Scientific Journal of Impact Factor (SJIF): 5.71

e-ISSN (O): 2348-4470
p-ISSN (P): 2348-6406

International Journal of Advance Engineering and Research Development

Volume 5, Issue 08, August -2018

FACIAL FEATURE EXTRACTION & APPEARANCE BASED HUMAN AFFECT RECOGNITION SYSTEM

[1]Swapnil O. Shelke

[1]*M.E. Student*
[1]*Department of Computer Science & Engineering,*
[1]*Government College of Engineering, Aurangabad, India, 431005*

Abstract—*There has been enormous amount of research on face recognition which consists of modification of state of art face recognition methods to make it able to work under partial occlusion, illumination/pose changes. Those modifications came up with additional computations which have compromised with execution time for accuracy. The modified version of LRC(linear regression classification) known as CRC (census regression based classification) grabbed an attention of researchers through its recognition performance. These CRC generates census transformed test and training images then estimates importance of each pixels which takes twice amount of time than execution time of LRC. The goal of this research is to improve execution performance of CRC(census regression classification) by eventually switch to LRC face recognition system for non-Face Matching face by detecting whether the face is Face Matching or not prior to face recognition using Facial Feature Extraction of face and SVM. Experimental analysis shows that proposed occlusion Recognition method has 96% accuracy for artificially generated occlusions of face images of SQL face database and execution time has been reduced by more than 50% for non- Face Matching faces.*

Keywords— *face recognition, LRC, Facial Feature Extraction.*

I.INTRODUCTION

Face recognition is the vast research area is still being rapidly developed to deal with problems such as illumination, pose, low resolution, partial occlusion etc. In recent year, partial occlusion condition took attention of researchers to deal with it. If the area of the face is covered with scarf, goggle or hat then we can say that it is Face Matching. Some approaches are there based on segmentation of occlusion region prior to face recognition using state of art image segmentation.

There are many traditional state of art face recognition system has been modified that are 2D-PCA [6], kernel PCA, PCA-LRC, 2D-LDA .In recent year new methods has been invented known as CRC (census regression classification), Trimmed LRC (linear regression classification) based on regression classification grabbed attention of many researcher through its ability to work for low resolution and partially Face Matching face image. CRC is the modified version of LRC based on generation of weighted training set and linear regression .

In this method to generate weight vectors regarding to every training vector, census transformed training and test set is generated followed by correlation between them using hamming distance is estimated. Therefore, CRC takes twice amount of time as compare to LRC. If we consider real-time scenario like face recognition in Video surveillance, social networking, fast criminal investigations we can Surely say that every face is not Face Matching. In that situation there are not any needs of additional calculations which are dedicated for partial-occlusion problem. Although face is non-Face Matching, additional dedicated tasks is performed this takes much more amount of time as compare to previous version of that method which is not suitable for partial occlusion problem. If we consider LRC and CRC methods, as described earlier, LRC is faster as compare CRC though it is not suitable for partially Face Matching faces. We can improve execution time performance of CRC by switching to LRC face recognition system for non-Face Matching faces and CRC face recognition system for Face Matching faces by early determining of whether the face is Face Matching or not . In this paper our goal to improve execution time by performing real time decision making between LRC and CRC by early determining of whether face is Face Matching or not. For analyzing presence of occlusion we extract structural features using Local Binary Patterns Histograms (LBPH) Recognition algorithm. Local Binary Patterns Histograms (LBPH) Recognition algorithm[14] put control points on the important part of the face i.e. on eyes , mouth , nose tip ,top

of the face then we generates twelve different features known as structural features by calculating Euclidean distance between the points, details has been described in [4]. Next to that we perform binary classification (i.e. classification of test input between Face Matching and non- Face Matching) using SVM. If a classification result shows that face is Face Matching then CRC will be switched otherwise LRC will be switched will be used.

Further part of the paper is structured as follows. First we take overview on related work in section 2.Then proposed approach is described in section 3. Section 4 shows Experiment result and analysis. Finally we come to the conclusion and analysis in section.

II. RELATED WORK

Face recognition approaches grouped into direct approach and hybrid approach. In hybrid approach prior knowledge is extracted followed by occlusion segmentation and further face recognition is performed on features extracted from non-Face Matching region. Toward this goal numerous previous approaches are as follows.

