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A Novel Feature Extraction Method for Texture and Shape Analysis of Face Makeup Database

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***Abstract*—** Human face images are very important for the identity of human faces and used for many applications such as authentication, or medical fields for analysis. The face retrieval and detection from the large database is a difficult problem. It becomes more challenging in the presence of makeup on the faces. Makeup is done in the different parts of the face such as lips, eyes, or on cheeks. Therefore, it is required to first detect the makeup on the image and then use efficient face recognition method. In this paper a novel texture and shape based feature extraction methods are presented using the wavelet based feature fusion for the efficient face recognition. The goal is to recognize the quarry face within the image database. The detection algorithm is very simple and fast to work for large databases. First a random quarry image is picked from database then features are extracted from both quarry and template images. Method first resizes the quarry and template images and then calculates features in RGB domain. For the texture analysis the Local Ternary Pattern (LTP) based feature are adopted in place of Local binary pattern (LBP). For feature enhancement the wavelet based fusion of lower and upper LTP patterns are proposed in the paper. Method is calculated and compared for images with and without makeup. To analyze the shape features Histogram of Gradient are plotted. The performance of our proposed feature extraction is tested using the Face images of man's and women's with heavy and light makeup and also without makeup.

***Keywords*—** Face Recognition, Makeup Detection, Feature extraction, Histogram of Gradient, Image binary patterns

I. INTRODUCTION

It is observed that, efficiency of the many face recognition systems degrades under the presence of the facial makeup on the human face. During feature based matching methods a quarry face image is picked and compared with the template face image in database. It is done by the features like Texture [10]; Shape [1] or Statistical color [5] based parameters to improve the efficiency of face recognition [1],[3]. The basic block wise processing steps of the makeup face image retrieval is shown in the Figure 1. Face recognition is a three step procedure. It can be seen clearly from the Figure that quality of the feature extraction is the prime factor for improving the efficiency of face detection system and it must be excellent. The current paper focused on detection of the facial makeup which can be further used for improving the efficiency of the Face recognition systems. By using this approach one can retrieved their desire Face image from the database based on visual and local content. Face recognition is widely used for applications Viz. data mining, person identification [2],[4],[5], real time video surveillance applications. In this paper it is proposed to extract the features by considering the local context to achieve the more accurate extraction efficiency. Method initially takes the face images and template images from database, compute feature extraction and then the matching techniques are used for detecting or matching the desired images with increased efficiency. The wavelet based feature fusion is used for feature enhancement. There are different kinds of features of image used to represent or match the desired quarry images. The Reference makeup images are shown in the Figure 2 below.

Figure 2 Reference makeup series images taken from [3]

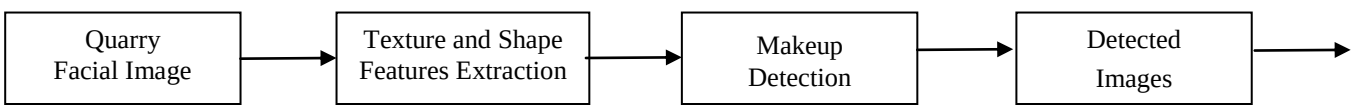


Figure 1 Block diagram of the facial makeup detection process

Remaining paper is organized as follows: Section II present the classification and reviews of the existing face makeup detection methods and their challenges. In section III various challenges of the feature extraction and face recognition methods are addressed. In section IV the basics feature extraction methods are described. Section V few experimental results are presented. Section VI gives conclusion and future work.

II. LITERATURE REVIEW

Different kind of makeup methods have been used and applied on the different face regions. Makeup can be classified as categories of Light makeup or Heavy makeup. In the light makeup the applied colour is correspond to natural skin, lip and eye colors. In the case of heavy makeup, the red or dark lips are strongly visible to human. Neslihan et al [1] proposed an efficient method for the makeup detection using the texture and shape features for the detection. The method seams to improve the efficiency and to minimize the computation cost but slightly complex. Cunjian et al [2] have presented an automatic method using Gabor wavelet feature descriptor for shape and LBP descriptors for the texture detection.

