

Intelligent Image Archival and Retrieval System

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INTRODUCTION

‘A visual idea is more powerful than verbal idea’, ‘A picture is worth more than ten thousand words’, ‘No words can convey what a picture speaks’, ‘A picture has to be seen and searched as a picture only’ are few of the well-known sayings that imply the certainty for the widespread availability of images. Common sense evidence suggests that images are required for a variety of reasons, like, illustration of text articles, conveying information or emotions that are difficult to describe in words, display of detailed data for analysis (medical images), formal recording of design data for later use (architectural plans) etc.

The advent of digital photography combined with decreasing storage and processing cost, allows more and more people to have their personal collection of photographs and other visual content available on the internet. Organising these digital images into a small number of categories and providing effective indexing is imperative for accessing, browsing and retrieving useful data in “real time”. The process of digitization does not in itself make image collections easier to manage. Some form of indexing (cataloguing) is still necessary. People’s interest to have their own digital libraries has burgeoned and hence requires a data structure to preserve the images for a long time and also provide easy access to the desired images. These requirements have indeed forced the design of specialized imaging systems/ image databases, such that an access to any image is effective and efficient.

An efficient image archival and retrieval system is characterized by its ability to retrieve relevant images based on their visual and semantic contents rather than using simple attributes or keywords assigned to them. Thus, it is necessary to support queries based on image semantics rather than mere-pixel-to-pixel matching. An image archival and retrieval system should therefore

allow adequate abstraction mechanisms for capturing higher level semantics of images in order to support content addressability as far as possible. That is, for two images to be similar, not only the shape, color and texture properties of individual image regions must be similar, but also they must have the same arrangement (i.e., spatial relationships) in both the images. In fact, this is the strategy, which is generally being employed by our vision system most of the times. An effective method of representing images depends on the perception of knowledge embedded in images in terms of objects/components (generally known as elements) present in them along with their topological relationships. The perception of topological relationships, especially spatial relationships existing among the significant elements of an image, helps in making the image database system more intelligent, fast and flexible.

An obvious method to search an image database is sequential scanning. The query is matched with all stored images (i.e., the representation of the query is matched with all representations stored in the image database) one by one. Retrievals may become extremely slow, especially when database search involves time consuming image matching operations. To deal with slow retrieval response times, and high complexity matching, an image database must utilize indexing methods that are faster than sequential scanning methods. In traditional image database systems, the use of indexing to allow database accessing has been well established. Analogously, image indexing techniques have been studied during the last decade to support representation of pictorial information in an image database and also to retrieve information from an image database. The use of significant elements present in images along with their topological relationships as indexes is the basic issue of the indexing methodologies developed to this aim.

BACKGROUND

An image archival and retrieval system is a system in which a large amount of picture data and their related information are stored, retrieved and manipulated. It is indeed necessary to design an image database system that represents images more efficiently. In addition, making the system capable of responding to specified queries to retrieve desired images from the database besides devising robust search techniques to make retrieval process fast and flexible is interesting and more challenging.

Image Archival and Retrieval System: An Architecture

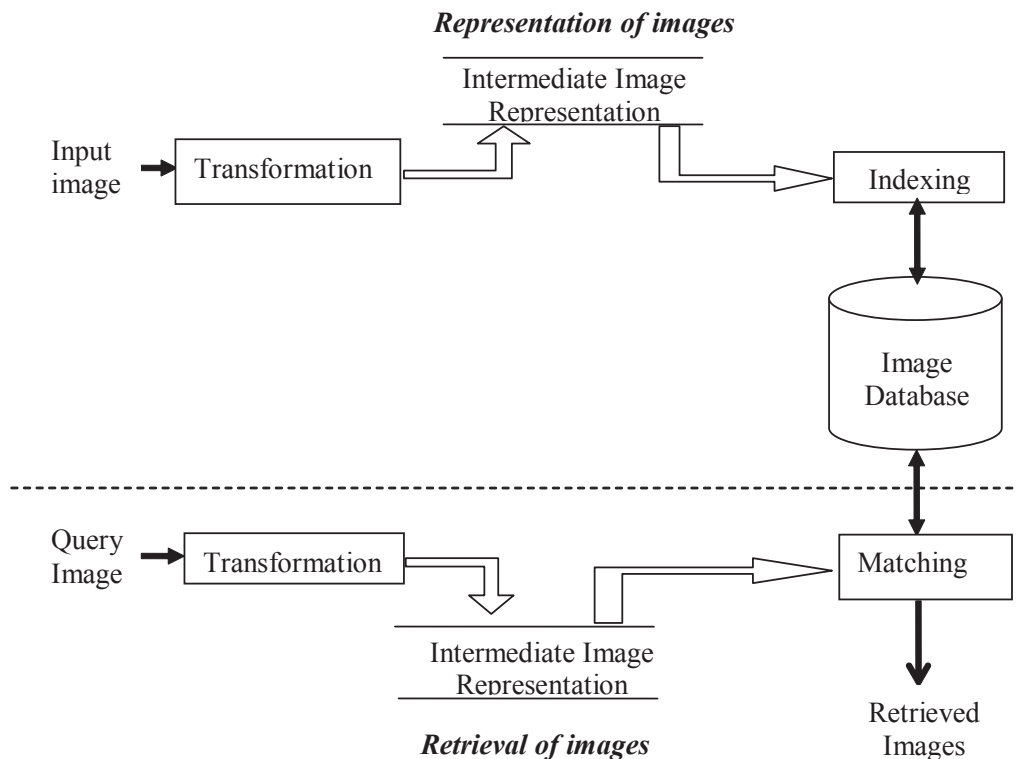
Crucially, the design of an image database system is a two stage problem. The first stage deals with the representation of images in the image database while the

second stage focuses on retrieving images relevant to a given query image as shown in Fig.1 The first stage concentrates on transforming images to intermediate representations through localization and identification of significant elements present in the images and then the mechanism of indexing the intermediate images in the image database. In the second stage, a given query image is subjected to the same transformation process to obtain its intermediate representation which shall subsequently be used in matching.

Image Transformation

Processing of images representing information only at pixel level to have interactive response to high-level user queries is not economically viable if not technologically impossible in a database environment where the number of images tends to be large. Therefore, given an image representing information at pixel level

Figure 1. General architecture of a typical image archival and retrieval system



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