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CSCI E-89 Deep Learning, Spring 2018

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# Topic: Identify Tree Species from Leaf Image

## Problem Statement

For broad-leaf trees, it is often possible for an expert to identify the species of tree by merely observing a leaf. However, it is difficult for non-experts to do so. Many computer systems use image processing to identify properties of the leaves, like branching patterns, points and shape, and then traverse a decision tree, but this method is unreliable. I wanted to investigate if a deep neural network could identify the species of a tree by only looking at an image of a leaf.

## Overview of Technology

I used Keras with Tensorflow to test various models, including MobileNet and a simpler convolutional network. The model was run on Amazon AWS p2.xlarge instances.

## Overview of Steps

Define problem statement

Obtain data

Exploratory analysis

Preprocess data

Create various models

Evaluate results and choose best model

## Dataset

Leafsnap is a collaboration by researchers from Columbia University, the University of Maryland, and the Smithsonian Institution. They provide an App that identifies trees from an image of a leaf by identifying features and then traversing a decision tree. In addition, they provide 976 MB of leaf images <http://leafsnap.com/static/dataset/leafsnap-dataset.tar>. I used a subset covering 159 Northeastern broadleaf trees.

## Lessons Learned

MobileNet performed surprising well in identifying a leaf with a test accuracy of 0.90. The correct tree was identified in the top 3 predictions with an accuracy of 0.99. These results surpassed other attempts I review in the literature, but more research is required. Also, a proper field test should be employed, as well as increasing the training and testing size.

## Youtube Videos

Two minute (short): <https://youtu.be/S6jOuE9KHlg>

15 minutes (long): <https://youtu.be/TKbMa8bZzLQ>