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Criminal Photograph Retrieval based on Forensic Face Sketch using LFDA Framework

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Abstract:-Today, improvements in biometric tools have provided law enforcement activities Additional tools in the identification of criminals. In addition to the incidental evidence, if a dormant fingerprint is found at the scene of crime or a surveillance camera captures an image of the face of a suspect, then these clues are used in defining the suspect using biometric identification techniques. However, many crimes occur where none of the above conversed information is present. Also, the lack of technology to effectively capture the biometric data like finger prints within a short span after the scene of crime, is a Routine problem in remote areas. despite these repercussions, many a times, an eyewitness Account of the crime is available who had seen the criminal. The Police division deploys a forensic painter to work with the witness in order to draw a sketch that limits the facial Presence of the culprit. These sketches are known as forensic sketches. Here we have used LFDA framework to identify culprit using these forensic sketches.
Terms:

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I. Introduction

Today, advances in biometric tools have provided law enforcement agencies Additional tools in the identification of criminals. In addition to the incidental evidence, if a latent fingerprint is found at the scene of crime or a surveillance camera captures an image of the face of a suspect, then these clues are used in determining the suspect using biometric identification techniques. However, manycrimes occur where none of the above discussed information is present. Also, the lack of technology to effectively capture the biometric data like finger prints within ashort span after the scene of crime, is a Routine problem in remote areas. Despite these repercussions, many a times, an eyewitness Account of the crime is available who had seen the criminal. The Police department deploys a forensic artist to work with the witness in order to draw a sketch that limns the facial Appearance of the culprit. These sketches are known as forensic sketches. Once the Sketch is ready, it is sent to the law enforcement officers and media outlets with the hope of catching the suspect.

Here, two different scenarios may arise for the culprit:

1. The person may have already been convicted once or
2. The person has not been acquitted even once or this is the first time, he may beCommitting felony.

We deal with the first type scenario. If the criminal has been convicted at-least once, a mug shot photo (photo taken, while the person is being sent to jail) is Available. Using an efficient forensic sketch matching system, the police can narrow down the potential suspects which will reduce the future crimes by the same criminal drastically. Also, consider a party with a camera at the entrance door, which captures the image of everyone entering the hall with a predetermined calibration. If some crime happens inside the party, and someone sees the criminal, he and the photos initially captured can act as eye Witness and mug shot photos respectively, can be used to catch the criminal using forensic Sketch matching.

II. Literature Survey

Most of the work in matching viewed sketches was implemented by Tang and Wang [1] [2]. They presented ainnovative photo retrieval system using face sketches. By transforming a photo image into a sketch, they reduced the difference between photo and sketch considerably, thus allowing effective matching between the two. Tang and Wang first approached the problem using an eigentransformation method to either project a sketch image into a photo subspace, or to project a photo image into a sketch subspace [1]. Once projected into the same image subspace, they were matched using a Principal Component Analysis (PCA)-based matcher.

An improvement to this method was offered by Wang and Tang, where the relationship between sketch and photo image patches was modeled with a Markov random field [2]. A. Sharma and P. Devalediscussed a method for representing face which is based on the features which uses geometric relationship among the facial features like mouth, nose and eyes [3]. T. Ahonen, A. Hadid and M. Pietikainenrepresented a unique and efficient facial image representation based on local binary pattern (LBP) texture features [4]. It stated that the LBP operator is one of the best performing texture descriptors and it has been widely used in various applications. To identify forensic sketches much efficient algorithm was presented by M. Ahmad and F. Bobere [5]. Both sketches and photos were considered for extracting feature descriptors using Scale Invariant Feature

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Transform (SIFT). A. K. Jain, Brendan Klare and U. Park discussed recent developments in automated face recognition that effect the forensic face recognition community [6].

