An Open Platform for an Image Retrieval System

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1 Introduction

The problem of image retrieval is an important issue in many application domains. An obvious application of such a system could be with a database of artistic paintings. The user has in his mind an outlook of a painting but he cannot recall where the painting is exhibited. The conventional image retrieval is achieved by using associated keywords, whereas the modern image retrieval uses sophisticated methods based directly on the features of the image. E.g. a certain painting can be retrieved by drawing a sketch of it or by giving its color distribution.

In an image retrieval system several components are needed: A *segmentation* component is needed for extracting the interesting parts of an image. These segmented objects can be stored in an *index structure*, which is used to avoid the linear behavior of the searching process. To create or edit a *query image* an *image editor* is a useful part of such a system. For the database usage a *database engine* is needed. Then, of course, *matching algorithms* and the corresponding *similarity measures* are needed.

There are some commercial image retrieval systems, such as **Virage** [1] and **QBIC** [2], which offer many options for the query. A system called $\mathbf{I^2C}$ [4] has been developed for medical image indexing, storage and retrieval. In I^2C, the user can embed new description types, segmentation algorithms and image processing algorithms.

We introduce an on-going project, whose aim is to develop a portable system to support the work of researchers working in the area of image retrieval. The system is called **Picsearch** [1]. By using this system researchers can concentrate on developing and testing new algorithms without the need to create a whole image retrieval system from scratch.

2 Overview of Picsearch

Picsearch is a platform designed for content-based image retrieval providing a straightforward way to add new algorithms and an easy-to-use graphical user interface. The primary target is to provide a system whose components can be easily extended. The modular architecture was designed keeping this goal in mind. The basic method for queries is based on algorithms that can support the idea of *signatures*. A signature is a predefined presentation computed out of an image and it is to be used in comparison to determine the similarity of two images. Thus, in this scheme the algorithms must be able to supply a relatively small description of each image and determine similarity by using only these descriptions.

Picsearch is programmed mostly in C++ and follows the principles of object-orientation. In the first place, only some algorithms are going to be incorporated: searching by identifier,

[1] The system is going to be freely available at http://www.cs.Helsinki.fi/~klemstro/picsearch.html.

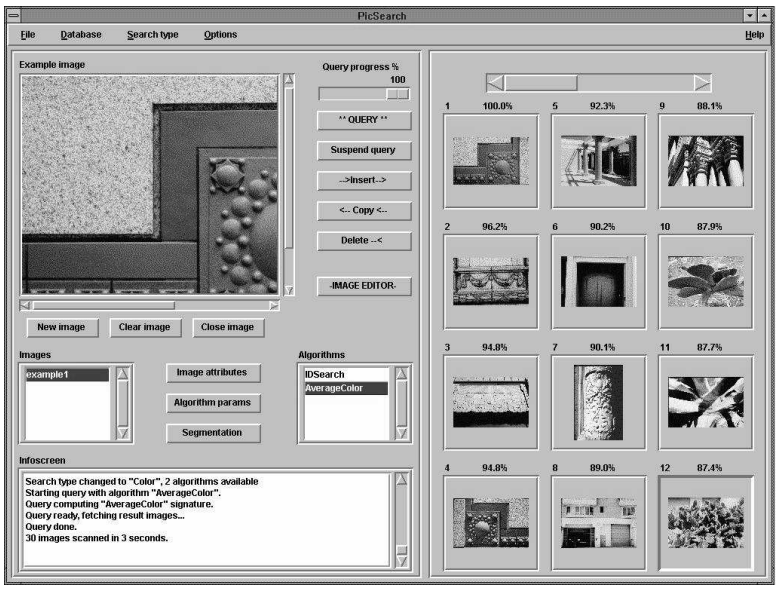

Figure 1: *The user interface of Picsearch.*

by name, by average color and by Wavelet-based matching [3]. Though the system is primarily coded by using C++, the graphical user interface (see Figure 1) was constructed with script language Tcl/Tk. By using these tools and restricting operating system dependent code into as small areas as possible, Picsearch should be a well-portable system.

The system is divided into five independent subsystems. First, there is a general class library, which implements all the basic classes used throughout the system. The second subsystem implements the basic functionality of Picsearch. All the interface issues are wrapped inside the third module; the main program completely ignores the visual aspects of the system. The implementation of permanent storage is wrapped into the fourth module. This subsystem provides an interface for the main module to write and read images, signatures, segments, etc. So far, no "real" database is used, but this subsystem includes a straightforward database implementation. The integration of a more sophisticated database engine should be easily done. Finally, there is a module consisting of the algorithm and the image handling functionality.

The algorithm module gives an easy way to embed new algorithms. New algorithms can be added by: (1) deriving a new C++ class from a common base class, (2) redefining a couple of functions and (3) recompiling the system. The Tcl/Tk scripts should be extended if the algorithm has some parameters that affect to the matching function. The extension of Tcl/Tk scripts requires no recompilation of the system. A programmer who is familiar with the programming environment should be able to embed algorithms without excessive difficulty.

References

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