

# Plant Leaf Classification for a Mobile Field Guide

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## Proposal

The rapid advancement of smartphone technology has given rise to highly-portable and computationally-powerful platforms. These platforms are capable of advanced image processing and computer vision techniques that can provide users with a greater understanding of their surroundings. The current method of identifying plants and animals in their natural habitat involves using field guide books that have an innate reference capacity limit imposed by the size and weight constraints of hiking. Naturally, nature field guides could be greatly enhanced with the processing power and storage capacity of modern smartphones.

We propose the development of an "automated field guide" mobile application for the Android platform that can identify different kinds of plants based on photos taken of leaf samples. Using a smartphone as a field guide carries size, weight, and ease-of-use advantages over traditional hard-copy field guides. Handsets today have enough storage capacity to hold plant species databases of vast sizes on flash memory without adding size or weight to the device. Additionally, analyzing pictures of leaves taken with a smartphone's built-in camera can allow the application to take over the process of identifying the plant species from the user.

Prior academic work on identifying a plant's species from a leaf picture has focused on modeling leaf shape using polygons [1] and transforming leaf shape into a one-dimensional signal parameterized by the distance from the leaf centroid to the edge given an angle from a standardized starting orientation [2] [3]. Additional practical applications outside of the mobile realm, automated visual identification of plant species is of particular interest to the agriculture industry for the purpose of robotically and discriminately spraying invasive weeds in crops [4].

High-level objectives of the project include having an initial matching database size of five distinct plant species from the greater San Francisco bay area and being able to calculate match likelihood between a given picture of a leaf and each species in the database. Leaf pictures used for matching will be restricted to leaves on solid backgrounds with a consistent alignment. The project will be broken down into smaller tasks in order to meet these objectives. In particular, a comparison metric of discerning leaf features will be devised; methods for matching leaves to their species will be implemented according to the developed metric; a cleanup filtering stage for camera images might be needed before further processing; and a basic user interface designed for touch input will be designed.

## References

- [1] C. Im, H. Nishida, T.L. Kunii, "Recognizing plant species by leaf shapes-a case study of the Acer family," *Proceedings Fourteenth International Conference on Pattern Recognition*, Vol. 2, pp. 1171-1173, 16-20 Aug. 1998.
- [2] J.-X. Du, X.-F. Wang, G.-J. Zhang, "Leaf shape based plant species recognition," *Applied Mathematics and Computation*, Vol. 185, No. 2, 15 Feb. 2007.
- [3] Z. Wang, Z. Chi, D. Feng, "Shape based leaf image retrieval," *IEE Proc. Visual Image Signal Process.*, Vol. 150, No. 1, Feb. 2003.
- [4] J. Hemming, T. Rath, "Computer Vision based Weed Identification under Field Conditions using Controlled Lighting," *Journal of Agricultural Engineering Research*, Vol. 78, No. 3, pp. 233, 2001.

## Hardware Request

One Motorola DROID handset will be required for this project (already received).