Classification of Face Detection Methods

There are many existing methods of face detection and feature extraction. Broad classification of the face detection methods are shown in the Figure 3.

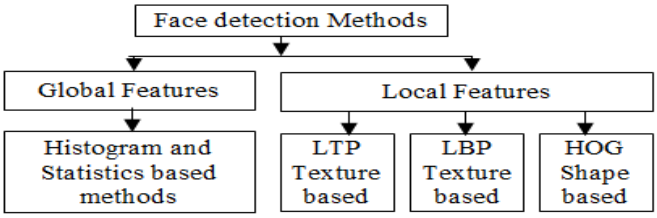


Figure 3 Classification of face detection methods

Paresh Rawat et al [5] have presented a global method of CBIR based on statistical soft computing methods. They have used HSV space and RGB space for the CBIR retrieval of true colour images.

Syed et al. [3] uses content based image retrieval based on study of texture and colour information between different facial parts and show that method improves verification performance in presence of facial makeup. As per the observation experiments are conducted on the two most challenging and unconstrained datasets containing images of female subjects. The datasets include variations in facial pose, illumination, expression, and image resolution.

Zhang, et al has proposed a comparative study of the Local derivative pattern (LDP) and the Local Binary Pattern (LBP) for feature extraction. The paper uses application in the face recognition with implementation of high-order local pattern descriptor. They efficiently used LBP method.

Histogram of Oriented Gradient (HOG) was proposed by et al. [1] for object detection used for computer vision and application in image processing for feature descriptor.. Method composed of local gradient direction histograms and hog feature are combined with SVM classifier. Paresh et al have used the soft computing techniques for CBIR template images. Summary is shown in Table 1.

In general it is found that global featu4res are prone to the background and noise especially when object is partially occluded or under the presence of geometric distortion [1],[6],[8]. It is difficult for only global method to establish effective image matching. While, local features are independent of image scaling, rotation and translation. These features are used for local texture matching.

III. CHALLENGES OF FACE DETECTION

The accuracy of any makeup detection for face recognition depends on various technical challenges major aspects can be listed as:

- Previously LGBP and HOG descriptors were combined to be used for makeup detection. LBP is simplest texture method and does not give the edge based features.

Table 1 Comparison of the existing Face recognition Systems

Author/ reference	Method Used	Kind of images (application areas)	Used colour spaces
Neslihan et al [1]	texture and shape features	Makeup image database	Proposed an efficient method for the makeup detection using the LGBP and classifier
Zhang, et al [16]	Texture based	Color Images	Feature extraction using Local Binary Pattern (LPB)
Cunjian et al [2]	Texture based	Close makeup Face images	Used ROI based local LBP feature extraction for makeup detection.
Neetu Sharma et al [9]	Color Histogram based method	True color image Databases	Matching the color histogram of template and quarry images
Our proposed work	texture and shape features	Face feature extraction makeup images	Texture based LBP and shape based on HOG method

- The experiments are conducted on three challenging datasets, which include variations in facial pose, illumination, expression, and image resolution. Two of these databases (YMU and MIW databases) were proposed in [7],[9] and the remaining database (FCD database) was proposed in [8].
- In [8], FCD database was used to analyze the impact of makeup on face recognition. In this study, it is the first time that FCD database is used for facial makeup detection purposes. The results of this study show that FCD database is more challenging compared to YMU and MIW databases.
- Since FCD database [8] provides annotation for non makeup, slight, intermediate and heavy makeup, it is the first time that the classification accuracy of a makeup detector is evaluated for multi-classes.
- The facial makeup detection approach is required to design which significantly outperforms over the state-of-the art face detection methods.
- The existing feature based methods are either inefficient for face makeup detection or are computationally too complex.

