© 2017 IJSRST | Volume 3 | Issue 1 | Print ISSN: 2395-6011 | Online ISSN: 2395-602X
Themed Section: Scienceand Technology

A Review on Forensic Photo Sketch Matching Using Local Feature Texture Analysis

Vibhakti D. Shirbhate[1], Nitin R. Chopde[2]

[1]ME Student, Department of Computer Science and Engineering, G.H. Raisoni College of Engineering & Management, Amravati, Maharashtra, India

[2]Assistant Professor, Department of Computer Science and Engineering, G.H. Raisoni College of Engineering & Management, Amravati, Maharashtra, India

ABSTRACT

Face recognition is considered one of the most essential applications of Biometrics for personal identification. Face sketch recognition is a special case of face recognition, and it is very important for forensic applications. We propose an generalize method for face photo-sketch recognition by generalizing a pseudo-sketch from a single photo. The proposed method is the first generalize method that deals with face sketch recognition. The proposed photo-sketch synthesis step consists of two main steps, namely: edge detection and hair detection, which are applied on the grayscale image of the photo image. In the recognition step, the artist sketch is compared with the generated pseudo-sketch. PCA and LDA are used to extract features from the sketch images. The k-nearest neighbor classifier with Euclidean distance is used in the classification step. We use the CUHK database to test the performance of the proposed Method. Results for the synthesized sketches are compared with state-of-the-art methods, e.g., Local Linear Embedding (LLE) and Eigen transformation. The experimental results show that the proposed method generates a clear synthesis sketch and it defines persons more accurate than other methods.

Keywords: Sketch/photosynthesis, Gradient edge detection, Hair detection, Gaussian Blur, Contrast stretching

I. INTRODUCTION

Face recognition is very important and is required in many different fields. It is used widely in security systems and crime investigation. Normal face recognition is between two face photos. But in crime investigation, the photo of the criminal is rarely available. It is replaced by a sketch which is drawn by an artist upon the description of eyewitnesses. The direct comparison between the photographic image and the sketch image doesn't produce a good recognition because they are in different modalities. For overcoming this problem, one of the two images must convert to the other. Converting a photo to a sketch or a sketch to a photo is the searching point in this field.

An important application of face recognition is to assist law enforcement. Automatic retrieval of photos of suspects from the police mug shot database can help the police narrow down potential suspects quickly. However, in most cases, the photo image of a suspect is not available. The best substitute is often a sketch drawing based on the recollection of an eyewitness. Therefore, automatically searching through a photo database using a sketch drawing becomes important. It can not only help police locate a group of potential suspects, but also help the witness and the artist modify the sketch drawing of the suspect interactively based on similar photos retrieved . However, due to the great difference between sketches and photos and the unknown psychological mechanism of sketch generation, face sketch recognition is much harder than normal face recognition based on photo images. It is difficult to match photos and sketches in two different modalities. One way to solve this problem is to first transform face photos into sketch drawings and then match a query sketch with the synthesized sketches in the same modality, or first trans- form a query sketch into a photo image and then match the synthesized photo with real photos in the gallery. Face sketch/photo

synthesis not only helps face sketch recognition, but also has many other useful applications for digital entertainment; we will study these two interesting and related problems: face sketch/photo synthesis and face sketch recognition.

Artists have a fascinating ability to capture the most distinctive characteristics of human faces and depict them on sketches. Although sketches are very different from photos in style and appearance, we often can easily recognize a person from his sketch. How to synthesize face sketches from photos by a computer is an interesting problem. The psychological mechanism of sketch generation is difficult to be expressed precisely by rules or grammar. The difference between sketches and photos mainly exists in two aspects: texture and shape the patches drawn by pencil on paper have different texture compared to human skin captured on a photo. In order to convey the 3D shading information, some shadow texture is often added to sketches by artist.

II. LITERATURE SURVEY

Klare and Jain [1] proposed a Scale Invariant Feature Transform (SIFT) based local feature approach. The method consists in sampling the SIFT feature descriptors uniformly across all the sketch and photo images, then both are matched directly or using a dictionary composed by training pairs. The recognition proceeds by computing the distance of the SIFT representation between the sketch and photo.

X. Tang and X. Wang,[2]-That a new approach for photo/sketch recognition based on the Local Feature-based Discriminant Analysis (LFDA) method. This new approach was tested and compared with its predecessors using three different datasets and also adding an extra gallery of 10,000 photos to extend the gallery. Experiments using the CUFS and CUFSF databases show that our approach outperforms the state-of-the-art approaches. Our approach also shows good results with *forensic sketches*. The limitation with this dataset is its very small size. By increasing the training dataset, the accuracy of our approach increases, as it was demonstrated by our experiments.

