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**IMPLEMENTATION OF ENHANCED UNIFORM CIRCULAR LOCAL BINARY  
PATTERN ALGORITHM FOR SKETCH RECOGNITION**

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**ABSTRACT**

To determine the uniqueness of criminal, growth in biometric technology have provide law enforcement agency other tools but, several crimes take place where none of the information is present, but instead an eyewitness description of the crime is presented. In these circumstances, a forensic artist is commonly used to work with the eyewitness in order to draw a sketch that depicts the facial look of the criminal according to the spoken description. Forensic sketches differ from view sketches in that they are drawn by a police sketch artist using the description of the issue provided by an eyewitness. Because face sketches represent the original faces in a very short recognizable form, they play an vital role in criminal investigations, human illustration discernment, and face biometrics. Normally forensic sketches and digital photo can be poor quality a multiscaleretinx, wiener filter and discrete wavelet transform techniques are used for preprocessing for enhancing quality of images.the proposed system Enhanced Uniform Circular Local Binary Pattern (EUCLBP) is used to extract the discreminant information present in local facial region.

**KEYWORDS:** forensic sketch, face recognition , mug shot gallery

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**INTRODUCTION**

Facial sketches are commonly used in law enforcement to help in identifying suspects involved in a crime when no facial image of the suspect is available at the crime scene (e.g., from a surveillance camera or a mobile phone). After a composite of a suspect's face is produced, authorities circulate the composite to law enforcement and media outlets with the hope that somebody will identify the individual and provide related information leading to an capture. Facial sketches are particularly important when eyewitness' or victim's descriptions are the only form of evidence available. Unfortunately, this process is ineffective and does not influence all existing resources, in particular, the extensive mugshot databases maintained by law enforcement agencies. Successful techniques for manually matching facial composites to mugshots will improve the effectiveness of facial composites and allow for faster apprehension of suspects.

Facial composites used in law enforcement can be divided into three categories:

(i) Hand-drawn composites: Facial composites drawn by forensic artists based on the description provided by a witness. Hand-drawn composites have been used in criminal investigations dating as far back as the 19th century.

(ii) Software-generated composites: Facial composites created using software kits which allow an operator to select various facial components Software-generated composites have become a popular and more affordable alternative to hand-drawn composites. According to, 80% of law enforcement agencies report using some form of software to create facial composites of suspects. We note that, based on conversations with law enforcement agencies, the actual adoption and use of composite-generation software may be lower than reported in.

(iii) Surveillance composites: Facial composites drawn by forensic artists based on poor quality surveillance images. Surveillance composites are used in scenarios when commercial-off-the-shelf (COTS) systems are expected to fail on query (probe) face images.

## RELATED WORK

Pong C. Yuen and C. H. Man [1], proposed system consists of two phase, sketch to digital photo matching and digital photo search using appropriate feedback. The sketch to digital photo matching phase uses local and global feature measurements to determine the similarity between a sketch and a digital photo. Local feature matching consider the shape of facial feature, while global feature matching determine the geometric distance among facial features. Digital photo in the suspect database are rank by the combine distance from local and global feature matching and display through a graphics border. Using the rank list of digital image images as input, the second phase enhance the digital photo search using the user response. If the aim is found in the first phase, the search is completed, and the process is finished. if not then, positive and negative samples are collected from the user. Linear discriminant analysis (LDA) is use to discover his/her preference and represent digital photo. A new LDA projection matrix will be generate based on the response samples. The digital photos are then reranked and display on the edge. The process above will iterate until the aim is found or the eyewitness terminate the search.

Xiaogang Wang and Xiaoou Tang, Fellow[3], developed a new approach to synthesize local face structures at different scale using a Markov Random Fields model. sketch synthesis technique based on local patches. It requires a training set contain digital photo and sketch. The face area is divided into patches. During sketch synthesis, for a digital photo patch from the face to be synthesize and find a similar photo patch from the training set and use its matching sketch patch in the training set to guess the sketch patch to be synthesize. if two photo patches are analogous, their sketch patches should also be similar. The size of patches decide the scale of the face structure. a multiscale Markov Random Fields model to learn face structures at different scales.

Yong Zhang, Christine McCullough, John R. Sullins, Christine R. Bose[5], The efficiency of hand-drawn sketches by comparing the performance of human volunteers and a principle component analysis (PCA)-based algorithm. To simplify the task, the sketches that were obtained under an supreme situation artists draw sketches by looking at the faces in photographs without a time constriction. This type of sketches allows, to tackle some fundamental issues that are of awareness to both criminal investigators and researchers in biometrics. Does the face sketch recognition speed change greatly from one artist to another? If then, they might harness the interartist dissimilarity through a multisketch fusion method. The ideal sketches can be used to create a recognition baseline to standard the performance of sketches that are drawn under a more forensically realistic condition and In a sketch to digital photograph matching, human vision use certain sketch or photometric cues more efficiently than a computer algorithm, or vice versa.