Min et el [8] shown hybrid face recognition approach in which presence of occlusion is first analyzed in patch-level, using Gabor wavelets, PCA and SVM. By using generalized Potts model markov random field Face Matching part is more precisely segmented and recognition is performed on LGBPHS (local Gabor binary pattern histogram sequences) extracted features from non-Face Matching region.

Similar to approach discussed in [8], in gao et el's approach[9] first error face is generated then segmentation is performed based on region based level set segmentation , has great accuracy but region based level set segmentation require lots of iteration to properly segment the Face Matching region as well as choosing initial point on image before starts iterations is critical.

In direct approach features are directly extracted without getting prior knowledge about occlusion on face and Face Matching area segmentation features are extracted directly from test samples. It involves most of the popular traditional as well as recently published methods such as PCA and its modified work 2D-PCA [6], FW-PCA, kernel-PCA. ICA has been improved to employs locally silent information in constructing ICA basis called as locally silent ICA. SVM face recognition has been improved for partially Face Matching images known as partial SVM described in [10] in which a separating hyper plane is constrained on incomplete testing or training feature space.

Recently similar to the sparse representation based classification (SRC) that has described how to compress and represents data, LRC (linear Representation classification) has been proposed which adopts linear combination of training and testing samples.

Yang-Ting Chou et. al. [6], reported kernel linear regression classification (KLRC) algorithm, which improves the limitation of the LRC by embedding the kernel method into the linear regression, to apply a nonlinear mapping function to twist the original space into a higher dimensional feature space for better linear regression. It proves robustness for very low-resolution face recognition under severe illumination variations.

Yang-Ting Chou et el.'[12] published novel method called as Census Regression Classification to improve accuracy against partial occlusion, light illumination change condition which include census transform based similarity matching to classify important of each pixels. This research work provides the basis for the reformulation of CRC method to improve execution performance details has been provided in section 3.

III. PROPOSED APPROACH

It is necessity of noting that CRC method calculates pixel similarity of census transformed test and training image to improve accuracy for problematic condition which is defined in above sections. However, that required calculations take twice amount of time than previous version of CRC (i.e. LRC) as well as in real time situation every person cannot be Face Matching .Thus, for non-Face Matching faces it is not important to perform additional computations that are dedicated to deal with partial occlusions. Therefore in this research work we detect whether the face is Face Matching or not prior to the face recognition.

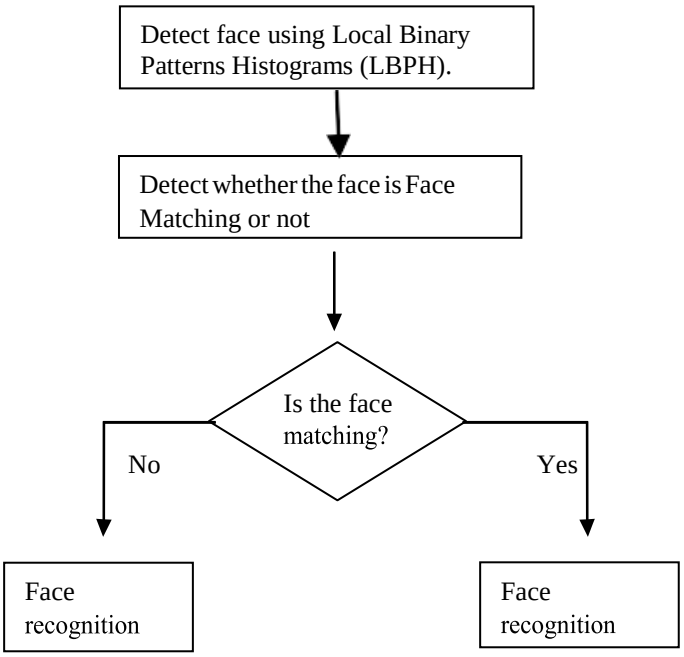

Figure1. Flowchart of proposed approach.

