A Literature Review on Facial and Expression Recognition with Advanced Image Descriptor Template

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ABSTRACT
The most recent advancement of both software and hardware technologies has created more demand for personalized interaction. Finding efficient facial features to represent face appearance is the most critical aspect in face recognition. Automatic facial expression recognition has become a progressive research area since it plays a vital role in the human-computer-interaction where the facial expression recognition finds huge application in areas like social interaction and social intelligence. A review of various descriptors and techniques used in facial expression recognition like the Gradient faces,local features, local binary pattern (LBP), local ternary pattern(LTP), local directional pattern (LD_iP)and Local derivative pattern (LD_eP) is discussed here, and out of all LDN (Local Directional number pattern a local featuredescriptor),forfaceanalysis acts efficiently which helps to encode the directional informationof theface'stexturesinquite better compact way,which produces more discriminativecodecompared to current methods. Additionally, for facial expression recognition (FER) we introduced tensor perceptual color framework (TPCF), which is based on information contains in color facial images.

General Terms
Gabor Filter, Local Directional Number Pattern, Kirsch Mask, Derived Gaussian Mask.

Keywords
Local pattern, Tensor approach, Log-Gabor filter, face recognition, LBP, LTP, LDN.

1. INTRODUCTION
Face Recognition is leading as one of the most prior biometrics authentication techniques from the past few years. Face recognition is an interesting and successful application of Pattern recognition and Image analysis. Face recognition system has two main tasks first verification and the one is identification. Face verification means a 1:1 match which helpsto compares a face image against a template face images whose identity is supposed to be known. Face identification means a 1: N problem that compares a query face image against all image templates in a face database. Machine recognition of faces is gradually becoming very important due to its wide range of commercial applications, which includes forensic identification, access control and human interactions.

2. REVIEW OF LITERATURE
This section describes the various existing patterns which are compared in this paper

2.1 Varying Illumination Using Gradient faces
In 2009, T. Zhang, Y. Tang, B.Fang, Z. Shang, and X.Liu proposedainnovative method for face recognition in order to extractillumination insensitive features underdifferent lighting conditions called the Gradient faces. Theoretical analysis showsthat Gradient faces are anillumination insensitive measure, and equivalently robust to different illumination. Moreover, as the gradient domain explicitly considers the relationships between neighboring pixels points Gradient faces is retrievedfrom the image gradient domain in a way thatit can prominently discover the underlying inherent structure of facial images. Thus, Gradient faces have more power than the illumination insensitivemeasure which is extracted from the pixel domain. And,hence instead of generating a feature vector in the pixel domain, Gradient faces is extracted from the gradient domain, whose components are the argument of gradient.

2.2 Dominant Local Binary Patterns
In year 2009, S. Liao, Max W. K. Law, and Albert C. S. Chung, introduced a couple of sets of features: dominant local binary patterns (DLBP) in a texture image and the supplementary features which are extracted by the circularly symmetric Gabor filter responses and apparently the dominant local binary pattern method prominently makes use of the most frequently occurred patterns in order to capture the descriptive textural information, whilecomparatively the Gabor-based features aim to supplythe additional global textural information to the DLBP features. This paper proposes a new approach to extract image features for the texture classification. The proposed features are, less sensitive to noise, histogram equalization, robust to image rotation.

2.3 Enhanced Local Texture Feature Sets
In 2010, X. Tan and B.Triggs, introduced LBP and its generalization LTP. LBP encodes the local neighborhood intensity with the help of center pixel setting it as a threshold for a sparse sample of the neighboring pixels. A few number of pixels used in this method introduce several problems. Firstly, it limits the accuracy of themethod. Secondly, the method discards most of the information in the neighborhood. And hence, it makes the method very sensitive to noise. The most important properties of LBP are its computational simplicity and tolerance regarding monotonic illuminationchanges. To address this problem, Tan andTriggs extended the original LBP to a version with 3-valuecodes, which is called local ternary patterns (LTPs). The LTP codes are moreresistant to noise, but equally no longerstrongly invariant to gray-leveltransformations. One

problem of LTP is to set threshold t,which is definitely not simple.

2.4 A Local Directional Pattern Variance (LDPv)

In 2010, Md. Kabir, T. Jabid, O.Chae, introduced the LDP and LDPv feature, overcomes the limitations of LBP features since the LDP is obtained from the edge responses which are less sensitive to varying illumination and noises. The LDP variance (LDPv), which characterizes both the spatial structure (LDP) and contrast (variance of local texture) information for more perfect and accurate facial expression recognition. Each LDP code is derived from the relative edge response values in all the eight directions, and later, the LDPv descriptor of a facial image is generated with the help of integral projection of each LDP code weighted by its corresponding variance. The performance of LDPvrepresentation is evaluated by two machine learning methods: Support Vector Machine (SVM) and Template matching and that too with different kernels.

2.5 Local Derivative Pattern (LDP)

In Feb 2010, B. Zhang, Y.Gao, S. Zhao and J.Liua introduced high-order local pattern descriptor, local derivative pattern (LDP).LDP isa general framework in order to encode directional pattern features based on the local derivative variations,which helps to capture more detailed information thanlocal binary pattern (LBP).Apart from LBP encoding the actual relationship between the center and its neighbors, the LDP templates helps to extracts high-orderlocal information by encoding various spatial relationships which exists in a given local region. The high-order LDP consistently performs quite better compared to LBP for both face identification and verification under various conditions.

