

Matching composite sketches to facial photos using component-based approach

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Abstract— Face recognition has wide potential applications in many computer area like face identification, face verification, criminal investigation. The face images can be represented by various representation approaches. Common approaches for representations includes component-based, analytic, patch-based and holistic. Also various researches on sketch recognition which focused on matching sketches drawn by professional artist based on a verbal description of the subject's appearances provided by an eyewitness.

In the proposed system composite sketches are synthesized using one of the several facial composite software systems which are publically available. We propose a component-based representation (CBR) approach to measure the similarity score between a composite sketch and mugshot photograph. Using an active shape model (ASM), first automatically detect facial landmarks in composite sketches and face photos. In propose system instead of comparing whole image at the same time, facial components from dataset will be compare for matching. Depending on the component matching images will be display in sorted order.

Keywords-Component-based face representation, composite sketch, faces recognition, forensic sketch, heterogeneous face recognition, modality gap.

I. INTRODUCTION

Recently face recognition from images has been a hot research topic in computer vision. This is because face recognition has many potential application values as well as theoretical challenges. Face recognition has important application for automatically identifying or verifying a person.

In criminal investigation, hand drawn sketches are used to match possible suspect with mug-shot gallery set. Various representation methods has been developed and used for face identification. These representation methods are used to solve the problem of matching facial sketches to photographs. To draw a sketches a professional artist is required who draw a sketches with description provided by an eye-witness. But due to budgetary reason many law-enforcement agencies now using composite software system to synthesized sketches.

A component-based face recognition method is used for calculate similarity score of component between photo and composite sketch.

II. LITERATURE SURVEY

1. Viewed sketch face recognition

Viewed sketch recognition has most importance because it improving matching accuracy. Viewed sketch-based face recognition is based on the synthesis, projection and feature-based methods.

1.1 Synthesis-based approaches

This synthesis based approach takes a photo from corresponding sketch or vice-versa. An eigensketch transformation algorithm is used to convert a photo into sketch by [Tang and Wang

2002]. Classification can be used on obtained eigenskecth features. The eigenskecth transformation algorithm reduced the discrepancies between photo and sketch.

A Local Linear Embedding (LLE) method is used to convert photos into sketches based on the image patches [Liu et al.2005]. Those sketches are geometry preserving synthetic sketches. It finds the nearest neighbors in the training set for each image patch to be converted, and uses their corresponding sketch patches to synthesize the sketch patch.

Tang and Wang [Wang and Tang 2009] further improved [Liu et al. 2005] by developing an advance approach to synthesize local face image at different scales using a different technique like a Markov Random Fields (MRF). In later, a multi-scale MRF learns local patches and scales jointly instead of independently which used in [Liu et al. 2005].

1.2 Projection based approaches

A main strategy in projection based approach is to find a lower-dimensional sub-space so that two modalities can be directly compare.

Lin and Tang [Lin and Tang 2006] proposed method of a linear transformation which can be used between different modalities (sketch/photo), called common discriminant feature extraction (CDFE). By using this method, images from two modalities are projected into a common feature space so that matching can be efficiently performed.

For sketch–photo recognition [Liu et al. 2005] proposed a kernel-based nonlinear discriminant analysis (KNDA) classifier. The main aim of this contribution is to use the nonlinear kernel trick to map input data into an implicit feature space.

1.3 Feature based approaches

Feature-based approach focuses on designing a feature descriptor for each image that is invariant to the modality, while being variant to the identity of the person rather than matching photos into sketches, or both into a common subspace. Scale invariant feature transform (SIFT), Gabor transform, Histogram of Averaged Oriented Gradients (HAOG) and Local Binary Pattern (LBP) this are most widely used image feature descriptor . Once sketch and photo images are encoded using these descriptors, they may be matched directly.

Based on invariant SIFT-features [Lowe 2004].Klare et al. [Klare and Jain 2010b] proposed the first direct sketch/photo matching method. Based on the magnitude, orientation and spatial distribution of the image gradients, SIFT features provide a compact vector representation of an image patch [Klare and Jain 2010b]. SIFT feature vectors are first sampled uniformly from the face images and mixed together separately for sketch and photo images. For NN matching Euclidean distance computed between concatenated SIFT feature vectors of sketch and photo images.

2. Composite sketch based face recognition

These studies focused on face recognition using composite sketches which are synthesized by composite software system.

Yuen et al. [Yuen and Man 2007] uses the both features i.e. local and global to represent sketches. This face recognition method required user input in the form of relevance feedback in the recognition phase. The second two focus on holistic [Klare and Jain 2013] representation.

