closer in space.

Below are the results from running the classifiers on the validation set. DT is decision tree, RF is random forest, KNN is K-nearest neighbors, L1 is a linear SVM implemented using SVC with kernel 'linear', L2 is a linear SVM implemented using LinearSVC, RBF is an RBF SVM, and POL is a poly SVM with 3 degrees. Green represents correct classifications and red represents incorrect classifications.

	1	2	3	4	5	6	7	8	9	10
DT	green	green	green	green	green	green	green	green	green	green
RF	green	green	green	green	green	green	green	green	green	green
KNN	green	green	red	green	red	red	green	red	red	green
L1	green	green	green	green	red	green	green	red	red	green
L2	green	green	green	green	red	red	green	red	red	green
RBF	green	green	green	green	red	green	green	red	red	green
POL	green	green	red	red	red	red	red	red	red	red

	1	2	3	4	5	6	7	8	9	10
DT	green	green	green	green	green	green	green	green	green	green
RF	green	green	green	green	green	green	green	green	green	green
KNN	green	red	green	green	red	green	green	green	green	red
L1	red	red	green	green	red	green	red	green	green	red
L2	red	red	green	green	red	green	red	green	green	red
RBF	red	red	green	green	red	green	red	green	green	red
POL	green	green	green	green	red	green	green	green	green	green

Both the decision tree and random forest performed the best with 100% accuracy on the validation set. The K-nearest neighbor and SVM classifiers all performed worse, with 55-60% accuracy. This suggests that these classifiers did not train but are guessing classes for each image. The poly SVM perhaps was the worst classifier, as it classified all but 3 images as non-agriculture.

I think this may be due to overfitting, the relatively small size of my training set, or because the proximity of points were not as close and discernable as I originally thought. With decision trees and random forest, we instead rely on decisions based on each individual feature. A single decision tree appears as accurate as a random forest, but perhaps with a larger dataset we may get different results.