III. Methods

Our goal is to develop a system that can recognize faces whose appearance changes according to different factors such as pose, expression, sketches where the treatment of face may fail to produce correct recognition. One of the images is taken as Test image and consider rest as training image. The important features of face are extracted and similarity measure between training image and test image is taken. Finally, the person who receives minimum distance is chosen as the best match. To deliver a perspective on the angle of our region-division approach that uses majority voting, compare the recognition performance of three techniques, namely the Scale Invariant Feature Transform (SIFT), Linear Feature Discriminate Analysis (LFDA) andMultiscale Local Binary Pattern (MLBP)are compared.

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

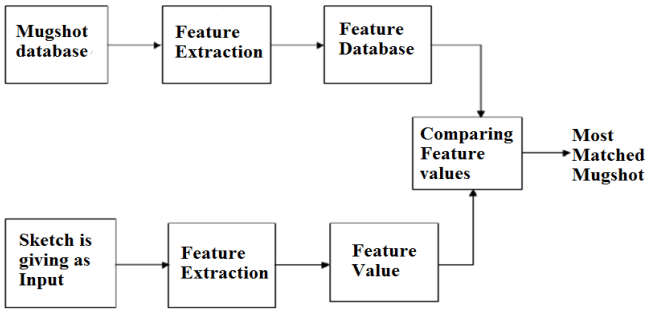

Figure 1: - Proposed System

The steps involved in above Description of sketch to photo matching are as follows:

Step 1: Average of all photos matching with the sketch is taken out.

a) Acquiring the image of individual face using sketch of the individual.

b) Location the face in the image

c) Apply feature extraction techniques on image and store results in the database

d) Store this feature extraction results for every image into a feature database

e) Analysis of facial image according different feature extraction techniques

f) Comparison of face by average calculated with the nearest neighbor matching method

g) Declaration of match or no match

Step 2: If match, those matched photos are given to witness so that he/she can help to criminal detection agencies/ Law Enforcement agencies for exactly find out the criminal.

LFDA: -

In the LFDA framework, each image feature vector is first divided into “pieces” of smaller dimensionality, where pieces correspond to the concatenation of feature descriptor vectors from each column of image patches.

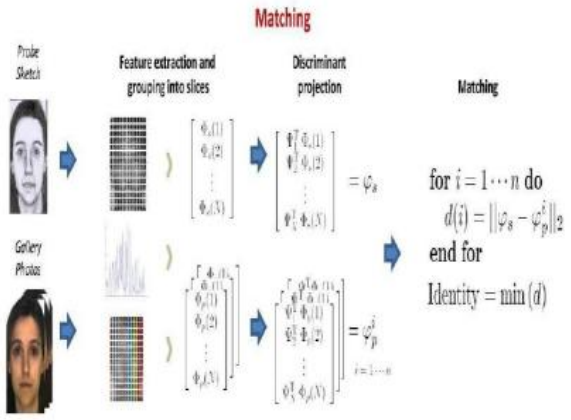

Figure 2: LFDA Framework[12]

Next, discriminant analysis is performed separately on each slice by performing the following three steps:

- PCA
- within class whitening
- between class discriminant analysis

Lastly, to remove redundant information among the feature pieces to extract the final feature vector, PCA is applied to the new feature vector as shown in “Fig.2”, of training and matching of LFDA

SIFT: -

SIFT is a mathematical algorithm for takeing out interest point features from images that can be used to perform reliable matching between different views of objects. For any object in an image, interesting points on the object can be extracted to provide a "feature description" of the object. This description, extracted from a training image, can then be used to detect the object when trying to locate the object in a test image containing many other objects. To perform reliable recognition, it is essential that the features extracted from the training image be noticeable even under changes in image scale, noise and illumination. Such points usually lie on high-contrast regions of the image, such as object edges. Another important characteristic of these features is that the relative positions between them in the original scene shouldn't change from one image to another. For example, if only the four angles of a door were used as features, they would work irrespective of the door's position; but if points in the frame were also used, the recognition

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would fail if the door is opened or closed. Similarly, features located in enunciated or flexible objects would typically not work if any change in their internal geometry occurs between two images in the set being processed. However, in practice SIFT detects and uses a much larger number of features from the images, which reduces the contribution of the errors caused by these local variations in the average error of all feature matching errors. SIFT can robustly find objects even among clutter and under partial constriction, because the SIFT feature descriptor is invariant to uniform scaling, orientation, and partially invariant to affine distortion and illumination changes. This section summarizes Lowe's object recognition method and mentions a few competing techniques available for object recognition under clutter and partial constriction.

