



CONTENT-BASED DIRECT ACCESS METHODS FOR FACE RECOGNITION BIOMETRIC SYSTEM: STATE OF THE ART

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ABSTRACT

As a biometric component, the human face has a unique information and characteristics that are invariant, so this allows the system to do a face search by utilizing the original information that is attached to the face that is unique internal characteristics of the extraction face, no longer use alphanumeric keyword to search-based face. In the conventional method, the process of searching is dominated by the use of external attributes as keywords and as a basis for classification. The use of visual attributes as a keyword is the latest method in this field. In this research a short explanation about various face recognition methods and application are given. A state of the art of content-based direct access methods for face detection is also explored. A future work on these research areas are given as a guide for other researcher to make an advanced research in the future.

Keywords: biometric, direct access methods, feature extraction, non alphanumeric.

INTRODUCTION

Application of World Wide Web and the internet is increasing rapidly, and with it the amount of digital image data accessible to the users. Several Image databases are added every minute and so is the need for effective and efficient image retrieval systems. There are many features of content-based image retrieval but four (Moghadam, 2005) of them are considered to be the main features. The features are colour, texture, shape, and spatial properties. The main features to investigate are colour, texture and shape because spatial properties are implicitly taken into account.

With the Internet growth and the availability of devices for image capturing such as digital cameras and image scanners, so digital image collection size is increasing quickly. Efficient image searching, browsing and retrieval tools are needed by users from various works. It includes remote sensing, fashion, crime prevention, publishing, biomedical engineering, architecture, etc. For this purpose, several general purpose image retrieval systems have been developed. There are two frameworks for image retrieval systems: text-based and content-based (Liu, 2007).

Content-based image retrieval (CBIR), as it growth today, is any technology that in principle helps to organize digital picture archives by their visual content. Based on the definition, anything ranging from an image similarity function to a robust image annotation engine falls under the purview of CBIR. This characterization of CBIR as a field of study places it at a unique juncture within the scientific society. While we witness continued effort in solving the fundamental open problem of robust image understanding, we also see community from different fields, such as, computer vision, image and signal processing, data mining, information retrieval, interaction between human and computer, database systems, theory of information, probability theory, statistics, and psychology

contributing and becoming part of the CBIR society (Wang *et al.* 2006). Moreover, a lateral bridging of gaps between some of these research communities is being gradually brought about as a by-product of such contributions, the effect of which can potentially go out of CBIR scope. Therefore, what we see nowadays as a few cross-field publications may very well spring into new fields of study in the foreseeable future (Datta, 2008).

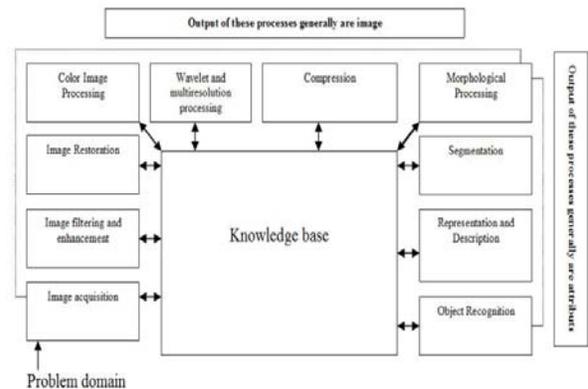


Figure-1. The steps of digital image processing (image recognition) (Gonzales, 2010).

Identifying face basically belong to the digital image processing. Figure-1 shows the steps of generic digital image processing (Gonzales, 2010). In this study, the output of original information in the form of internal attributes contained in an image (template).

All steps of digital image processing in Figure-1 are part of Pre-Processing and also part of Feature Extraction which is a sub part of biometric diagram as described in Figure-2.

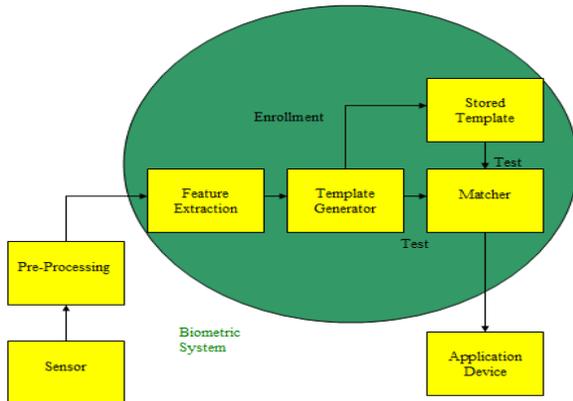


Figure-2. Biometric system diagram.

Part circled in Figure-2 is a special part of biometric systems. That is a major part of this research starting from the extraction of features. In this study, feature extraction becomes very important, because the feature extraction will start the next process that will involve many steps. The output of the feature extraction process will result in a face template containing specific characteristics and original face which is then used as a reference to facilitate direct access to the non-alphanumeric database.

CONTENT-BASED DIRECT ACCESS METHODS

Introduction of content-based direct access methods

Direct access to content-based method is defined as a method of accessing to an object by utilizing the characteristics of the original object without going through the process of adding tags or attributes.

