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Review Of SIFT and LBP Algorithm for Crime Investigation Using LFDA Framework

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Abstract*—In this paper, we discuss some of the popular face recognition algorithm used for forensic images for crime investigation. Basically sketch matching with large database gallery maintained by crime investigation agencies. Normally face recognition methodology is divided in three phases such as face detection; feature extraction and face recognition. This paper concentrates on the key point extraction from sketches as well as images. We discuss about popular feature descriptors such as SIFT (Scale Invariant Feature Transform) and LBP (Local Binary Patterns).Further, we discuss LFDA (Local Feature Discriminant Analysis) applied to both sketch and photos using SIFT and LBP features, which is one of the important preprocessing steps in high –dimensional data analysis for dimensionality reduction to match a large target data set. LFDA improves matching performance of sketches with large gallery images.

***Index Terms*—Face recognition, Feature descriptors (SIFT and LBP), Local feature discriminant analysis (LFDA), gallery images.**

I. INTRODUCTION

The biometric technology used by law enforcement agencies includes recognition of fingerprints, palm print, face recognition, iris recognition, hand geometry, DNA, retina recognition, speaker recognition. Now-a-days CCTV cameras are useful source of information of the culprit. In such investigation face recognition plays a vital role. While in case of sketch drawn by forensic artist that depicts the face resemblance of the culprit by matching with large number of database maintained by crime department. The SIFT (Scale Invariant Feature transform) is a very important key points descriptor popularly used for feature extraction of sketch or image. Another method used for feature extraction is LBP (Local Binary pattern).Finally we can use LFDA to perform minimum distance matching between sketches and photos which reduces dimensionality of data without losing vital information.

II. FEATURE EXTRACTION METHODOLOGY

A. Scale Invariant Feature Transform

SIFT features are features extracted from images which help in reliable matching between different views of the same object. These extracted key points features are invariant to scale and orientation.

The Key point features are extracted in following steps,

Step (1) SIFT computes the locations of potential interest points in the image by detecting the maxima and minima of a set of difference of Gaussian (DOG) filters applied at different scales all over the image.

Step (2) Then these locations are refined by discarding points of low constrast.An orientation is then assigned to each key point based on local image features.

Step (3) Finally, a local feature descriptor is computed at each key point. This descriptor is based on the local image gradient, transformed according to the orientation of the key point to provide orientation invariance. Every feature is a vector of dimension 128 distinctively identifying the neighbourhood around the key point.

B. Local Binary Pattern

LBP is very good means of feature description. The LBP operator was originally designed for texture description. The LBP operator assigns a label to every pixel of an image by thresholding the 3x3-neighborhood of each pixel with the centre pixel value and considering the result as a binary number. A local binary pattern is called uniform if the binary pattern contains at most two bitwise transitions from 0 to 1 or vice versa when the bit pattern is considered circular. In the computation of the LBP histogram, the patterns used are uniform so that the histogram

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has a separate bin for every pattern which is uniform and all non-uniform patterns are assigned to a single bin. The original LBP operator was using the 8 pixels being the central pixel as a threshold.

Steps for LBP Algorithm

Step 1: The LBP histogram method, each pixel of an image is labelled with an LBP code.

Step 2: Then it will first divide the image in several blocks.

Step 3: For each block the LBP Histogram of an image is calculated and after that all histograms will be combined of that image. Then we will get all histograms into one vector.

C. Local Feature Discriminant Analysis

In such discriminant analysis, each image feature vector ϕ is first divided into slices of smaller dimentionality, where slices correspond to the concatenation of feature descriptor vectors from each column of image patches. The two phases of the LFDA framework having Training phase in the figure 1 and matching phase in figure 2 are shown as follows In figure 1 each sketch and photo is represented by SIFT & LBP feature descriptors extracted from overlapping patches. After grouping "slices" of patches together into feature vectors Φ (k) where k=1….N.