As shown in figure 1, if the occlusion Recognition result shows that face is Face Matching then face is recognized using CRC approach and if face is not-Face Matching face recognition is performed by LRC approach. Means for Face Matching faces the predicted vector is generated according to CRC approach but if face is not-Face Matching then the predicted vector is generated using according to the LRC. After that Euclidean distance between each of the predicted vector and original response vector is calculated followed by choosing of one of the class based upon minimum distance

A. Face Recognition: Understanding LBPH Algorithm:

LBPH face Recognition is the popular face Recognition framework which is absolutely practical stuff for real time scenario. face location is precisely detected from this face location different object is cropped; Figure.2 shows the block diagram of face which is obtained by applying the viola-Jones algorithm, from the face image different object such as left eye, right eye, nose and mouth regions are cropped and it is being shown by imposing bounding box over it. Using co- ordinates of bounding box we acquired control points which shows center of the eyes, mouth, nose tip, corner of the eyes, top of the face etc.

(a) (b) (c) (d)

Figure 2. (a) & (b) shows control points and bounding boxes if face is not Face Matching.(c) shows misplaced mouth control point & (d) shows mouth bounding box is completely overlapped and misplaced since the face is Face Matching.
However, it works fine if face is non-Face Matching, under better light condition and face is not tilted above 45 degree. But that is what we want to extract proper structural features that can distinguish Face Matching and non-Face Matching face.

1) Haar Feature Extraction:

In general, three kinds of features are used in which the value of a two rectangular features is the difference sum of the pixels within two rectangular regions. These regions have same shape and size and are horizontally or vertically adjacent as shown in Fig 3. Where as in the three rectangular features are computed by taking the sum of two outside rectangles and then subtracted with the sum in a center rectangle. Moreover, in the four rectangles feature computes the difference between diagonal pairs of rectangles.

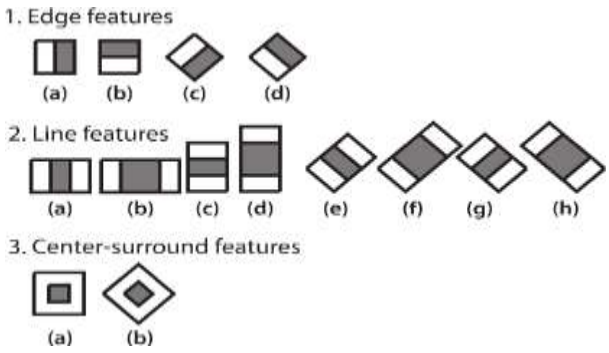

Figure 3. Example of features use in Haar-cascade

The sum of pixels in the white rectangles is subtracted for the sum of the pixels in the grey rectangles.

2) Integral image:

The integral image at location x, y contains the sum of the pixels above and to the left of x, y, inclusive:

$ii(x,y)=\Sigma$

keep ALL the weak classifiers.

Using the following pair of recurrences:

2) S(x, y)= s(x, y1)+i(x, y)

3) ii(x, y) =ii(x1,y)+s(x, y)

Where s(x, y) is the cumulative row sum, the integral image can be computed in one pass over the original image.

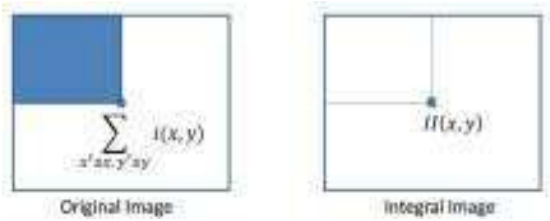

Figure 4. Shows original image and integral image

The sum of the pixels within rectangle D can be computed With four array references:

- The value of the integral image at location 1 is the sum of the pixels in rectangle A. The value at location 2 is A + B, at location 3 is A + C, and at location 4 is A + B + C + D.

The sum within D can be computed as 4 + 1 − (2 + 3).

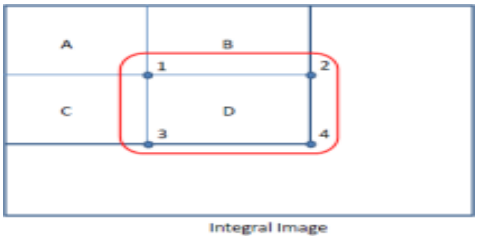

Figure 5. find sum of dawned rectangular area.

