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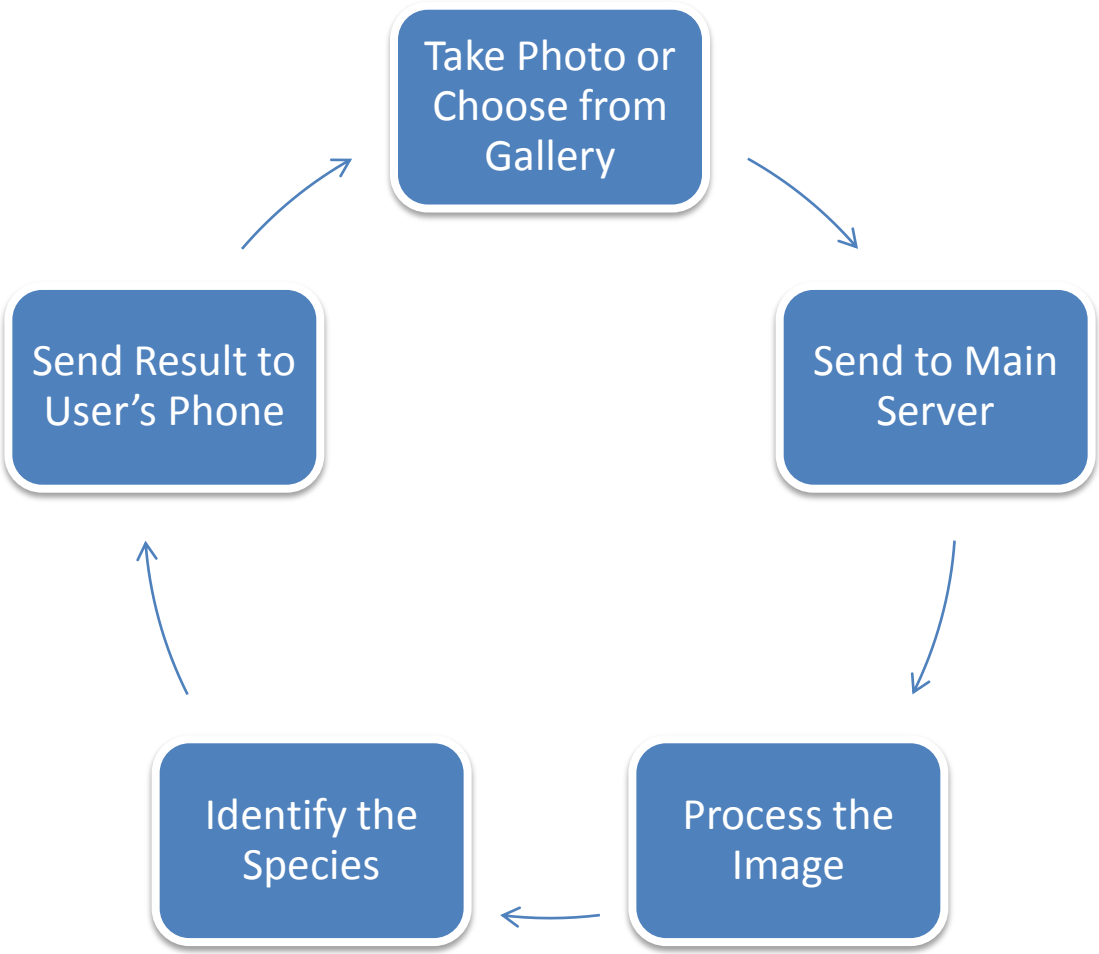
Introduction

- 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.