So far research on content-based direct access based on the method of CBIR (Content Base Image Retrieval). Regularly, the search process is based on the classification of the external attributes, while content-based access method for the classification process is based on the original information that is contained in the attached template extracted face (after the extraction is done).

Datta (Datta, 2008) has conducted research based on the development of CBIR method, but that the subject of the study the researchers have not focused, because almost all forms of data such as text, information, audio, video, and also image classification in all humans, animals, plants, buildings publicly accessible and so far no specific conduct research in the form of biometric face recognition.

Several earlier studies form the basis for strengthening the basis of this study describes methods used in the study face identification based on categories created by (Yang, 2003) as described in Table-1.

Table-1. Various face recognition methods and representative works (Yang, 2003).

Methods	Representative works
Knowledge base	Multi resolution rule-bases method
Feature Invariant .Facial Features .Texture .skin color .Multiple feature	Grouping of edges Space Grey-level Dependence of face Mixture of Gaussian Integration of skin, color, size and shape
Template matching .Predefine face template .Deformable template	Shape template Active Shape Model (ASM)
Appearance-based Method .Eigen face .Distribution based .Neural Network .Support Vector Machine (SVM) .Naive Bayes Classifier .Hidden Markov Model (HMM) .Information-Theoretical Approach	Eigenvector decomposition and clustering Gaussian distribution Ensemble of neural network SVM with polynomial kernel Join statistics of local appearance Higher order statistic Kullback relative information

Content-based direct access methods for face recognition

Direct access to content-based method is defined as a method of accessing to an object by using the original characteristics of the object without going through the process of adding tags or attributes. The object of this research is the image of the face (digital images of human faces).

Direct access method using feature extraction, as an initial step to determine the template that is used as a keyword in the search process and the extracted template is used to design the data structure. Figure-3 is a depiction of the feature extraction process, starting from the face image is reduced to elements that have important information (still to be unique) and serves as a keyword. The template is then stored in the stored templates (feature database) that has a non-alphanumeric specific data structures. The new design of the featured database is one of the goals of this research.

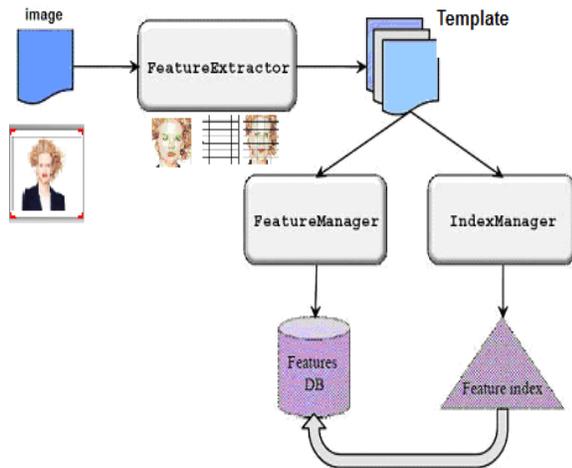


Figure-3. The process of feature extraction and storage in database.

Furthermore, the retrieval process of the direct access methods, keyword extraction results in the form of non-alphanumeric will be processed into the query processor for performing direct matching process (1: n) with data stored in the database (database feature) to produce a face image matching as illustrated in Figure-4.

In content-based method of direct access, the face image is the main data and the first to be accessed directly (extracted), further processing of the extracted facial templates will also be accessed directly (used to design the data structure), then the resulting data structure is used as the basis for image search process (searching). The data structure facilitates the searching methods with direct access methods, to produce optimal performance in accordance with the purpose of this research.

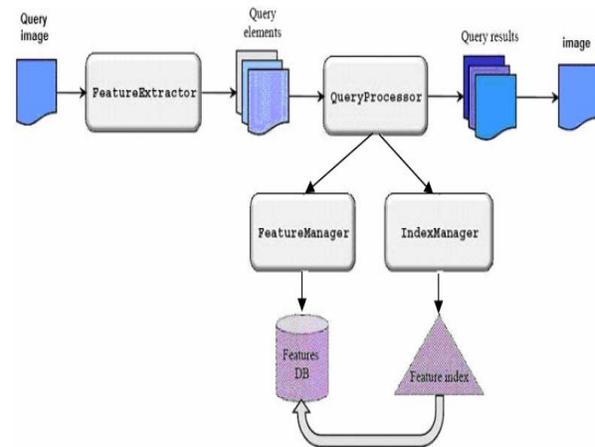


Figure-4. Direct access methods for image searching.

The use of DBMS (such as those held by the Oracle 10g, MySQL and others) with the basic syntax of SQL like select, insert, delete, alphanumeric-based can not be used in this study, because in this research basically used data in non-alphanumeric format which can not be accessed extracted using a keyword standard DBMS. Therefore, in this study, the design of non-alphanumeric data structures are very decisive in determining the query process and used also in designing facial biometric data base, so that the basic syntax of the select, insert, and delete can be built using non-alphanumeric format in accordance with their respective functions.