Zhifeng Li, Brendan F. Anil K.Jain[8], To identify forensic sketches, present a framework called local feature-based discriminant analysis (LFDA). In LFDA individually represent both sketches and digital photos using SIFT feature descriptors and multiscale local binary patterns (MLBP). Multiple discriminant projections are used on partition vectors of the feature based representation for minimum distance matching. first partitions sketch and digital images into number of slices. It then computes scale-invariant feature transform (SIFT) and multiscale local binary pattern (MLBP) descriptors for each slice, which stay stable between sketches and photos. then it uses local-feature-based discriminant analysis (LFDA) to extract the salient features for each slice. the system measures the similarity between feature vectors to match sketches with digital photos.

Himanshu S. Bhatt, Samarth Bharadwaj, Richa Singh [9], An automatic algorithm for matching sketches with digital face images using the Weber's local descriptor (WLD). WLD is used for representing images at multiple scales with circular encoding. The multiscale analysis helps in assimilate information from minute features to the most major features in a face recognition. Mimetically optimized distance measure is used for matching sketches with digital face images. The corresponding algorithm improves the performance by assigning optimal weights to local facial regions. To additionally improve the performance, a Discrete Wavelet Transform (DWT) fusion based preprocessing method is offered to improve the forensic sketch and digital image. MCWLD representation for a given digital image is constructed by tessellating the digital face image and compute a descriptor for each region. MCWLD encodes significant micro patterns from local regions to form facial signatures of both sketches and digital face images and memetic optimization based weighted distance is used to match two MCWLD histogram.

Hu Han, Brendan F. Klare, Kathryn Bonnen, and Anil K. Jain[12], Unlike sketches hand drawn by artists, composite sketches are synthesize using one of the number of facial composite software systems available to law enforcement agency. To calculate the similarity between a composite sketch and digital photograph a component based

representation (CBR) approach. manually detect facial landmarks in composite sketches and digital photos using an active shape model (ASM). Features are extract for each facial component using multiscale local binary patterns (MLBPs), and per component similarity are calculate. Finally, the matching score obtained from individual facial components are merged together, Matching performance is more enhanced by filtering the large gallery of digital images using gender information. These are useful for law enforcement investigation of the variations in the quality of composite sketches synthesize by two users of different cultural environment suggests that users of facial composite software should be train to reduce the cross race bias in order to create high quality composite sketches for prospective suspects of various race. The second approach to sketch recognition attempt to learn or design feature representations that reduce the infraclass difference caused by modality gap while preserving interclass separability.

## PROPOSED WORK

To extract discriminating information from local regions of both sketches and face images using the automatic algorithm. An Enhanced Uniform Circular Local Binary Pattern (EUCLBP) is used to extract the structural information along with minute details present in local facial regions. memetic optimization algorithm is proposed to assign optimal weight to every local facial region to boost the identification performance, a Discrete Wavelet Transform (DWT) fusion based preprocessing technique is used to improve the quality of images and improve the identification performance. Enhanced Uniform Circular Local Binary Pattern Matching Algorithm extracts perceptive information present in local facial regions at dissimilar levels of granularity. Both sketches and digital face images are decaying into multi resolution pyramid to preserve high frequency information which forms the perceptive facial patterns. The Extended uniform circular local binary pattern matching descriptors use these patterns to form a unique signature of the face image. More, for matching, a mimetic optimization base method is planned to find the optimum weights corresponding to each facial region.

## IMPLEMENTATION

### Preprocessing

A Multiscale retinex(MSR) i.e a retinex which combines several Single scale retinex(SSR) outputs to produce a single output image which has both dynamic range compression and color constancy and good tonal rendition.a single scale retinex(SSR) is can either achieve color rendition or dynamic range compression bt not both. MSR overcome this limitations both color constancy and dynamic rande successfully accomplished. the multiscale retinex (MSR) algorithm with four iterations. MSR is applied on both red\ and luma channels.

MSR can be written as,

$$F_i(x, y) = \sum_{n=1}^N W_n \cdot \{\log [S_i(x, y)] - \log [S_i(x, y) * M_n(x, y)]\}$$

Whrere ,N number of scales, weight associated with the nth scale



Fig: Input digital and sketch images from database



Fig2: multi scale retinex output

Noise removal in the previous step may lead to blurring of edges. symmetric low pass filter of size 7x7 with standard deviation of 0.5 efficiently restores the genuine facial edges. Applying this Wiener filter. Wiener filtering is an effective linear image restoration approach. The task is to find the estimate of the “best” image  $f$  is done usually in frequency domain:

$$\hat{F}(u, v) = \frac{|H(u, v)|^2}{H(u, v)|H(u, v)|^2 + |N(u, v)|^2 / |F(u, v)|^2} G(u, v),$$

where  $H(u,v)$  is the degradation function,  $G(u,v)$  is the Fourier transform of the degraded image,  $N(u,v)$  is the power spectrum of noise,  $2 F(u,v)$  is the power spectrum of the undegraded image. The Wiener filter performs deconvolution in the sense of minimizing a least squares error i.e.:  $e^2 = E\{(f - \hat{f})^2\}$ , where  $E$  is the mean value,  $f$  is the undegraded image which is usually not known.