A. Facial Feature Extraction:

Real time nature of Local Binary Patterns Histograms (LBPH) Recognition algorithm in which if face is Face Matching then facial components such as eyes nose , mouth etc should wrongly detected means control points or bounding boxes should be misplaced as shown in figure (c) & (d) of figure 2. We used this disadvantage of voila Jones as strength to detect whether the face is Face Matching or not. After placing of control points over the face we acquire twelve different features. All these features has been demonstrated in table 1.

Table 1.
Twelve structural (distance based) features.

	Feature
1	Normalized eye width =[width(left eye)+width(right eye)]/2
2	Normalized eye height =[height(left eye)+height(right eye)]/2
3	Width of the nose
4	Height of nose
5	Width of mouth
6	Height of the mouth
7	Euclidean Distance from left eye corner to right eye corner.
8	Euclidean distance from left eye center to nose tip
9	Euclidean distance from right eye center to nose tip
10	Euclidean distance from left eye center to mouth
11	Euclidean distance from right eye center to mouth
12	Euclidean distance from nose tip to Mouth

IV. RESULT AND DISCUSION

We evaluate execution time and accuracy performance of our proposed approach on artificially Face Matching images of SQL database and comparing our result against its related methods. Test set comprises 42 differently Face Matching images 14 of them are clear another 14 are mouth Face Matching with different size of partial occlusion and another 14 are eye Face Matching images .All these images are differently scaled and belong to all subject. Training set is comprised of 40 subjects 10 images per subject. The main goal of this experiment is to improve execution time performance of CRC method by eventually switching of LRC for non-Face Matching images. Table 2 shows about accuracy of LRC, kernel LRC [15], CRC based on test set which is already explained.

Accuracy of proposed occlusion Recognition approach on COFW test database which consist 507 images successfully tested with 91.76% of accuracy rate but due to sensitive nature of Local Binary Patterns Histograms (LBPH) Recognition algorithm 15% of the images could not be detected successfully due unreal extremely edited images .Thus testing could successfully be done on 85% of the COFW database. Proposed Occlusion Recognition algorithm could successfully achieved 98% of accuracy on artificially Face Matching ORL database. Finally, we compare execution time performance of our proposed approach verses CRC.

Table 2.
Comparison table.

	Face Matching	Maximum Distance face Matching	Minimum Distance Face Matching
LRC	100%	91.50%	34.68%
KLRC	100%	85.13%	35.64%
CRC	100%	84.93%	45.81%

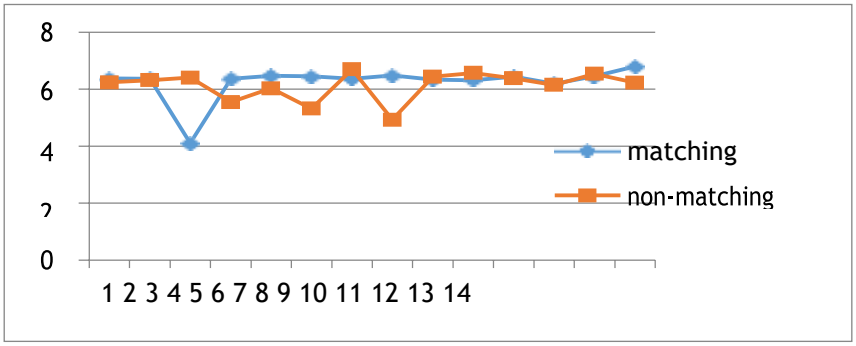

Figure 6. Execution time analysis of CRC for 1st to 14th Face Matching as well as non-Face Matching images

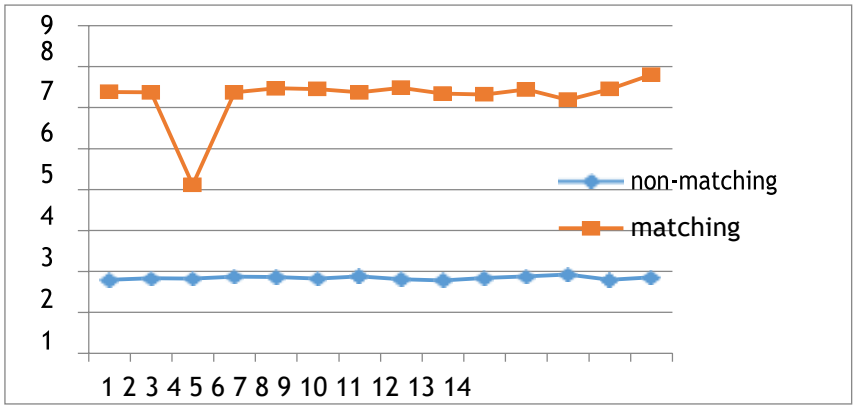

Figure7. Execution time analysis of our proposed approach for 1st to 14th Face Matching as well as non-Face Matching images.