Processes that initiate direct access methods begin with the normalization stage. It called pre-processing. This process will be passed by each image, either in the form of training image or testing image. It aims to obtain image data with the standard size, which represents the actual original image data.

State of the Art

This study focuses on the direct access methods. There are three kinds of understanding of the direct access methods in this study, the point of novelty, namely:

- 1) Direct access to the content through an extraction process of face object. (Extraction).
- 2) Direct access to unstructured non-alphanumeric data type (formation of new data types).
- 3) Direct access to the database through searching methods that can facilitate direct access.

Figure-5 below describes the state of the art of research. This research is like constructing a building, which consists of various components as can be seen in Figure-5.



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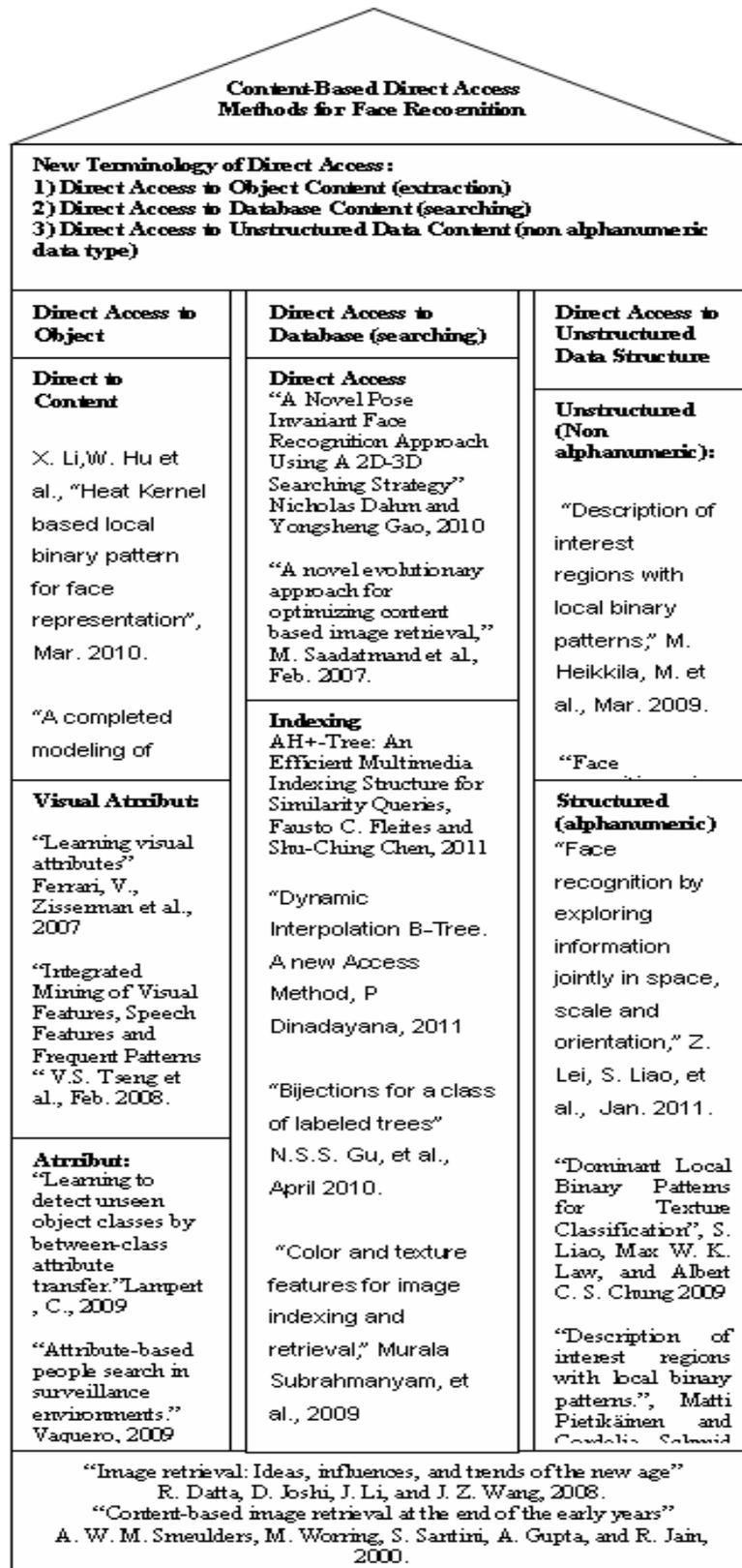


Figure-5. State of the art of content-based direct access methods.



CONCLUSIONS

The study of literature is an activity undertaken as the first step of the research. In this research, information retrieval through various media which resulted in a general view of the condition of the research studies on the human face, the studies that have been done, the method has been developed as well as other matters related.

We have presented a comprehensive survey highlighting current progress, emerging directions, the spawning of new fields, and methods for evaluation relevant to the young and exciting field of image retrieval. We have contrasted the early years of image retrieval with progress in the field in the current decade, and suggest a specific future research in this fields. We believe that the field will experience a paradigm shift in the future, with the advanced focus on application-oriented, research on a specific field, generate a considerable impact in day-to-day life.

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