Treelogy

THE BIG PICTURE



User Interface

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

Image Processing

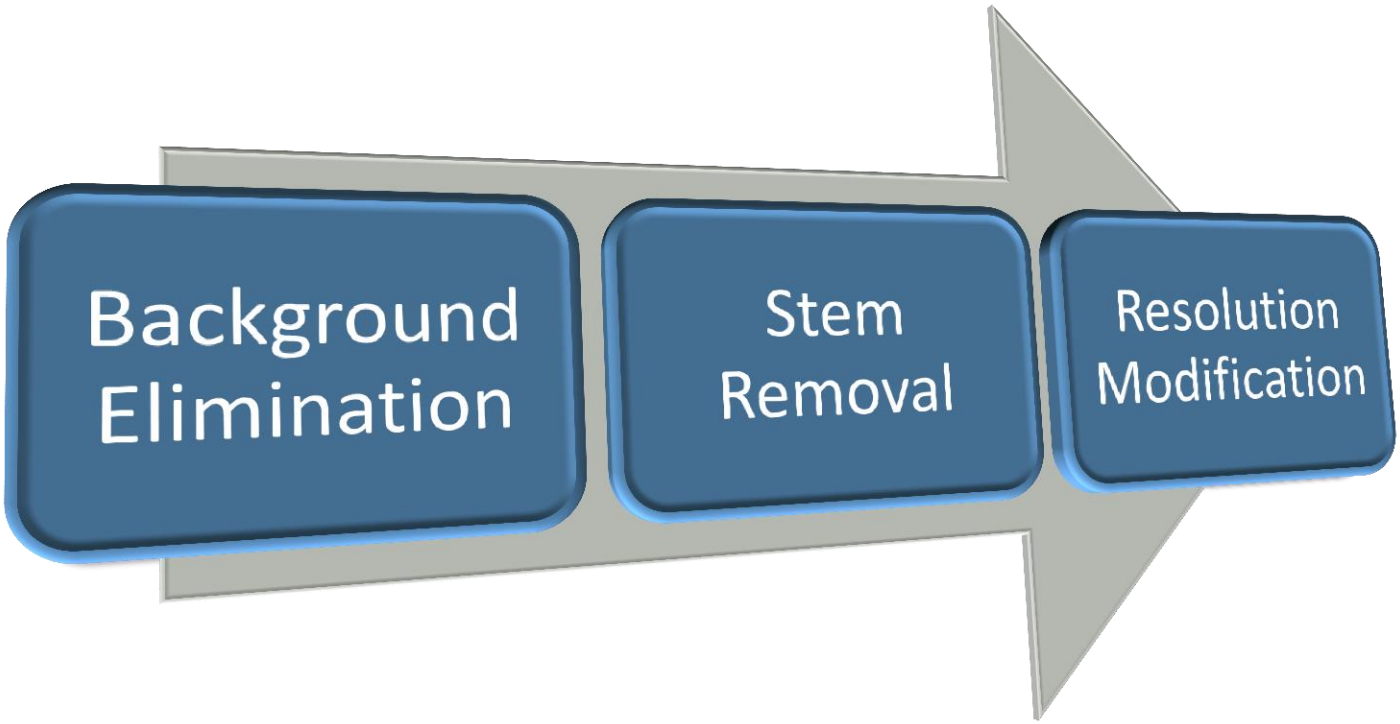


Image Processing

- Background Elimination
  - OpenCV [1]
    - ✓ Applying K-means Clustering Algorithm