The holistic method [Klare and Jain 2013] uses similarities between local features Computed on uniform patches across the entire face images. Later translate it into a facial sketch/mug shot into 154 uniform patches, SIFT [Lowe 2004] and multi-scale local pattern (MLBP) [Ojala et al. 2002] invariant features are extracted from each patch. With this feature encoding, as improved version of the common representation from [Klare and Jain 2010b] is applied, later RS-LDA [Wang and Tang 2006b] is applied to generate a discriminative subspace for NN matching with cosine distance. The score generated by each feature and patch are used for final recognition.

III. PROPOSED SYSTEM

This study proposes an automatic matching of composite sketches to mug-shots gallery set. Instead of professional artist in propose system we are using input image which is synthesized by using composite software. Different composite software's are available like Identikit, FACES, EvoFIT, Mac-a-Mug. By using this system we can synthesize a sketch by selecting facial components.

These synthesize sketch or photo image will be provide to the recognition system. This face recognition system can take a input in the form of photo image or sketch image.

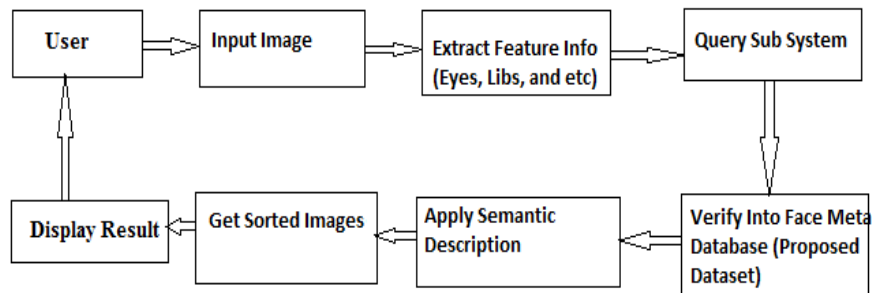


Figure 1. Block diagram of proposed system

In previous work author also used component-based approach for matching sketches to facial photographs. In that they used MLBP algorithm to extract the features of images. For each image feature information is stored in dataset. When any new image comes for matching then features for that image also calculated. By measuring the similarity score matching is provided. To obtain the overall sketch-photo similarity, similarity scores of each facial component are normalized and fused together. In propose face retrieval system also we are using a component-based approach for face recognition. In this we are maintaining a set of facial components for matching. Instead of comparing whole input image with the image from gallery set, we compare each facial component from the data set of facial components. When any new image comes for matching then we extract the features of it and then we compare the each facial component with data set of facial component. For each facial component we will get matching image from gallery set. Depending on the facial component we will get sorted images from dataset. For better accuracy gender information is maintain. To increase the similarity score at the run-time face component localization can be change by using composite sketch software.

Algorithms that are used for matching input image to facial photos as follows:

K-Means Algorithm

This algorithm is to find the neighboring pixels in clusters.

- 1) Compute the Euclidean distance
- 2) Order the labeled examples by increasing distance
- 3) Find a heuristically optimal number k of nearest neighbors, based on RMSE. This is done using cross validation
- 4) Calculate an inverse distance weighted average with the k-nearest multivariate neighbors

Canny Edge Detection Algorithm

This algorithm is used to detect the edges of the face.

- 1) Apply Gaussian filter to smooth the image in order to remove noise
- 2) Find the intensity gradients of the image
- 3) Apply non-maximum suppression to get rid of spurious response to the edge detection.
- 4) Apply double threshold to determine potential edges
- 5) Track edge

IV. EXPERIMENTAL RESULTS

Table 1.Dataset collection table

Dataset Name	Number of images	Normal	Mugshot
MEDS-I	712	611	101
MEDS-II	1306	1243	163

Table 2.Match Percentage based on eye detection-Average matching rate (%) at Rank-N for different type of Match

	R(1)	R(50)	R(100)	R(150)	R(200)
FaceVACS	7.1	44.7	58.0	73.0	89.7
Holistic MLBP	0.9	6.2	13.1	15.0	21.6
CBR	14.2	76.8	82.4	92.9	96.7

CONCLUSIONS

We solve the challenging heterogeneous problem of matching composite sketches to mug shot gallery. Component based representation method address the modality gap between composite sketch and photo image efficiently. In this we are avoiding comparing of whole input image with the gallery set, because its time consuming process. Instead of it we will perform matching for each individual facial component from component list to the input image. For each facial component related image will be display as result. A Component based approach gives better performance due to the accuracy of synthesized sketches. This component based approach efficiently work for age-invariant photo-to-photo matching. The main goal of this work is to provide matching to possible suspect with mug shot gallery set.

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