Lu et al. [3] proposed a new system to produce pencil drawing from natural images. They used the gradient with convolution a line in 8 directions for obtaining a strong stroke. They combined the tone and stroke structures to obtain on rich and well-ordered lines to express the original scene vividly.

Tang and Wang [4] proposed a new method based on Eigenfaces method. They converted the input photo to a sketch by projecting the photo in the Eigen space of the training sketches. Finally, the mean of the training sketches is added to the result of this projection to produce the synthesis sketch. They achieved accuracy 75% by PCA classifier and 81% using Bayesian classifier.

Liu and Tang [5] present a new sketch synthesized method to map the nonlinear relation between the photo and the sketch. They divided the input photo into local patches. For each patch, they found its local nearest neighbor patches, using the Euclidean distance, in the photo training set. Then, the corresponding sketch patches to these neighbor patches are used to synthesis a new patch in the output sketch. They used 13x13 patch size; the number of the nearest neighbours is 5 and the overlapped region equal 2/3 of the patch size. These parameters produced a performance rate 87% by using KNDA classifier.

Kumar et al. [9] enhanced the edge information in an image by using Coherence shock filter. They preserved the boundary line drawing in the image by using the bilateral filter. They preserved the local structure orientation features by using a 2D anisotropic filter.
Wanga et al. [10] presented the Edge Flow Estimation and Step Edges Detection to detect a lot of meaningful features effectively in the photo. They produced strong lines with good edge localization.

Gaoet al. [11] divided the image into many meaningful regions using an efficient method of image segmentation. They applied an edge detection Sobel operator besides the image is sharpened by Unsharp Mask (USM).

Li and Cao [12] are the only lines drawing researchers who focused on hair and skin similarity. They presented bilateral filter with a large parameter for extracting prominent facial features and bilateral filter with a small parameter for texture.

III. PROPOSED WORK

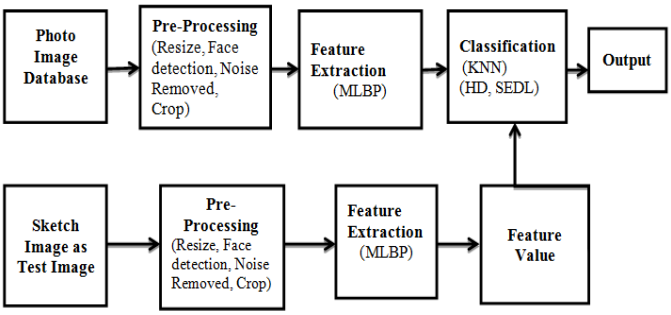

Figure 1. Block Diagram for Sketch Detection

A. Image Database

The experiments are conducted on the CUHK face sketch database. It contains 188 pairs of faces photos and their corresponding artist sketches. Images are in a frontal pose with a normal expression and size 900x1200pixels. We cropped images to remove the background and keep only the face region. The suitable image size that preserves the face details is 130x100 pixels.

B. Pre-Processing

Resize the photo or sketch. Original size of photo and sketch is 1024x768 and 414x582 its convert into 256x256. The Adaptive Median Filter performs spatial processing to preserve detail and smooth non-impulsive noise. A prime benefit to this adaptive approach to median filtering is that repeated applications of this Adaptive Median Filter do not erode away edges or other small structure in the image. Median filtering is a nonlinear operation often used in image processing to reduce "salt and pepper" noise. A median filter is more effective than conventional when the goal is to simultaneously reduce noise and preserve edges.

Face detection proposed by Viola and Jones based on statistic methods is most popular among the face detection approaches. This face detection is a variant of the AdaBoost algorithm which achieves rapid and robust face detection. They proposed a face detection method based on the AdaBoost learning algorithm using Haar features that detected the face successfully with high accuracy. However the accuracy of the method is still not enough when this method is used to detect facial feature. We have Viola Jones, skin colour pixel detection and physical location approximation technique to have a hybrid design which can detect face, mouth and eyes more accurately while consuming less time.

C. Feature Extraction

1) MLBT

The original LBP operator labels the pixels of an image with decimal numbers, which are called *LBPs* or *LBP codes* that encode the local structure around each pixel. It proceeds thus, as illustrated in Fig.2.

