Texture Feature Based Local Binary Pattern for Smile Recognition

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Abstract- **Automatic facial expression recognition has become very popular now days due to its applications in friendly human machine interface. In this paper we propose a feature named Local Binary Pattern (LBP). For facial Feature recognition LBP is the most prominent texture classification feature. By using LBP method we are going to recognize the Smile in the faces. Smile expression represents the happy expression in the face. Hence, by using LBP method we can recognize the smile in the faces of the persons. There are several expressions present in the faces like happy, sad, dull, surprise etc.., in all these we recognize the smile face nothing but the happy face. Local Binary Pattern (LBP) uses two binary values i.e 1 and 0, 1 represents the fore-ground and 0 represents the Back-ground . It discriminates bright object against dark back-ground vice-versa. It is very simple to implement and it is robust to small fluctuations in the pixel values. It is very efficient in recognizing the facial features. But this LBP is not resistant to noise. Hence , this paper extends Local Binary Pattern (LBP) to Local Ternary Pattern (LTP) which is robust to noise. It uses three values 0,1,-1 in which 0 represents foreground, 1 represents Back-ground and -1 represents Noise in the image and gives excellent results when compared with the LBP. Experiments have been done on standard databases .**

Keywords: Fisher-faces, LDA, DRLTP, FLTP, Emotions and Decision making

I. INTRODUCTION

Face recognition plays an important role in our daily lifes in decision making system which has been widely used to identify criminals at various places providing security. Face recognition is an interesting and challenging task and is used in peoples everyday life ranging from identifying criminals providing security and surveillance systems to smart phones, smart homes and intelligent digital photography, biometrics etc.., Facial expression recognition is playing prominent role in pattern recognition, computer vision, artificial intelligence and other fields. Most important expression in the face is "SMILE" Several applications are running in now a days.one of the application is detecting the smiles when taking photos. Here, we can extract the features of a human faces by two methods. One of the method is Geometric feature based method and other is Appearance based method. In Geometric feature method it utilizes the shape of the face-components like mouth, Eyepair,nose..,etc where as in appearance based method image filters are applied to whole face or certain area to extract only particular features like eyebrows, Left Eye , Right Eye ..,etc . In Smile Recognition we go for the mouth feature by using LBP and LTP methods.

In this Paper, we are proposing two methods LBP and LTP. These methods are mainly used to extract the mouth feature in the human faces inorder to recognize the Smile. Different Types of Smiles like

Big Smile, Cute Smile, Small smile. Human faces exhibit different kinds of smile. Smile face is similar to the happy face. Hence, by using Proposed methods LBP and LTP we are distinguishing between Smile and NON-Smile faces. Non-Smile represents the different facial expressions of human faces like sad, disgust, surprise, Anger,Fear except happy expression. From happy faces we are extracting the mouth features which represents Smile expression. From other expressions we can represent the NON-Smile Faces.

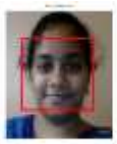
II. LBP OPERATOR

Local Binary Pattern is the most popular texture classification feature which shows the excellent face detection performance. LBP consists of two binary values 0 and 1. 1 for Foreground and 0 for Background. Each pixel in an image can be considered by 3x3 matrix. Center hood pixel value is taken as Threshold value , if the neighbor hood pixel value is greater than the threshold value then it is considered as 1 else if it is less than the threshold value ,then it is considered as 0. Here, gc represents the center pixel and gp represents the neighbourhood pixel. Center pixel value

is taken as threshold value, based on this neighbor pixel values changes. In the below equation x can be treated as neighbour value , if x greater than gc considered S(x) as 1 else 0.

$LBP = \sum_{k=0}^{7} s$(gc-gp) 2p

$$S(x) = \begin{cases} 1 & \text{if } x>=0 \\ 0 & \text{if } x<0 \end{cases}$$



20	30	8
5	7	3
31	2	4

1	1	1
0		0
1	0	0

Pattern=01000111=1+2+4+64=7

Fig. 1 computing LBP value

Here, a Face image taken and LBP operator is applied the result of the pixel values are tableted in the matrix. Each pixel is represented by 3X3 matrix. Based on the threshold values neighbor hood values are taken , Later the Binary values are converted in to decimal number. Face image consists of different colors. LBP is very simple to implement and also it is roubust to small variations in the pixel values. But , this LBP is Sensitive to noise

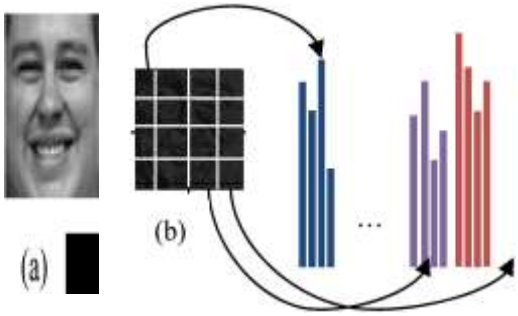


Fig. 2 Extraction of LBP features

III. LOCAL TERNARY PATTERN

Local Ternary Pattern is used to avoid noise partially in Local Binary Pattern. Local Ternary Pattern consists of three values 1,-1, 0 in which 1 represents the foreground ,-1 represents noise and 0 represents background. Later , the ternary code is converted into decimal form. LTP is the most texture classification features which gives better results than LBP. LTP preserves more textural information than the LBP. In LTP, two thresholds are taken when compared with one threshold in LBP. These thresholds creates 3 different states. One for fore-ground image, one for background and another state is to represent noise. It is robust to Noise and small pixel fluctuations when compared to LBP.