Therefore the goal of current study is to design an efficient method for face based attendance monitoring system. In this study, texture analysis is applied using LTP as the same experiments of [1],[11],17] using our wide images classes. Hence an almost exact comparison with the study [1] was possible. The results of this comparison show that the selected descriptors in our study (LGBP and HOG) are more appropriate for makeup detection compared to the descriptors selected in [1],13],[14]

IV. FEATURE EXTRECTION METHODS

In this section, we will introduce some widely used techniques for extracting colour, texture, shape and spatial relationship from images. There are many feature descriptors used for texture and shape identification. Here we are focussing on the two basic descriptors.

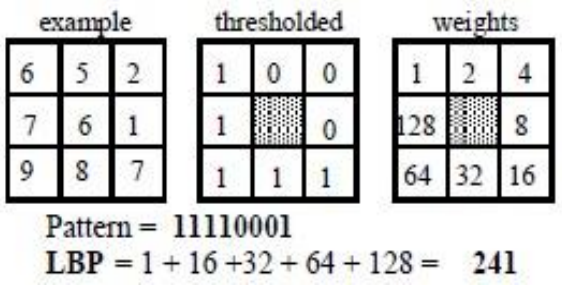
Texture analysis

There are different methods were designed for the image texture analysis or texture feature extraction. In this paper two unique and widely used texture feature methods are described. The texture of the image gives the information about its background and objects also thus are very useful in the image detection and recognition applications. Thus these texture based features are considering for current study in this paper.

1. LGBP Method: The LGBP means Local Gabor Binary Patterns. In this technique the magnitude of brightness values are encoded using the LBP operator on the Gabor features matrix. The original LBP [13,[17] labels the image pixels using the thresholding with 3x3 neighbourhood of every image pixel at the canter value as a binary number. LGBP method is used for texture identification of Facial images. In this paper local features are extracted by the Local binary pattern (LBP) [14].

The LBP features have two main benefits as they are grayscale and rotation invariant in nature. LBP is capable of representing the local extracted textures features. The Local Binary Pattern LBP computes the relations among the pixel and there neighbouring pixels. Method uses the thresholding for encoding to allow binary detection of patterns/ texture features. The simplicity of LBP feature method forces its uses in texture analysis and matching.

LBP is binary code used to represent the local texture patterns of a face image. The center gray value of mask of size 3x3 is used as threshold for generating the binary pattern in the local neighbourhoods. The LBP process is shown in the Figure 4 sequentially. In order to threshold the pixels greeter then center pixel value in neighbourhood are allotted as 1 or else as 0.



Contrast: C=(6+7+8+9+7)/5 – (5+2+1)/3 = 4.7

Figure 4 Process of LBP Calculation

2. LTP Method:

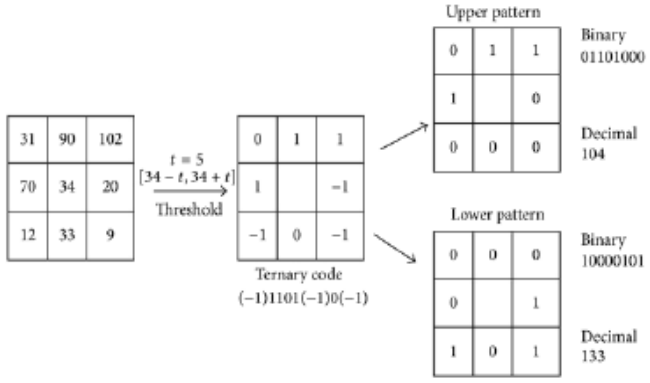
The method of texture feature extraction is named as Local Ternary Pattern (LTP) method. The procedure of calculating the LTP features for the mask size of 3 x 3 is shown n the Figure 5 a).

In this process the threshold is taken as t. Therefore, the window range assign to the current pixel is taken as to with c as intensity of middle pixel in mask. The method of LTP is similar to the LBP but it is different in the sense that it gives me a three value windowing mask. During the process the upper and lower LTP pattern are used. During upper pattern the 1's are quantized to the 1 and -1 is quantized to the value 0's and vice versa for the lower LTP. Then LTP value is calculated.

