Developing a semi-automatic system for photographic species identification

Rob Barnsley

October 1, 2011

Abstract

This report details the progress made in developing a system for use in object recognition.

The project was undertaken for the EOL during the 2011 Google Summer of Code.

Chapter 1

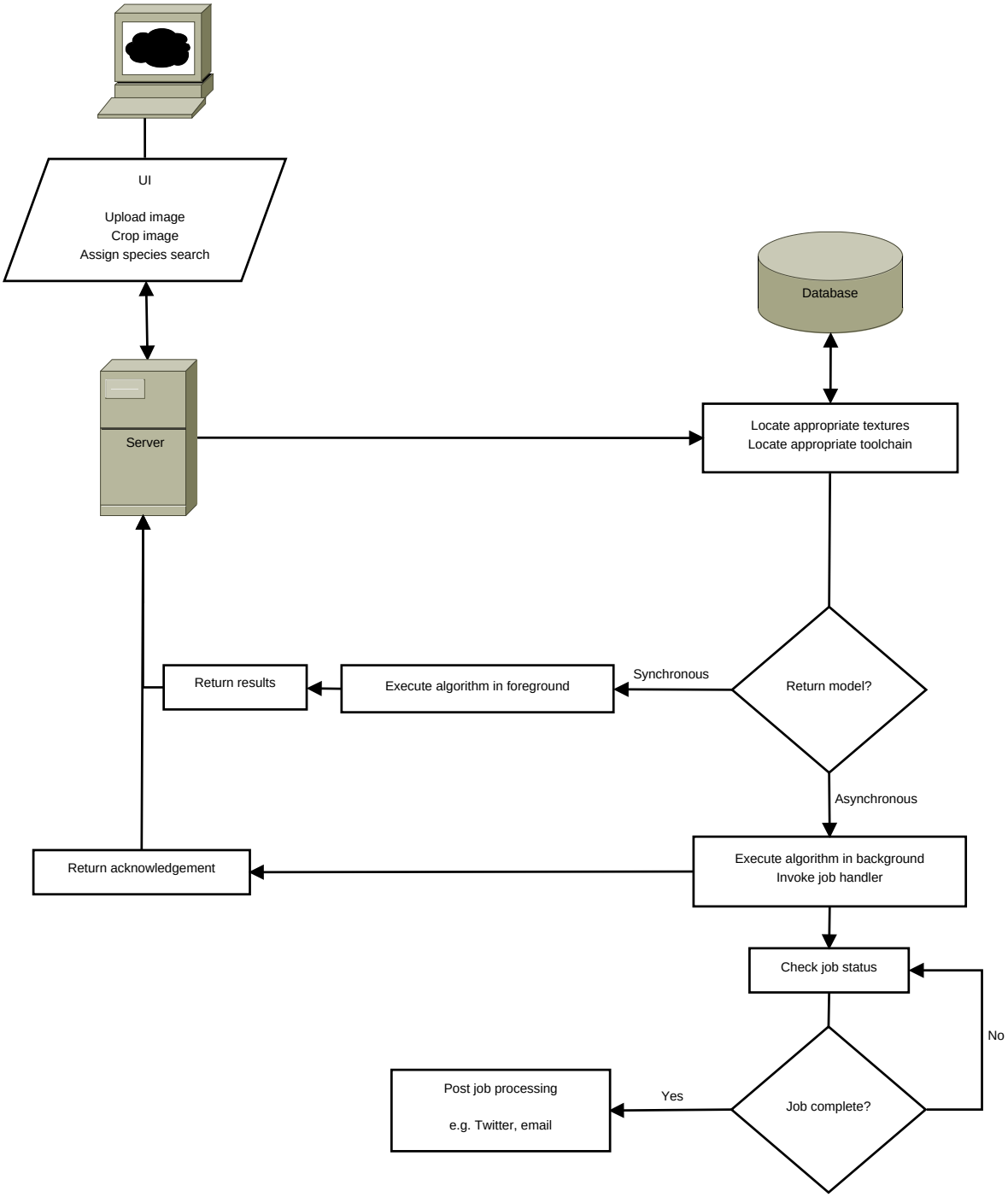
Introduction

There exist already many different algorithms for object recognition. Examples include SIFT (Lowe, 1999) and HOG (Dalal and Triggs, 2005), which are both histogram based feature detectors. To produce a unique set of features these algorithms often work in a high dimensional space, producing sets of vectors known as keypoints. Unfortunately, this high dimensionality comes at a price, in that they are typically computationally expensive. Hybrids of these algorithms have appeared in an attempt to address the long processing times e.g. SURF (Bay et al., 2008), but in doing so often sacrifice the uniqueness of their descriptors.

A simpler form of object recognition can be achieved by using colour histograms. Colour histograms are used to show the distribution of light in a given colour space. HSV (Hue, Saturation and Value) is a common colour space used in computer vision, as the channels are less correlated with each other than a colour space such as RGB (Red, Green and Blue). In conjunction with a comparison metric, colour histograms can be powerful and computationally inexpensive tools. Unfortunately, the use of colour histograms is limited by two factors:

- **They are not indiscriminate**. Two images pertaining to different objects can possess identical colour distributions.
- **They are not invariant**. Two images taken under different conditions (e.g. lighting) may possess different colour distributions.

A system that utilises colour histograms must take these factors into account.


UI
Upload image
Crop image
Assign species search
Database
Server
Locate appropriate textures
Locate appropriate toolchain
Return model?
Synchronous
Execute algorithm in foreground
Return results
Asynchronous
Execute algorithm in background
Invoke job handler
Return acknowledgement
Check job status
Job complete?
No
Yes
Post job processing
e.g. Twitter, email

Bibliography

Herbert Bay, Andreas Ess, Tinne Tuytelaars, and Luc Van Gool. Speeded-up robust features (surf). *Comput. Vis. Image Underst.*, 110:346–359, June 2008. ISSN 1077-3142. doi: 10.1016/j.cviu.2007.09.014. URL `http://portal.acm.org/citation.cfm?id=1370312.1370556`.

Navneet Dalal and Bill Triggs. Histograms of oriented gradients for human detection. In *Proceedings of the 2005 IEEE Computer Society Conference on Computer Vision and Pattern Recognition (CVPR'05) - Volume 1 - Volume 01*, CVPR '05, pages 886–893, Washington, DC, USA, 2005. IEEE Computer Society. ISBN 0-7695-2372-2. doi: http://dx.doi.org/10.1109/CVPR.2005.177. URL `http://dx.doi.org/10.1109/CVPR.2005.177`.

David G. Lowe. Object recognition from local scale-invariant features. In *Proceedings of the International Conference on Computer Vision-Volume 2 - Volume 2*, ICCV '99, pages 1150–, Washington, DC, USA, 1999. IEEE Computer Society. ISBN 0-7695-0164-8. URL `http://portal.acm.org/citation.cfm?id=850924.851523`.