To evaluate execution time performance of CRC and Proposed approach we have taken 14 Face Matching in which seven of them is eye covered and another seven are mouth covered and 14 non-Face Matching images. X-axis shows time in second while Y- axis shows 1st to 14th Face Matching and non-Face Matching images. Above fig 6 and 7 shows that Execution time analysis for each of the 14 Face Matching and non-Face Matching faces in which we found that, execution time required for CRC on both Face Matching as well as non-Face Matching are above 4 seconds while our proposed approach has taken below 2 seconds for non-Face Matching faces.

Execution time performance of proposed occlusion Recognition approach has been analyzed on previously discussed SQL database and we found that our proposed occlusion Recognition approach has taken not more than 0.50 seconds.
Note that we didn't focus on accuracy of the system .thus we haven't taken big size database nor we compared accuracy of the system with more than three approaches .Our goal is toward making of efficient system that can work efficiently in real time environment.

V. CONCLUSION

We addressed the problem of CRC face recognition method regarding to execution time as well as we have proposed combined approach of extracted structural features and SVM to detect whether the face is Face Matching or not .The contribution of occlusion Recognition prior to face recognition has boosted execution time performance. The proposed approach has been compared to its plain version i.e. CRC to show time performance improvement by thoroughly experimenting on artificially Face Matching SQL Database. Proposed method of Recognition of whether the face is Face Matching or not has demonstrated that, good accuracy as well as time performance has been achieved with minimum number of structural features.

VI. ACKNOWLEDGMENT

The author wants to give thanks to the faculty members of Department of Computer Science and Engineering of Government College of Engineering, Aurangabad (MH), India for their support and guidance for research of this topic.

REFERENCES

[1] Kim, Jonathan C., and Mark A. Clements, "Multimodal affect classification at various temporal lengths," IEEE Transactions On Affective Computing 6.4, 2015, pp. 371-384.

[2] Li, Yang. "Novel face recognition algorithm based on adaptive 3D local binary pattern features and improved Singular Value Decomposition method." Inventive Computation Technologies (ICICT), International Conference on. Vol. 3. IEEE, 2016.

[3] Latif, Mohd, Shahrul Na'im Sidek, and Nazreen Rusli. "Texture descriptors based affective states recognition-frontal face thermal image." (2016): 1-6.

[4] M. Z. Uddin; M. M. Hassan; A. Almogren; A. Alamri; M. AlRubaian; G. Fortino, "Facial Expression Recognition Utilizing Local Direction-based Robust Features and Deep Belief Network," in IEEE Access, vol.PP, no.99, pp.1-1.

[5] Matlovic, Tomas, et al. "Emotions detection using facial expressions recognition and EEG." Semantic and Social Media Adaptation and Personalization (SMAP), 2016 11th International Workshop on. IEEE, 2016.

[6] Mayya, Veena, Radhika M. Pai, and MM Manohara Pai. "Combining temporal interpolation and DCNN for faster recognition of micro-expressions in video sequences." Advances in Computing,

[7] Communications and Informatics (ICACCI), 2016 International Conference on. IEEE, 2016.

[8] Tae Young Kim, Kyoung Mu Lee, Sang Uk Lee, and Chung-Hyuk Yim “Occlusion Invariant Face Recognition Using Two-Dimensional PCA” , CCIS 4, pp. 305–315, 2007.

[9] Ms.Reeniya Bopaiaha , Mrs.Rajeshwari “Literature Survey on Face Recognition In Case Of Partial Occlusion and Its Applications” Vol. 3, Issue1, pp: (135-140), Month: January - March 2015.