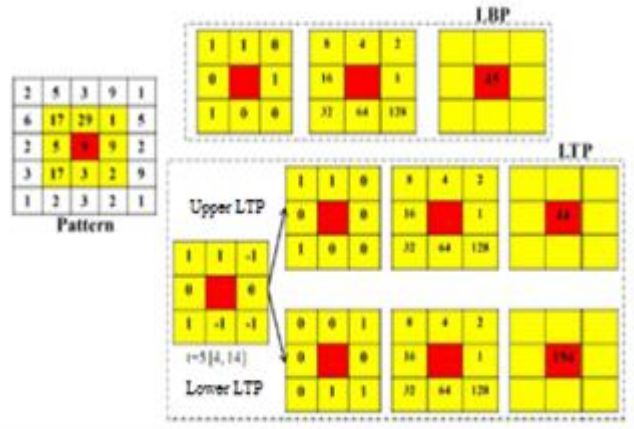
The comparison of the LBP and LTP feature generation method is given in the Figure 5 b).from Figure 5 b) the process of the upper and lower feature extraction became very clear.

It can be observed from the Figure 5 b) that, LBP is single stage and dual valued system while LTP is dual stage and three value system as 0, 1 and -1. Thus LTP offers better edge representations.

The only limitation of the LTP method is that it is slightly time taking as it performs the computation twice the time then LBP. Therefore it is required to design the fast and efficient method using LTP features.



a) Local Ternary Pattern



b) LBP vs. LTP

Figure 5 Texture extraction procedures a) LTP b) comparison of LTP and LBP methods

Shape analysis

For the shape analysis Histogram of Gradient (HOG) method is widely used. This method is used to describe the objects shapes as the edges forms and there orientations.

HOG Method: The HOG stands for Histogram of Gradients. HG is basically a dense feature extraction method used for extracting the image features. The meaning of dense is that it is capable of extracting features for all pixels or locations within the image. This descriptor is used for the shape identification.

To compose the HOG, the histograms of each pixel within a cell casts the weighted votes, by using the gradient L2 norms, for histogram channel based on orientation. Primarily the HOG method captures the shape of any structures in the region using the gradients information. Method divides an image into small 8x8 pixels cells and blocks of cell size of 5x5. Every cell is having a flat number of gradient orientations as bins.

The effect of the makeup is different in the different color components as clear from the Figure 6 presenting the RGB component of makeup images. The Red color may have maximum possibility to represent the makeup changes. Thus, this paper uses red space for feature adoption.

a) Original Tri Color image b) Red Component

c) Red Component d) Red Component

Figure 6 the comparison of RGB component and Makeup effects.

V. RESULTS AND DISCUSSIOMS

Section presents the results of extracted features from the different methods are presented for comparison. The few of the template database images are shown in the Figure 7 for the two distinct classes. It can be observed that the template images in each class are of different colours and features and true colours.

Figure 7.Two class of the sample images of makeup images used for database each row of the figure representing the one class of images with different makeup and poses.

Texture Features Results

Some of results based on texture features are shown in the Figure 8. It can be observed that the LBP features are different for every image and give the information about the texture of the image. It can be observed that the presence of the makeup may significantly affect the image texture features. Comparison of the experimental results for normal and the HOG histograms of the input template images are shown in the Figure 9. It can be observed that the histograms of gradients for both quarry and template images are different.