MLBP: -

Multiscale Local binary patterns (MLBP) is a type of feature used for classification in computer vision. It has since been establish to be ainfluential feature for texture classification; it has further been determined that when LBP is combined with the Histogram of oriented gradients (HOG) descriptor, it improves the detection performance significantly on some datasets. In the LBP histogram, an image pair is first split into sub-regions. The similarity score of each local LBP histogram pair is dignified using the similarity function. The similarity scores are then concatenated to form an input feature vector for feature selection process. The LBP operator was eventually designed for texture description. Over complete features can be delivered by shifting and scaling thelocal regions. In general, the total sample size of inter-person pairs is larger than that of intra-person pairs. This will give rise to a bias for feature selection.

PCA: -

The PCA method has been broadly applied for the task of face recognition. Principal Components Analysis (PCA) is a dimensionality reduction technique used widely in Remote Sensing studies (e.g. in change detection studies, image enhancement tasks and more). The PCA involves a mathematical method that transforms a number of correlated variables into a number of uncorrelated variables called principal component. PCA is in fact a linear transformation applied on (usually) highly correlated multidimensional (e.g. multispectral) data. The input dimensions are changed in a new coordinate system in which the produced dimensions (called principal components) contain, in decreasing order, the greatest variance related with unchanged landscape features. PCA is a standard DE correlation method which projects the input signal into a space where features have no correlation with each other. It is a common technique for signal representation or signal compression because PCA can reduce the dimensionality by keeping the space which encapsulates the maximum amount of signal variation and propelling out dimensions with small variation which are regarded as noise.

IV. Results

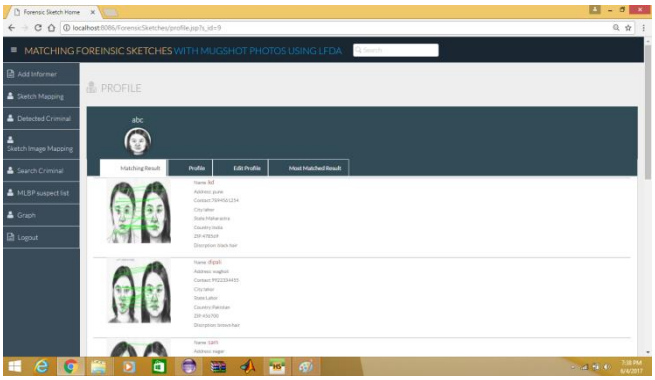

Figure 3:Sketch To Sketch Matching Page

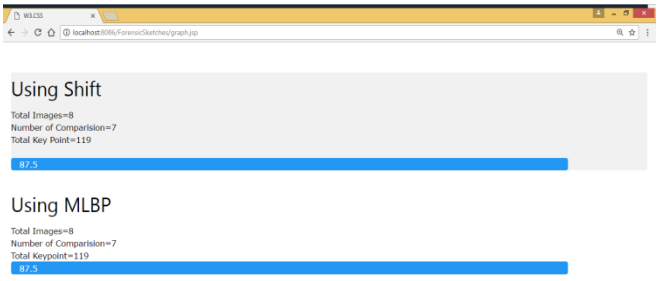

Figure 4: Comparison of SIFT and MLBP

V. Conclusion

We have implemented Retrieval of Mug shot photos matching with delivered input Forensic sketch. We have employed Local feature based discriminant analysis (LFDA) technique, which incorporates SIFT and MLBP feature descriptors. We have also compared the result of both feature descriptors. This Proposed method works well than other methods. In the comparison of SIFT and MLBP, most of the times MLBP achieves better than SIFT. MLBP is more accurate than SIFT.

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