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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