a) LBP features of the image without makeup

b) LBP features of image with makeup

Figure 8 LBP texture features comparison for the makeup face images

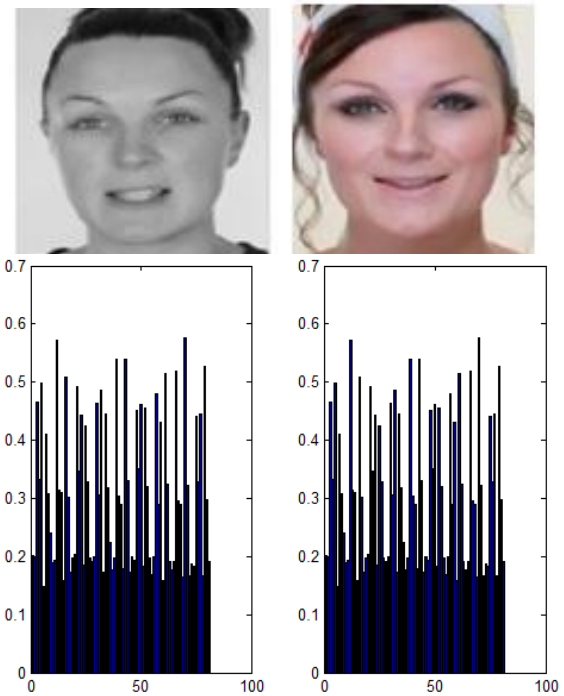


Figure 9 HOG features of the image with and without makeup

In addition, comparison of the texture features extrected by LBP and the LTP methods are presented in the Figure 9 Reterive features of the image is compared with cearfuly. Quarry and template dataset image with makup. Two distinct images for two classes are compared with dataset and it is observed that the LTP methods give the features of the human face but it requires tuning the parameters.

a) Class 1 with and without makeup

b) Class 2 feature extraction with and without makeup

Figure 10 Extracted features LLTP and LBP.

Wavelet Fusion Method WLTP

In this paper the novel wavelet based fusion method is proposed for fusing the upper and lower LTP features. The wavelet transform of 2 levels DWT is calculated and then ULTP and LLTP images are fused using the pixel level averaging method as proposed by Paresh et al [17]. Wavelet decomposition process is shown in the Figure 11.

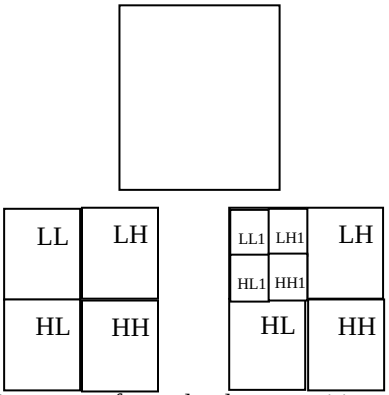


Figure 11 process of wavelet decomposition at level 1 and second level

Wavelet fused results are shown in the Figure 12 for Quarry and template images. It can be clearly observed that the fused features represent the much better features thus performs better for makeup and pose invariant case.

Figure 12 Feature Fusion result for ULTP and LLTP suing wavelet transform.

VI. CONCLUSION AND FUTURE SCOPE

A comparison of the face feature extraction methods are presents in this paper. The method of facial makeup detraction is implemented using texture and shape features retrieval methods. Methods are required to be the efficient so that it can be tested on the various face recognition systems. It is proposed that in the presence of the makeup on the face the recognition efficiency degrades. It is proposed to use the combination of the LBP and the HOG methods feature vectors for face recognition. It is concluded that there is not much changes in the HOG histograms although there is significant change in shape in the makeup images. the use of wavelet based fusion may reduce the time as well as may improve features and thus the better method is tested on the different kind databases with different expressions and textures. It is to design a fast and efficient method having better recognition performance.

REFERENCES

[1] Neslihan Kose, Ludovic Apvrille, Jean-Luc Dugel, "*Facial Makeup Detection Technique Based on Texture and Shape Analysis*" IEEE international conference and Workshop on Automatic Face and Gesture Recognition, pp. 1-7, 2015.

