Forensic Sketch-Photo Matching using LFDA and Pre-Processing Algorithm

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Abstract:
To find the identity of criminals plays very important role in investigation. The development of biometric technology has provided additional tools to solve the problem. In automated biometric identification we are making use of the clues like fingerprints as well as image of suspect’s face, captured by camera to find the selfhood of culprit’s. In most of the crimes none of the information is present and in some of the cases only eye witness are available. In such circumstances a forensic artist draw sketch on basis of the verbal description that indicate the facial appearance of culprit. This is called as forensic sketches. So, the matching of forensic sketch to the mugshot images is address using framework called feature based discriminant analysis (LFDA). The pre-processing methodology is used to raise up the quality of image which improve the performance of culprit identification. This paper present the approach to match the proposed algorithm with preprocessing with better identification accuracy.

Keywords: Mugshot, forensic sketch, Local feature-based discriminant analysis, Feature-based approach, Texture descriptors.

I. INTRODUCTION

Procession in biostatistics upgrades the law enforcement agencies by providing a means of identifying criminals with lesser amount of time. Visual Biometric along with Fingerprint recognition provides face recognition which gives the analysis of facial features for the recognition of an individual’s identity. In numerous cases the facial photographic image of a suspect is unavailable. In these considerations, usually sketch is drawn from the information provided by a spectator or victim to identify possible suspects. Here, two different situations may occur for the culprit:

1) The person may have already been sentence once.

   Or

2) The person has not been sentence even once or this is the first time, he may be committing crime.

In general, sketches are classified into two categories:

1. Viewed sketches and
2. Forensic sketches

Viewed Sketches

The sketches which are drawn by an artist, directly looking at the subject or the photograph of the subject.

Forensic Sketches

The sketches which are drawn by specially trained artists based on the description of subject by an eye witness. To draw forensic sketches police artist requires an enormous amount of training in drawing and pictorialization. Composite sketches instead requires several hours of training which allows even non-artist to compose a sketch with the help of composite sketch software, becomes a perfect alternative to provide assistant in investigation. Using composite sketches is advantageous as it is less time consuming and more economic. There are a lot of problems in forensic sketch recognition compared to normal face recognition in which both probe and gallery images are photographs. The fineness of sketches whether they may be viewed sketches or forensic are different from large mug-shot gallery. Most of the work done previously is principally focused on forensic sketches or viewed sketches. Forensic sketches have additional problems compared to viewed sketches. Due to the fractious nature of the memory, the exact visual aspect of the criminal cannot be remembered by the spectator. This leads to an incomplete and inaccurate depiction of the sketches which reduces the recognition performance considerably. To handle such difficulties, local feature-based discriminant analysis (LFDA), algorithm is used which features multiple discriminative subspace projections from portioned vectors of SIFT & LBP features. Component-based face recognition methods; however, these algorithms either directly utilized intensity features that are sensitive to changes in facial appearance or employed supervised algorithms for classification whose performance is sensitive to the amount of training data available. The problems like misalignment in photo to photo face matching & heterogeneous modality gap present. In computer generated composite sketches to facial photograph is solve by this algorithm.

II. RELATED WORK

The proposed method of sketch matching has started to increase accuracy of sketch recognition as it is very small in
traditional method. This is in turn due to a large texture difference, between a sketch and a photo. Even though all the methods that are applicable to viewed sketches, are also applicable to forensic sketches, the unavailability of a public database for forensic sketches led to a lack of standard test procedure on the latter one. That is why most of the early work consists of tests on viewed sketches only. There are a lot of problems in forensic sketch recognition compared to normal face recognition in which both probe and gallery images are photographs. The fineness of sketches whether they may be viewed sketches or forensic are different from large mug-shot gallery. Most of the work done previously is principally focused on forensic sketches or viewed sketches. Forensic sketches have additional problems compared to viewed sketches. Due to the fractory nature of the memory, the exact visual aspect of the criminal cannot be remembered by the spectator. This leads to an incomplete and inaccurate depiction of the sketches which reduces the recognition performance considerably. To handle such difficulties, Klare et al. developed a local feature-based discriminant analysis (LFDA), which learns a discriminative representation from partitioned vectors of SIFT [5] and LBP [6] features. Most of the work in matching viewed sketches was performed by Tang and Wang [1] [2]. Tang and Wang first approached the problem using an Eigen transformation method [1] to either project a sketch image into a photo subspace, or to project a photo image into a sketch subspace. An improvement to this method was offered by Wang and Tang [2], where the relationship between sketch and photo image patches was modeled with a Markov random field. Here, by using a variety of standard face recognition algorithms the synthetic sketches generated were matched to the gallery of photographs. In the paper [3] for representing face authors uses geometric relationship among the facial features like mouth, nose and eyes. By independently matching templates of three facial regions i.e. eyes, mouth and nose feature based face representation is done. In paper [4] facial image representation which I based on local binary pattern (LBP) texture using multiple discriminative subspace projections is given.

II. PRE-PROCESSING ALGORITHM

The digital images may be noisy and of sub-optimal quality because of the printing and scanning of images. Forensic sketch-digital image pairs of lower visual quality may lead to reduced matching performance as compared to good quality sketch-digital image pairs. Forensic sketches may also contain distortions and noise introduced due to the excessive use of charcoal pencil, paper quality, and scanning (device noise/errors). In this paper, following pre-processing technique [7] is used that enhances the quality of forensic sketch-digital image pairs.

IV. PROPOSED APPROACH FOR PHOTO MATCHING

The proposed feature-based method for sketch to photo matching system is shown in the following given block diagram:

Figure 1. Representation of the sketch matching system

Here we have group of sketches (Probe images) as well as mugshot photographs. The step by step sketch to photo matching is as follows:

1. For the input sketch image and the corresponding photo, apply feature extraction techniques on each of them and store results in the database.
2. Feature extraction results related to every image is stored into a feature database.
3. For every probe image, the corresponding match is that with the minimum distance calculated with the nearest neighbor matching method.
4. The final retrieved images are then displayed. From the above figure, we can say that the image database represents the gallery of images of the culprits. These images are called as the mugshot images. A mug shot is a photographic portrait taken after one is arrested. Sketch image is the probe sketch which is the input given to the matching system that is to be identified against the available mugshot images.

- Feature extraction: Feature extraction represents any feature-based sketch matching technique. For example there are different types of feature (image) descriptors which can be used, that are SIFT, MLBP, SURF (Speeded up Robust Features), Haar, Gabor, and intensity.
- Feature database: Feature database is the database maintained where all the results or values obtained from the feature extraction method are stored. These are afterwards used for matching purpose with the probe sketch.
- Matching algorithm: Proper match between the probe sketches images with the mugshot images are done by using matching algorithm. We can match sketch to photos using ‘nearest neighbor matching’ method in which the minimum distance between the calculated values of the mugshot images and the probe sketch is found out.

V. RESULTS

Following is the result that we get after applying proposed methodology to different images. First we apply feature extraction techniques on sketch image and the corresponding photo and store the results in database.
For every probe image, the corresponding match is that with the minimum distance calculated with the nearest neighbor matching method as shown below.

VI. CONCLUSION

As it is only proposed work we are thinking of using a robust feature-based method LFDA for matching forensic sketches to mugshot photos. This proposed approach will help to perform significantly better than other methods for matching forensic sketches. Thus in future good method of forensic sketches matching will be available.

VII. REFERENCES