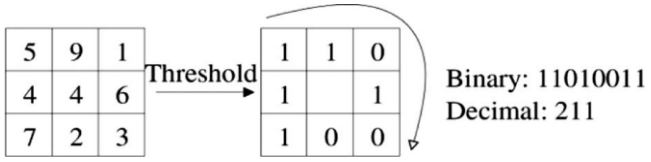

Figure 2. The basic LBP operator

Each pixel is compared with its eight neighbours in a 3×3 neighborhood by subtracting the center pixel value; the resulting strictly negative values are encoded with 0, and the others with 1. For each given pixel, a binary number is obtained by concatenating all these binary values in a clockwise direction, which starts from the one of its top-left neighbor. The corresponding decimal value of the generated binary number is then used for labelling the given pixel. The derived binary numbers are referred to be the LBPs or LBP codes.

D. Classification

In pattern recognition, the *k* Nearest Neighbors algorithm (or *k*NN for short) is a nonparametric Method used for classification and regression In both cases, the input consists of the *k* closest training examples in the feature space. The output depends on whether *k*NN is used for classification or regression.

In *kNN classification*, the output is a class membership. An object is classified by a majority vote of its neighbours, with the object being assigned to the class most common among its *k* nearest neighbours (*k* is a positive integer, typically small). If $k = 1$, then the object is simply assigned to the class of that single nearest neighbor.

In *kNN regression*, the output is the property value for the object. This value is the average of thevalues of its *k* nearest neighbours. *k*NN is a type of instance based learning, or lazy learning, where the function is only approximated locally and all computation is deferred until classification. The *k*NN algorithm is among the simplest of all machine learning algorithms.

IV.CONCLUSION

The method synthesizes a sketch image from a single photo image to use it for photo-sketch recognition by comparing the synthesized sketch with the artist sketch. The method synthesizes a sketch through image gradient to emphasize the dominant feature and image threshold to preserve hair features. The k-nearest neighbor classifier (k-NN) with Euclidean distance is used to match images and find the nearest k-class to the tested sketch. Experimentation of the proposed method is done using the CUHK student database. Results show that the proposed method achieves a recognition rate at the1-nearest neighbor (rank1: first-match) range from 82% with PCA to 94% with LDA. The highest recognition rate is obtained at the5-nearest neighbor (rank 5) is 98%, which improves the recognition by about 10% better than the reported results of the state-of-the-art methods.

V. REFERENCES

[1] B. Klare and A. K. Jain, "Sketch to photo matching: A feature-based approach," *Proc. of SPIE Biometric Technology for Human Identification*, vol. 7667, pp. 766 702–766 702, 2010.

[2] X. Tang and X. Wang, "Face Sketch Recognition,"IEEE Trans. Circuit Syst. Video Technol., , vol. 14, no.1,pp.50-57,January2004.

[3] C. Lu, L. Xu, and J. Jia, "Combining sketch and tone for pencil drawing production, Symposium on Non-Photorealistic Animation and Rendering(NPAR),pp.65-73,2012.

[4] X. Tang and X. Wang, "Face Sketch Recognition," IEEE Trans. Circuit Syst. Video Technol., , vol. 14, no. 1, pp. 50-57, January 2004.

[5] Q. Liu and X. Tang, "A Nonlinear Approach for Face Sketch Synthesis and Recognition," IEEE Int. Conf. on Computer Vision and Pattern Recognition, San Diego, CA, pp. 1005-1010, Jun.2005.

[6] P. Kumar and N. Swamy," Line Drawing for Conveying Shapes in HDR Images," International J. of Innovations in Engineering and Technology (IJIET), pp. 866-872, 2013.

[7] S. Wanga, E. Wua, Y. Liu, X. Liu, and Y. Chen," Abstract line drawings from photographs using flow-based filters," Computers & Graphics, vol. 36, Issue 4, pp. 215-304, 2012.

[8] X. Gao, J. Zhou, Z. Chen, and Y. Chen, "AUTOMATIC GENERATION OF PENCIL SKETCH FOR 2D images," International Conference on Acoustics, Speech and Signal Processing (ICASSP), pp. 1018-1021, 2010.

[9] X. Li and X. Cao, "A Simple Framework for Face Photo-Sketch Synthesis," Mathematical Problems in Engineering, vol. 2012, 19 pages, 2012[9] P. Kumar and N. Swamy," Line Drawing for Conveying Shapes in HDR Images," International J. of Innovations in Engineering and Technology (IJIET), pp. 866-872, 2013