[2] Cunjian Chen, Antitza Dantcheva, Arun Ross, "Automatic Facial Makeup Detection with Application in Face Recognition", Appeared in Proc. of 6th IAPR International Conference on Biometrics (ICB), (Madrid, Spain), pp. 1-8 June 2013

[3] Syed Hamad Shirazi,, Noor ul Amin Khan " *Content-Based Image Retrieval Using Texture Color Shape and Region*, International Journal of Advanced Computer Science and Applications, (IJACSA) Vol. 7, No. 1, 2016.

[4] N. Kose, N. Erdogmus and J.-L. Dugelay. "*Block based face recognition approach robust to nose alterations*", IEEE International Conf. on Biometrics: Theory, Applications and Systems (BTAS), pp. 121-126, 2012.

[5] Neetu Sharma, Paresh Rawat,, "*Efficient CBIR using color Histogram Processing*", A Robust CBIR System, " in Lambart publication Germany 2011.

[6] N. Kose and J.-L. Dugelay. "*Mask spoofing in face recognition and countermeasures*", Image and Vision Computing Journal - Elsevier, Special Issue of IMAVIS - Best of Automatic Face and Gesture Recognition 2013, Vol. 32, no. 10, pp. 779-789, July 2014,

[7] Y. P. Chen, S. Z. Li, and X. M. Lin, "*Fast hog feature computation based on cuda*," in *Computer Science and Automation Engineering (CSAE) IEEE International Conference on*, 2011, pp. 748–751 *,2011*.

[8] M.-L. Eckert, N. Kose and J.-L. Dugelay. "*Facial cosmetics database and impact analysis on automatic face recognition*", IEEE Int. Workshop on Multimedia Signal Processing (MMSP), pp. 434-439, 2013.

[9] C. Chen, A. Dantcheva, and A. Ross. "*Automatic Facial Makeup Detection with Application in Face Recognition*", International Conf. on Biometrics (ICB), pp. 1-8, 2013.

[10] S. Varshovi. "*Fjm yjacial makeup detection using HSV color space and texture analysis*", Master's thesis report , Concordia University, Canada, 2012.

[11] C.-C. Chang and C.-J. Lin. "LIBSVM: A library for support vector machines", ACM Trans. on Intelligent Systems and Technology, vol. 2, pp. 1-27, 2011.

[12] L. Apvrille and A. Apvrille. "Pre-filtering Mobile Malware with Heuristic Techniques", Proceedings of GreHack' 2013, Grenoble, Nov. 2013.

[13] S. Z. Li and A. K. Jain, editors. Handbook of Face Recognition, 2nd Edition. Springer, 2011.

[14] Y. Fu, G. Guo and T. S. Huang. "Age synthesis and estimation via faces: a survey", IEEE Trans. on PAMI, vol. 32, pp. 1955-1976, 2010.

[15] W. Zhang, S. Shan, et al. "Local Gabor binary pattern histogram sequence (LGBPHS): a novel non-statistical model for face representation and recognition", Proc. ICCV, pp. 786-791, 2005.

[16] A. Dantcheva, A. Ross, C. Chen, "Makeup challenges automated face recognition systems", SPIE Newsroom, 2013.

[17] T. Ojala, M. Pietik¨ainen, and T. M¨aenp¨a¨a. "Multiresolution gray-scale and rotation invariant texture classification with local binary patterns", PAMI, vol 24, pp. 971-987, 2002.

[18] O. Ludwig, D. Delgado, et al. "Trainable Classifier-Fusion Schemes: An Application To Pedestrian Detection", Int. IEEE Conf. On Intelligent Transportation Systems, pp. 432-437, 2009.

[19] G. Rhodes, A. Sumich and G. Byatt. "Are average facial configurations attractive only because of their symmetry?", Psychological Science, vol. 10, pp. 52-58, 1999.

[20] S. Ueda and T. Koyama. "Influence of makeup on facial recognition", Perception, vol. 39, pp. 260, 2010.

[21] G. Guo, L. Wen and S. Yan. "Face Authentication with Makeup Changes", IEEE Trans. on Circuits and Systems for Video Technology, 2013.

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