2.6 Gabor Magnitude and Phase

In May 2010, S.Xie, S. Shan, X. Chen and J. Chen, proposed the local Gabor XOR patterns (LGXP), which helps to encode the Gabor phase by using the local XOR pattern (LXP) operator. Then, they introduced block-based Fisher's linear discriminant (BFLD) in order to reduce the dimensionality of the proposed descriptor and equally to enhance its discriminative power. Finally, by using BFLD, they fused the local patterns of Gabor magnitude and the phase for face recognition purpose.

2.7 An Optical Flow-Based Approach

In 2010, Chao-Kuei Hsieh, Shang-Hong Lai, and Yung-Chang Chen proposed an integrated face recognition system that is perfectly robust againstthe facial expressions by combining the information from computed intraperson optical flow and the synthesized face image in a proper probabilistic framework. However, this proposed integrated system is more computationally costly compared to the previous works, since the image synthesis, optical flow computation, and the probability calculations are needed for all candidates in the database. It input's only one OF-Syn operator in our past work and there is no need of image synthesis in the weighted optical flow algorithm.

Table 1.Comparisontableon theliteraturesurvey

Name	Method	Performance	Limitations
Eigenfacesvs.Fisherfaces	Fisher'sLinearDiscriminant	Recognitionrate higher thanPCA	Globalfeature vectorsare generated
Recognizing FaceswithPCA andICA	Independent ComponentAnalysis	Recognitionrate is improvedcomparedto PCA andFLD	Computational-lyexpensive thanPCA
MultilinearImageAnalysis forFacialRecognition	MultilinearImageAnalysis	Recognitionratehigher thanPCA	LessperformancethanColorSubspaceLDA
GaborFilter BasedFaceRecognitionTechnique	2-DGaborFilterBank	Higherrecognitionrate thanPCA, LDA, 2DPCA, Global EigenApproach	Lowandhighfrequencycomponentattenuate
Localbinarypatterns	LocalGaborBinary pattern	Betterrecognitionrate thanGaborfilterbank	Colorinforma-ionis not included
Local directional number pattern	LDN code using compass mask	Encodes face texture in compact way	System is less effective if facial expressionvaries
Color information	GlobalEigenApproach usingColorImages	YUVcolorspace has highestrecognitionrate	RGBcolorspacedoesnot provideanyimprovementin recognitionrate
Tensor perceptual color framework	LDA Classifier	Color components provides additional information	Computation-al complexity

2.8 Dominant Neighborhood Structure

In year 2011, Fakhry M. Khellah, introduced new global texture descriptor that is based on the texture DNS. The DNS features are robust to rotation-invariant and noise. In order to derive both the local and global information in texture image, the proposed global features are combined with the localfeatures which are obtained from the LBP method. The proposed texture features are obtained by producing an estimatedglobalmap which represents themeasured intensity similarity betweenany given image pixel and its surrounding neighbors within a certain pixel window structure.

2.9 Local Directional Pattern (LDP)

In 2013, D.Kim, S.Heon Lee and M.Sohn, presented a novel approach for achieving the illumination invariant face recognition via LDP image. Most of the past face recognition researches based on LBP utilized the descriptor for the extraction of histogram feature of a face image. Similarly to LBP, LDP descriptor is also utilized to extract the histogram facial features in past researches. The proposed approach has a positive point that the illumination effects can be degraded by using the binary pattern descriptor and the 2D-PCA is more robust against illumination variation as compared to global features.

2.10 Local directional number patterns

In year2013, A.Rivera, J.Castillo, and O.Chae, proposed another local feature descriptor, local directional number pattern(LDN), for face analysis (face and expression recognition). LDN helps to encode the overall directional information of the face'stextures in a way better compact way. A LDP operator calculates the edge response values in allof the eight directions at each pixel position and later it generates a code from the relative strength magnitude. As the edge responses are more illumination insensitive and noise insensitive as compared to intensity values, the resultant LDP feature then describes the local primitives. Given a central pixel in a particular image, we compute the eight directional edge response values with the help of Kirsch masks in eight different orientations.

3. PROPOSED SCHEME

3.1 Tensor based perceptual color framework

This framework is used for face appearance identification suggested to access under different color space transformation. The tensor perceptual color framework (TPCF) enables multilinear image analysis in different color spaces, and resembles that color components provide additional information for robust FER. The significant role played by this framework is the emotion recognition of image texture. A perceptual color space provides effective efficiency for face appearance using face pictures with lighting conditions. With the help of Viola-Jones method based on the Haar-like features algorithms the face area of an image is detected. Log-Gabor filter is proposed for feature extraction, which allows more information to be captured with desirable high pass characteristics.

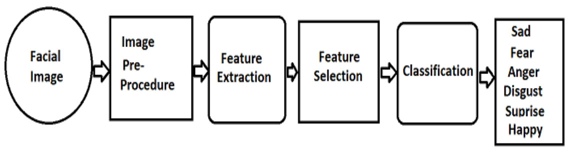

Figure 1. System Level Diagram

In the proposed system we are going to compare different standard databases such as FERET, JAFFRE and will improve the accuracy of emotion detection, as well as our system will detect whether the given image is Human face or not.

4. CONCLUSION

LBP: Despiteof simplicity in the bit string coding strategy, it discards most informationof the neighborhood. Forexample, the Ld_iP and Ld_eP methods miss some directional information by treating all directions equally. Also, they are quite sensitive tonoise and illumination changes, as the bits in the code will flip andthe code will represent a totally different characteristic. To avoid these sorts of problems,we investigate a new approach, Tensor based feature level facial expression approach which is used to evaluate with face database under the different color transformation and resolution. The current state the technique for facial expression classification mostly focuses on Gray-scale image, while rarely considering color image features. In order to achieve broad spectral information and to have ample bandwidth Log-Gabor filter is used which is Gaussian when viewed on a logarithmic frequency scale, which in return allows us to capture more information.

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