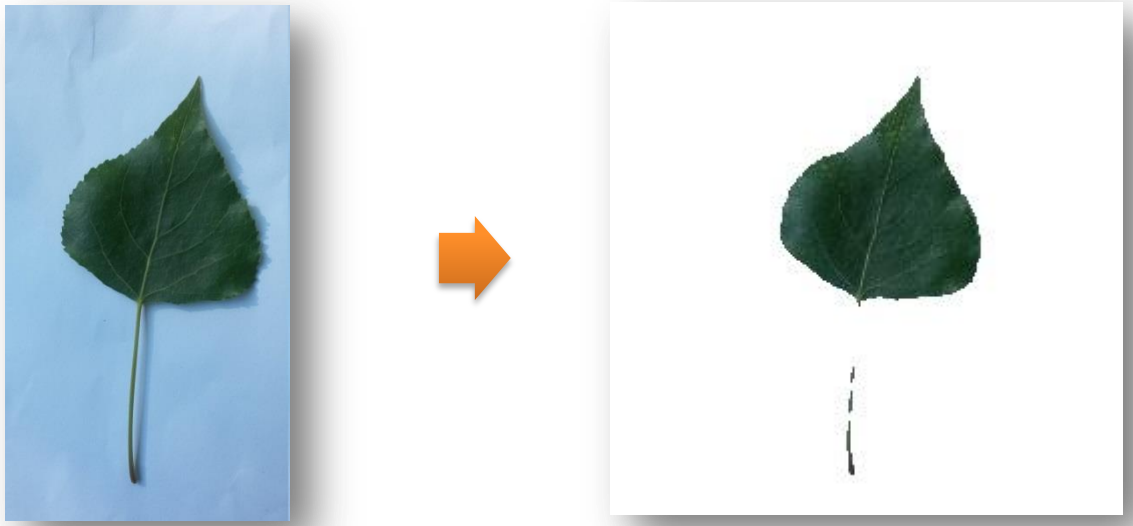


Image Processing

- Stem Removal
  - OpenCV [1]
    - ✓ Applying Morphological Operations

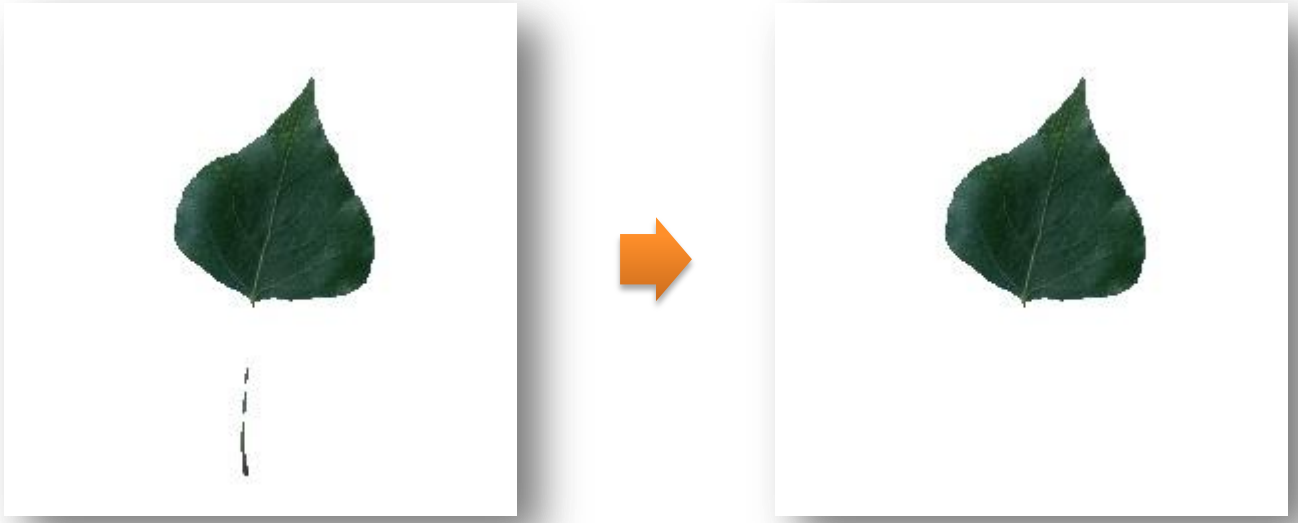
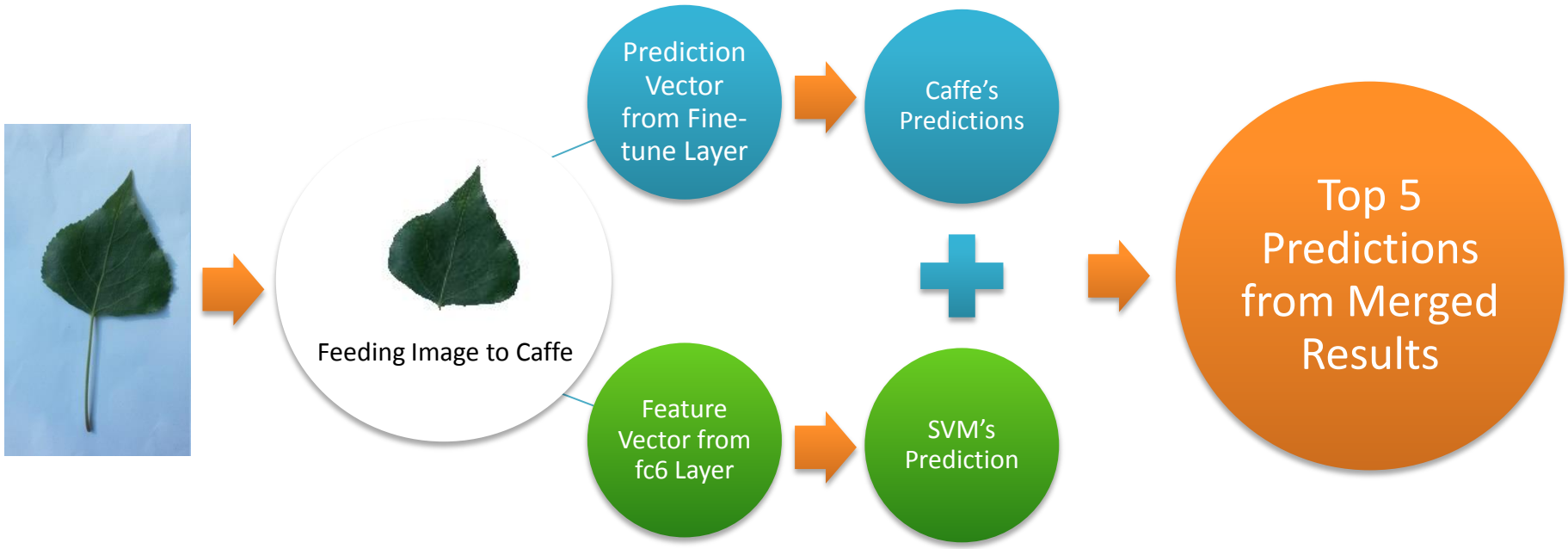


Image Processing

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

Identification Process



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 Itır 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

- [1] http://opencv.org/
- [2] http://caffe.berkeleyvision.org/
- [3] http://flavia.sourceforge.net/
- [4] http://m.plantnet-project.org/