paY inekereG

> İlke Çuğu
> Eren Şener
> Burak Balcı
> Çağrı Erciyes
> Emre Akın
Introduction

• Definition
  ✓ A mobile application, which can perform leaf-based tree identification using one picture of a given leaf.

• Purpose
  ✓ Providing an application which has a good performance and localization support for identifying tree species native to Turkey.
THE BIG PICTURE

Take Photo or Choose from Gallery

Send Result to User’s Phone

Identify the Species

Send to Main Server

Process the Image
User Interface

- Android Application
  - Compatible with Android ≥ 2.3 devices
  - Available at Google Play
Image Processing

• Background Elimination
  ➢ OpenCV [1]
    ✓ Applying K-means Clustering Algorithm
Image Processing

• Stem Removal
  ➢ OpenCV [1]
    ✓ Applying Morphological Operations
Image Processing

• Resolution Modification
  ✓ Resizing image to 256x256 while preserving aspect-ratio.
Identification Process

1. Feeding Image to Caffe
2. Prediction Vector from Fine-tune Layer
3. Caffe’s Predictions
4. Feature Vector from fc6 Layer
5. SVM’s Prediction
6. Merged Results
7. Top 5 Predictions from Merged Results
Identification Process

• Deep Learning

➢ Caffe Framework [2]
  ✓ Dataset consists of 4000+ training & 700+ test images for 57 tree classes gathered by photoshooting, Flavia [3] and Pl@ntNet [4]
  ✓ Caffe is fine-tuned with 16000+ training & 2800+ test images (original images * 4 rotation(90 degrees))
  ✓ Model is built after 50000 iterations
  ✓ Accuracy is 91.7%

Special thanks to our team leader İtir Önal
Identification Process

• Support Vector Machine
  ➢ Linear SVM
    ✓ Uses fc6 layer of fine-tuned Caffe
    ✓ Accuracy is 93.54%
    ✓ Experimental: Merging fc6 & image processing feature vectors
      ❖ fc6 layer -> 1x4096 feature vector obtained from image itself.
      ❖ Image processing  -> 1x56 feature vector obtained from shape & texture descriptors.
    ❖ Pros: Accuracy 93.75% -> 93.85% for 50 classes (slightly improved)
    ❖ Cons: Runtime increases
Server

- Implemented from scratch with Python.
  - Refreshes thread pool after every 100 users.
  - 13 identification units (caffe.Nets & SVM classifiers) are running concurrently.

- Currently deployed at Google Compute Engine.
  - 2 vCPUs, 7.5 GB memory
  - 20 GB SSD
References