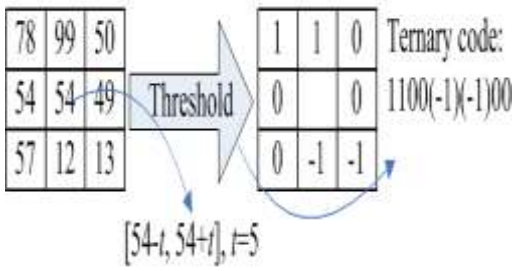
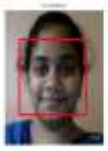


Fig. 3 computing LTP values

$$\begin{cases} 1, & \text{if } p > c + k \\ 0, & \text{if } p > c - k \text{ and } p < c + k \\ -1 & \text{if } p < c - k \end{cases}$$

According to the LTP definition , we are taking a Smile Image for that LTP operator is applied , Center pixel taken as threshold value. Based on that neighbourhood values are taken. Here, -1 represents noise, 1 represents foreground and 0 represents background.



20	30	8
12	11	6
4	11	31

1	1	-1
1	0	-1
-1	0	1

Fig. 1 computing LTP value

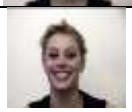
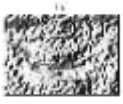
Ternary code: 1(-1)01(-1)(-1)11

Here, also binary values are convereted into decimal value and placed in that pixel in an image.LTP is very efficient in face-recognition. It is also very simple to implement and robust to small fluctuations in the pixel values. When compared with LBP, LTP method gives better results and noise is also very less in LTP when compared with LBP.

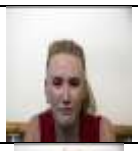
IV. EXPERIMENTAL RESULTS AND ANALYSIS:

In experiment of this paper we have taken five databases images which consists both smile images and NON SMILE images. For those SMILE and NON-SMILE images we are going to apply the proposed operaters that is LBP and LTP. Results have tablated and graphs has been drawn on the values. From the Graph it has shown that LTP operator distinguishes between SMILE and NON-SMILE images clearly when compared with the LBP operator. Hence, the LTP operator has given better performance than LBP on the standard databases. By using our proposed methods , recognition of smile becomes very simple to implement. The graphs of LBP and LTP distinguished the Smile and Non Smile images very clearly.

SMILE DATABASES

		SMILE	
DataBases	Mouth	LBP	LTP
		0.8495	0.5174
		0.8267	0.5045
		0.5701	0.4591
		0.5629	0.4799
		0.6483	0.4555
		0.6289	0.4539
		0.8173	0.5963
		0.7937	0.6011
		0.6148	0.4059
		0.6079	0.4044

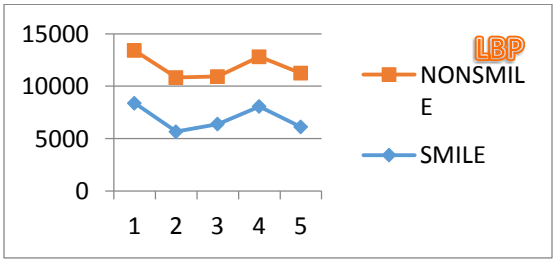
NON-SMILE DATABASES

	LBP	LTP
	5031	5723
	5157	4999
	4531	4239
	4751	4077
	5129	5566

Comparision of SMILE and NON SMILE IMAGES USING LBP

LBP	SMILE	NONSMILE
	8381	5031
	5665	5157
	6386	4531
	8055	4751
	6113	5129

Table:1

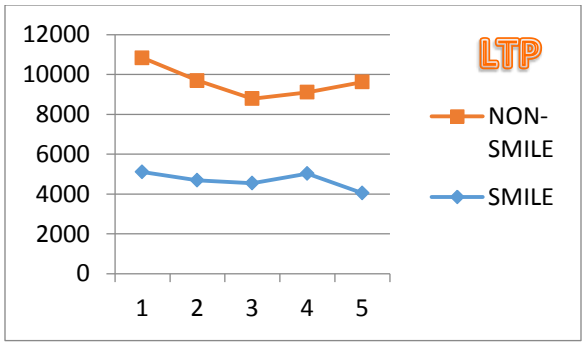


Graph-1

Comparision of SMILE AND NONSMILE IMAGES USING LTP

LTP	SMILE	NONSMILE
	5109	5723
	4695	4999
	4547	4239
	5030	4077
	4051	5566

Table:2



Graph-2

V. CONCLUSIONS

In this paper Texture Feature Based Local Binary Pattern for Smile Recognition is developed. As a system it recognizes the smile faces in the group of several face images in a photo. Because the proposed method distinguishes between the Smile Faces and Non-Smile faces easily. In the experiment analysis we are giving the faces of five databases which consists both Smile and Non-Smile faces. Later, proposed methods are applied to the faces which gives the mouth feature values in the faces. Values has been tabulated for both LBP and LTP methods. Graphs has drawn for both the methods. LTP method shown the better results than the LBP. But this paper can't find the intenssional Smile expressions in the face. In future we can extend our paper to intenssional Smile expressions in the human faces.

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