Preliminary Study of Extraction of Facial Geometric Measures as Features for Content-Based Retrieval*

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Abstract

In this technical poster, we present the first results of our research on face feature detection. The main goal is to build a tool capable of producing a set of suitable data for face similarity comparisons on content-based retrieval systems. The results are still not very precise, but quite promising.

1. Introduction

Face plays an important role in human identification and interaction. That is one of the reasons why there are so many researches on face recognition and feature detection [1]. The results of these studies will improve identification systems, human-computer interaction, teleconferencing, etc.

On the other hand, multimedia data is becoming more common than ever. Unfortunately, in most of the cases, queries are based on textual descriptions. Therefore, there is an effort to develop techniques for content-based retrieval [2].

In this paper, we propose a simple approach for face feature detection, using template matching, integral projections and edge operators. The remainder of the paper is organized as follow. Section two describes a technique for face feature detection and section three discusses the results and presents conclusions and future work.

2. Approach

Our objective is to locate some facial elements, as pointed by Santini and Jain [2], to extract geometric measures that are considered sufficient for similarity analysis (see figure 1). A flow chart of the proposed approach can be seen in figure 2.

The input data is an image with a single upright frontal face in well-constrained environment, like a passport photo.

2.1. Locating ocular region and irises

The first step is to locate the eyes. We determine the ocular region using template matching. Each iris is found in the same way, using smaller templates for the eyes.

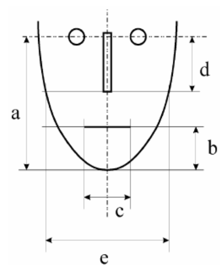

Figure 1 Considered points and distances, including irises. Adapted from Santini and Jain [2]

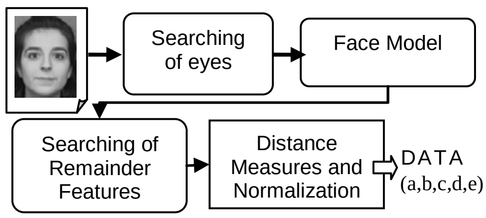

Figure 2 Flow chart of the approach

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2.2. Geometric face model

After eyes identification, we are able to determine the interocular distance. With this measure and some anthropometric relations, we can build the geometric face model to divide the input image into specific feature search areas.

2.3. Nose and chin

The vertical coordinate of the nose is defined by the maximum value of horizontal integral projection of a horizontal edge image of the nose search area. The horizontal coordinate is defined by the middle point between the pupils. For the chin, a similar procedure is employed.

2.4. Mouth

After the subimage of the mouth search area has been defined, we apply Sobel edge operator (horizontal mask only) and then we calculate the vertical integral projection of the edge map. The left lip corner is located where the value of integral projection first exceeds a threshold (usually the average of integral projection) and the right lip corner is located where the value falls back below the same threshold. The vertical coordinates are determined by searching for the darkest pixel along the columns determined in the former step. This procedure is similar to the one described by Feris et all [3].

2.5. Face width

We have noticed that the face is darker in its extremities for our image set. We used this fact to create a method for face width determination. The measure of the face width is taken in the line at nose's abscissa. At this level, each extremity of face is defined by the first valley of the intensity profile in the nose-to-cheek direction. The search starts only after the horizontal coordinate of the respective iris to avoid the nose pixels, which can lead to false positives.

2.6. Distance calculations and normalization

Once we have located the necessary points, the distances *a*, *b*, *c*, *d*, and *e* (figure 1) are calculated using Euclidean distance. The distances are then normalized considering the interocular distance. Therefore, *a*, *b*, *c*, *d*, and *e* become adimensional and they are no longer dependent on the real measures of input image.

3. Preliminary results and conclusions

For testing purposes, we have applied the technique on AT&T* and Yale† face databases, and also on a local face database. In general, the expected results were obtained (see some sample results in figure 3), but sometimes the template matching fails. In other occasions the localization of the points is not very precise. So, our next steps are towards the improvement of the accuracy of feature point determination and the reduction of the processing time. In a near future, the developed tool will be fully integrated with a database system. A first attempt has already been made and the tool was integrated as a data supplier for the MIFLIR system [4], which uses metric indexing and geometric features for image retrieval.

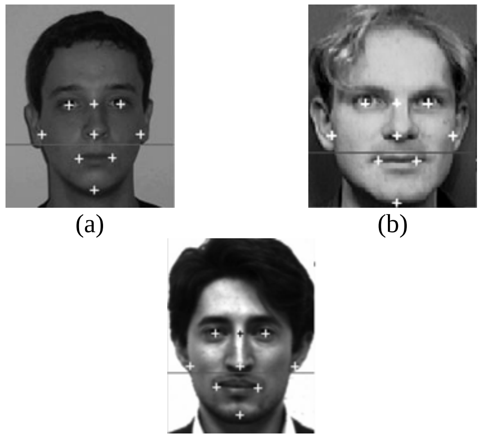

Figure 3 Samples of satisfactory results (a) local database (b) AT&T and (c) Yale

4. References

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[3] R. S. Feris, T. E. de Campos e R. M. César Junior, "Detection na Tracking of Facial Features in Vídeo Sequence", Lectures Notes in Artficial Intelligence vol 1793, 197-206, April 2000

[4] A.Gavioli, M. Biajiz, J. Moreira. MIFLIR: A Metric Indexing and Fuzzy Logic-based Image Retrieval System. In: 21th IEEE International Conference on Data Engineering, Workshop on managing data for emerging multimedia applications, 2005,Tokio, Japan.

* http://www.uk.research.att.com/facedatabase.html

† http://cvc.yale.edu/projects/yalefaces/yalefaces.html