Fig3. wiener filter output

After computing the globally enhanced red and luma channels, DWT fusion algorithm is applied. to compute a feature rich and enhanced face image Single level DWT (with db 9/7 mother wavelet) is applied to obtain the detailed and approximation bands of these images.let, LL, LH ,HL and HH be the four subband where LL represents the approximation

Sub band, and LH, HL, and HH represent the detailed subbands. To preserve features of both the channels, find the average of and for the coefficients from the approximation band. The approximation band of the enhanced image. All three detailed subbands are divided into windows of size  $3 \times 3$  and the sum of absolute pixels in each window is calculated. For the  $i$ th window in HL subband of the two images, the window with maximum absolute value is selected to be used for enhanced subband HL. Similarly, enhanced subbands HLand HH are also obtained.



Fig4. Discrete Wavelet transform output

Finally, inverse DWT is applied on the four subbands to generate a high quality face image.



Fig5. Inverse Discrete wavelet transform

**Feature Extraction by using EUCLBP**

LBP represent the description of pixel region image in the binary form. Basic LBP operator uses eight pixels of neighborhood, accepting the central pixel as a threshold. Pixels with the values, higher than the central one (or equal to it), accept the value 1, those which are lower than the central one, accept the value of 0. Thus, we get the eight-bit binary code, which describes the pixel vicinity. An extension of this approach is to have the pixel neighbors well separated on a circle around a central pixel. The circle can have different diameters and varying number of neighbors to account for texture at different scales. Similar to basic LBP, Circular LBP (CLBP). CLBP is extended to Uniform Circular Local Binary Patterns to achieve robustness to rotation variations and dimensionality reduction. A binary pattern is called uniform binary pattern if it has at most two bitwise transitions from 0 to 1 or vice versa.

Uniform LBP determine only important local textures, such as ends of lines, edges, angles, spots. Encoding difference of signs between the neighbouring pixels is not sufficient for describing facial texture. Other important features could also be derived from the information that lies in the difference of the gray level values. A method to encode the exact difference of gray level intensities and reported a marked improvement in the performance of texture descriptors. This forms the motivation to further extend Uniform CLBP to encode exact gray level difference along with the original encoding. The proposed descriptor is called Extended Uniform Circular Local Binary Pattern. The combination of the exact gray level difference and adds a complimentary layer of discrimination on top of the original descriptor which provides the assimilated information. Layer 1 is Uniform CLBP that encodes difference of signs while the other three layers encode the exact gray level differences. We experimentally observed that Layer 1 and Layer 2 of EUCLBP are the most discriminating. Therefore, the final descriptor is the concatenation of Layer 1 and Layer 2 histograms.

#### **Memetic Algorithm For Matching Sketches Images**

Memetic algorithm (MA) can be successfully used to optimize such large search spaces. It is a form of hybrid global-local heuristic search methodology. The global search is analogous to traditional evolutionary approaches such as population-based method in a Genetic Algorithm (GA), while the local search involves refining the solutions within the population. From an optimization perception, MAs have been established to be more efficient and effective than traditional evolutionary approaches such as GA. In this research, memetic algorithm is used for weight optimization.

The steps involved in the memetic optimization process are described below:

1. **Memetic Encoding:** A chromosome of length is encoded where each unit in the chromosome is a real valued integer representing the equivalent weight.
2. **Initial Population:** A population of 100 chromosomes is generated starting with a starting point chromosome.
3. **Fitness Function:** Fitness is evaluated by performing recognition using the weights encoded by each chromosome. 10 best performing chromosomes from a population are selected as survivors to perform crossover and mutation.
4. **Hill Climbing Local Search:** The survivors obtain in Step 3 are used to find superior chromosomes in their local neighborhood and parents are selected.
5. **Crossover and Mutation:** New population is generated from parents obtained after local search in Step 4. A set of uniform crossover operations is performed followed by mutation. To avoid local optima, adaptive mutation and random offspring generation techniques are used.
- 6: Repeat Steps 3–5 till convergence criteria is satisfied.

## **EXPERIMENTAL RESULT**

In this paper, we have done our experimental setup based on the image processing tool to make the analysis for the feature extraction and to find the matching image in the data sets.



*Fig6 Matching sketch with digital image*

Recognition Rate by using EUCLBP and Memetic optimization are given in below table

Prob Data set	Recognition Rate in%
10 Images	80%
20 Images	85%
30 Images	73.33%
40 Images	82.5%
50 Images	86%

*Table 7 Recognition Rate*

## CONCLUSION

Forensic face sketch matching technique is tried to improve the enhancement in current state of the art face sketch matching systems. Since, there are some limitation on forensic sketch and digital image Recognition. To overcome the Recognition problem, the preprocessing and feature extraction technique(EUCLBP) is used for face sketch recognition.

## FUTURE SCOPE

In future work, to calculate the optimized weight for the feature extracted image and then match it with the data set which obtain the top matches. Semi-forensic sketches are introduced to bridge the gap between viewed and forensic sketches. Training on semi-forensic sketches can better model the variations for matching forensic sketches as compared to algorithms trained on viewed sketches.

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