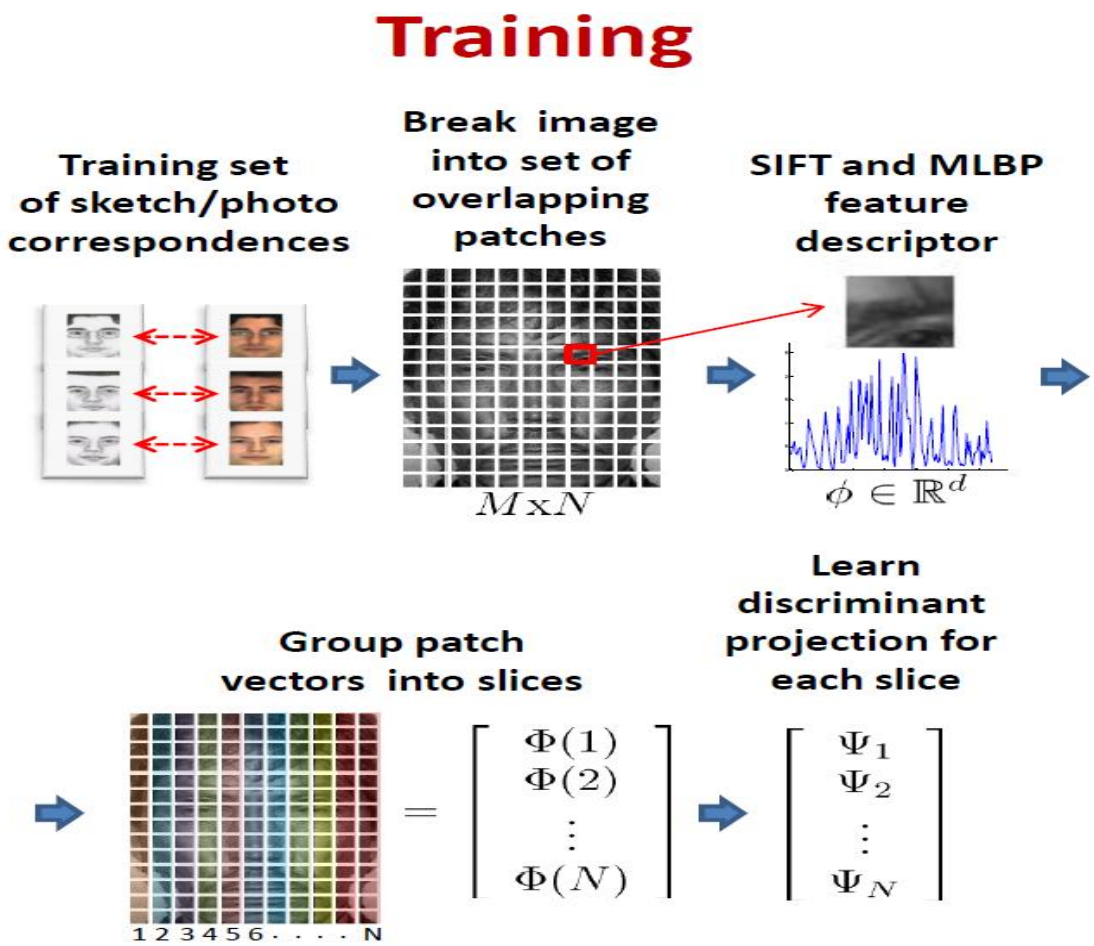

Fig 1: Overview of training using the LFDA framework.

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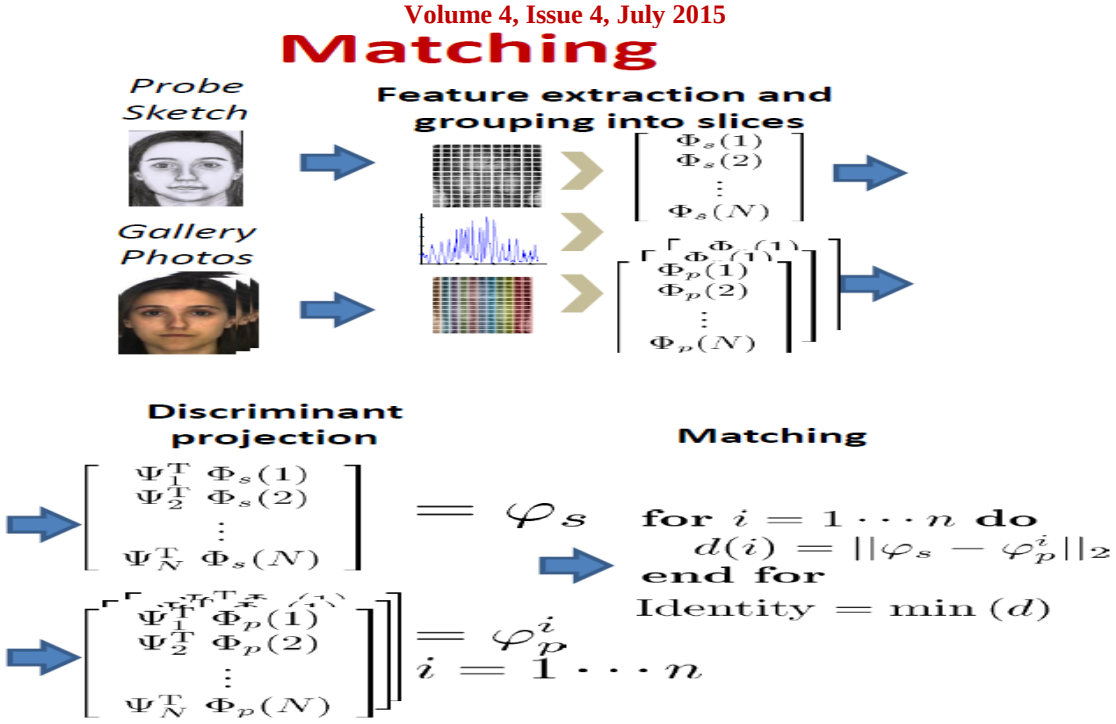

Fig 2: Overview of matching using LFDA framework.

Recognition is performed after combining each projected vector slice into a single vector φ and measuring the normed distance between a probe sketch and gallery photo.

III. CONCLUSION AND FUTURE WORK

We have studied the algorithms which are used to extract features for sketch recognition. As a forensic sketch is an more challenging approach rather than an face image, we also apply an LFDA frame work for more reliable accurate matchings.The feature extraction algorithms such as SIFT and LBP helps in extracting key point features. Forensic sketches pose additional challenges due to the inability of a witness to exactly remember the appearance of a subject, which often results in an inaccurate and incomplete forensic sketch causing difficulties in crime investigation. Thus, in future a pre-processing techniques such as using multi-scale retinex (MSR) and DWT fusion algorithms can be applied to enhance the quality of a forensic sketch digital image pair.

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