FACE IDENTIFICATION SYSTEM SIFT-BASED GRAPH MATCHING TOPOLOGY

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ABSTRACT

This paper presents a new face identification system based on Graph Matching Technique on SIFT features extracted from face images. Although SIFT features have been successfully used for general object detection and recognition, only recently they were applied to face recognition. This paper further investigates the performance of identification techniques based on Graph matching topology drawn on SIFT features which are invariant to rotation, scaling and translation. Face projections on images, represented by a graph, can be matched onto new images by maximizing a similarity function taking into account spatial distortions and the similarities of the local features. Two graph based matching techniques have been investigated to deal with false pair assignment and reducing the number of features to find the optimal feature set between database and query face SIFT features. The experimental results, performed on the BANCA database, demonstrate the effectiveness of the proposed system for automatic face identification.

Keywords: Face Recognition; Identification; SIFT features; Biometrics; Graph matching;

INTRODUCTION

During the past decade, face identification and verification has drawn significant attention from the perspective of different real life applications such as human computer interface, surveillance, authentication and video indexing. Due to variations in illumination, nearby clutter, variability in scale, translation, and rotation, and pose, face identification is a challenging task. Facial expression, occlusion and lighting conditions also change the overall appearance of the face. Many efforts have been devoted to solve the threats owing to face identification systems, which result in the severe degradation of the performance. Although many appearance based face identification or verification techniques based on the component analysis such as in [1], exist in the literature, they are inefficient to capture a substantial amount of facial variations or new class samples. Reference [2,5] proposed a face recognition system by elastic bunch graph matching technique. However, the performance of the system has not been tested under different constraints and furthermore, the overall identification process resulted quite complicated. Reference [3] has proposed a probabilistic face recognition approach that could compensate for
the imprecise localization, partial occlusion, and extreme expressions with a single techniques to further improve the overall system performance

SIFT FEATURES

In object recognition and image retrieval applications, affine-invariant features have been recently researched [5], [6]. These affine-invariant features are highly distinctive and matched with high probability against a large case of image distortions and illumination conditions.

Local features points are extracted from the following steps:
- Select candidates for further points by searching peaks in the scale space from a difference of Gaussian (DOG) function.
- Localize the features points by using the measurement of their stability.
- Assign orientations based on local image properties.
- Calculate the features descriptors which represent local shape distortions and illumination changes.

After candidate locations have been found, a detailed fitting is performed to the nearby data for the location, edge response, and peak magnitude. To achieve invariance to image rotation, a consistent orientation is assigned to each feature point based on local properties.

REPRESENTATION OF FACES

In this work each face is represented with a complete graph drawn on features points extracted using the SIFT operators [4]. Two matching constraints are proposed: gallery image based match constraint and reduced point based match constraint. These techniques can be applied to find the corresponding sub graph in the probe face image given the complete graph in the gallery image.

A. Taxonomy of correspondence graph in the context of graph matching constraint.
B. Graph matching Methodologies

EXPERIMENTAL RESULTS

The proposed graph matching technique is tested on the BANCA database [7]. For experiment, the matched controlled (MC) protocol is followed, where the image from the first session are used for training, whereas second, third, and fourth sessions are used for testing and generating client and impostor scores.
Figure 1. Corresponding points of image 1 are mapped into image 2 using the minimum Euclidean distance measure.

Whenever \( N < M \) many interest points from the second image are discarded, while if \( N > M \), many repetitions of the same point would be occurred as corresponding points in the second image.

\( M \) (\( N = \) number of interest points on the first image; \( M = \) number of interest points on the same image), both the cases would be possible.

Figure 2 Features points and their matches for a pair of image, based on the Euclidean distance measure.

Figure 3 (G1) All matches computed from the left to the right image.
Figure 4 (G2) An example of reduced point based match constraint complete graphs with a few numbers of false matches

The testing images are divided into two groups G1 and G2 of 26 subjects each. The error rate was computed using the following procedure [7]:

- For getting G1 scores, perform the experiment on G1.
- Perform the experiment on G2, getting G2 scores.
- Compute the ROC curve using G1 scores; determine the prior equal error rate and the corresponding client specific threshold for each subject or each individual from several instances.

CONCLUSION

This paper proposes two methods for face identification based on the SIFT [4] to generate a complete graph representation. The database and query face images are matched by finding the corresponding features points using two matching constraints to deal with false pair assignments and optimal feature sets. The future, tests will be performed to allow a direct comparison of the results from the two methods.

REFERENCES


