

Introduction

A predictive model was created to classify images of common irritant plants as well as of plants which are often confused with them on the basis of appearance. The model was deployed to an Android phone and tested live in the field with the phone acting as an edge device.

Problem Statement

The plants poison ivy, poison oak and poison sumac contain the resin urushiol which causes an allergic skin rash. There are also several common plants that appear to be very similar to the irritant plants: boxelder, hog peanut, fragrant sumac, wild raspberry, wild strawberry and Virginia creeper. Labelled classes of images were created for each of these nine as well as a default “none of the above” class for all other plants that may be seen along with them. The first task was to train a model to distinguish the irritant plants from each other and from their lookalikes. The next task was to deploy that model to an Android phone for use in real time to classify plants.

This task is much more challenging than simple flower classification for several reasons:

- Unlike flowers, which tend to look very different from each other, these classes are *by design* all similar to each other. This makes classification much more difficult.
- This classification is based mainly on foliage. Flowers and fruit are not much use because they are not typically seen with these types of plants. Unlike flowers, foliage exhibits much less variability particularly with regard to color. The leaves of all of these plants are usually green and then change to the same shades of yellow, orange, red and brown in the autumn.
- These types of plants can change in appearance modestly as they age, complicating the task.

Data Set

There were no pre-existing aggregate sets of images of these plants. The data set was constructed through manual retrieval and labelling from searches using the two most popular search engines (Bing

and Google) as well as from the iNaturalist site (<https://www.inaturalist.org/>). The data set was augmented by manually photographing approximately 1500 images of some of these types of plants.

Methods and Results

Google AutoML Vision was used to train the 10-category classification as a TensorFlow Edge model. During the evaluation, the 10-category model achieved accuracy of 87.81% and an F1 score of 87.84%, whereas through random chance the accuracy would have been 10%.

The model was then deployed to the Android phone by leveraging the code for the existing Android app TFL Classify (https://www.tensorflow.org/lite/models/image_classification/overview). This code was changed slightly in the Android Studio IDE to use – instead of the model that comes with TFL Classify – the 10-category model that had been trained and exported from AutoML Vision. This code (including the changes made to use the 10-category model) is available in this repository (<https://github.com/sylvite/Android2>).

By running that code in Android Studio, an app containing the trained model was deployed to a Samsung Galaxy S10e phone. That phone was used in the field to make real time predictions of plant identification. Actual screenshots of the phone and the deployed model in action are shown below:

