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FACIAL EXPRESSION RECOGNITION USING BIOGEOGRAPHY-BASED OPTIMIZATION WITH SUPPORT VECTOR MACHINE

ABSTRACT

Facial expression recognition is an attractive and difficult issue, and effects vital applications in numerous zones, for example, human–computer connection and information driven movement. Removing the ideal components from pictures is continuously needed in face acknowledgment calculation to accomplish high precision. In this paper we have displayed a proficient facial representation and face acknowledgment calculation in view of Biogeography Based optimization (BBO). To start with we separate the elements utilizing the principal Component Analysis (PCA) in the wake of applying Gabor channels and afterward we apply BBO to get the most alluring highlights. The Execution investigation is performed utilizing CohnKanade face database. Execution results demonstrate that biogeography based face acknowledgment calculation produces preferable results over the SVM using LBP.

Keywords: BBO, Gabor filter , LBP, PCA ,SVM,

1 INTRODUCTION

There is a great deal of exploration parkways in the field of face acknowledgment because of difficulties present in the field. The objective of face acknowledgment is to match a given picture against an expansive database of pictures to check its vicinity.

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Outward appearance is a standout amongst the most intense, normal and prompt means for people to impart their feelings also, intensions. Facial expression recognition is an attractive and difficult issue, and effects essential applications in numerous territories, for example, human–computer connection and information driven movement. The face acknowledgment has been connected to two generally vital applications i.e check (coordinated coordinating) and recognizable proof (one to numerous coordinating). Scientists have displayed a ton of methods for face acknowledgment. These systems can be ordered as all encompassing coordinating strategy for e.g Principal Component Analysis (PCA) and neighborhood highlight coordinating technique .

Determining a successful facial representation from unique face pictures is a key stride for fruitful outward appearance acknowledgment. There are two basic ways to deal with concentrate facial elements: geometric highlight based techniques and appearance-based routines. Geometric components display the shape and area facial segments, which are removed to shape a component vector that speaks to the face geometry. As of late have shown that geometric component based systems give comparable or preferred execution over appearance-based methodologies in real life Unit acknowledgment. On the other hand, the geometric component based strategies more often than not requires exact and solid facial element identification and following, which is hard to suit in many situations. With appearance-based routines, picture channels, for example, Gabor wavelets, are connected to either the entire face or particular face-areas to concentrate the appearance changes of the face. Because of their unrivaled execution, the real chips away at appearance-construct techniques have concentrated in light of utilizing Gabor-wavelet representations. On the other hand, it is both time and memory escalated to convolve face pictures with a bank of Gabor channels to concentrate multi-scale and multi-orientational coefficient.

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Fig-1 Representative set of Cohn Kanadeface database

In this paper we will concentrate on PCA. One of the greatest difficulties in PCA is that we can't utilize it on crude pictures specifically. They have to be appropriately adjusted and consistently enlightened. This test can be comprehended utilizing Gabor channels which take a crude picture, createGabor channel reaction and convert the crude picture into appropriately adjusted and always lit up picture. We have investigated the exploration that demonstrated that Gabor PCA based strategy for face acknowledgment beats PCA based Eigen face strategy.

II) GABOR Filter

Gabor channels for the most part called as Gabor wavelets or pieces are complex band pass channels. They have shape like the state of the cells of the visual cortex of mammalian brains. These are utilized as a part of numerous applications for example, extraction of multi resolution, spatially neighborhood elements of a kept recurrence band. Another critical component of the Gabor channels is that they go about as an effective device for facial component extraction and powerful face acknowledgment. By and large the group of 2D Gabor channels can be characterized in the spatial area in the accompanying way .

$$\Psi_{U,V}(a,b) = \frac{f_u^2}{\pi \text{ƙ} \eta} e^{-\left(\left(\frac{f_u^2}{k^2}\right)a_1^2+\left(\frac{f_u^2}{\eta^2}\right)b_1^2\right)} e^{i2\pi f_u a_1} \quad (1)$$

Where $a_1 = a\cos\Theta_v + b\sin\Theta_v$,$b_1 = -a\sin\Theta_v + b\cos\Theta_v$, $f_u = f_{max}/2^{(u/2)}$ and $= v\prod/8$

Each Gabor channel speaks to a Gaussian portion capacity regulated by complex plane wave whose middle recurrence what's more, introduction are given by *f*u and θv, individually. The parameter ƙ and η focus the proportion between focus recurrence and size of Gaussian envelope. In spite of the fact that we can have distinctive qualities for aforementioned parameters deciding attributes of the channels, the most commonparameters utilized for face acknowledgment are $\kappa = \eta = \sqrt{2}$ and $f_{max} = 0.25$. At the point when utilizing Gabor channels for facial highlight extraction, scientists ordinarily develop a channel bank highlighting channel of five scale and eight introduction (contained 40 channels as demonstrated in Fig. 2),that is u = 0,1… ...p-1 and v = 0,1… ,r-1,where p = 5

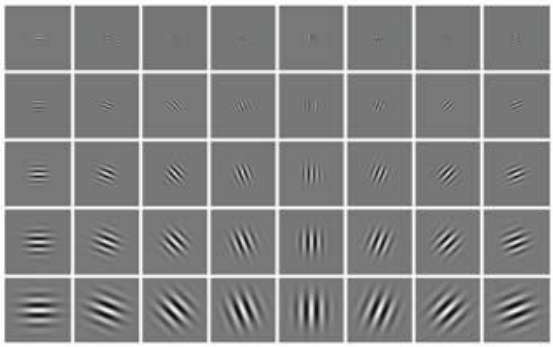

Fig-2. The real parts of the Gabor filter bank commonly used for feature extraction in the field of face recognition.

III) PRNICIPAL COMPONENT ANALYSIS

Extraction of components from the pictures is the first venture in face acknowledgment. PCA is a standard procedure utilized for highlight extraction. The picture as A x A grid can be communicated as a point in the space A x A measurements. The objective of PCA is to locate the obliged vectorsthat can speak to the picture data and structure another space. PCA steps are as per the following:

1. Let t_1, t_2 … .t_n be the face pictures of the preparation set.
2. Average face of the set is given by

   $\Psi = \frac{1}{p}\sum_{r=1}^{p} t_r$.

3. We figure the separation of the considerable number of appearances from the normal $\Phi = \Gamma_i - \Psi$
4. Eigen qualities and Eigen vectors are figured from the covariance grid and after that we figure the face parts from the new face picture by operation given beneath.

   $$C = \frac{1}{p}[\sum_{r=1}^{p} \Phi_r \Phi_r^T] \quad (2)$$

5. Weights are ascertained utilizing expression given underneath (4) and afterward we shape a vector $\Omega = \omega_1,\omega_2\ldots \omega_p$ which willspeak to the relating weights of each eigen vector in the representation of pi

$\omega_k=\mu_k^t(\Gamma-\Psi)$, k=1,2….p (3)

Where μ_k, is the eigen vector.

III) PRINCIPAL COMPONENT ANALYSIS OF GABOR FILTER

Initially we have to apply Gabor channel to the crude pictures to produce Gabor channel reaction and afterward these Gabor channel reaction go about as info to the PCA. The entire procedure till presently is demonstrated in the Fig. 3. Gabor channel gives strength against changing differentiation and brilliance. It can likewise speak to normal for neighborhood face region.

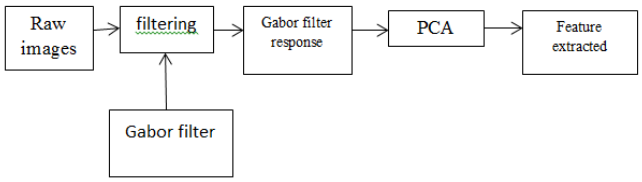

Fig-3. Features extraction

Let D(a, b) be a dim scale picture of size m x n pixels furthermore, let $\Psi_{U,V}$ (a,b) indicate a gabor filter given by its middle frequencyfuand orientation θv. The filtering operation of the given face picture D(a, b) can be:

$M_{U,V}(a,b) = D_{U,V}(a,b) * \Psi_{U,V}(a,b)$ (4)

Where $M_{U,V}(a,b)$ denote the Gabor filter response and it spilts into real ($E_{U,V}(a,b)$) and imaginary part ($O_{U,V}(a,b)$)

$E_{U,V}(a,b) = Re[M_{U,V}(a,b)\ ]$ (5)

$O_{U,V}(a,b) = Im[M_{U,V}(a,b)\ ]$

2. PREVIOUS WORK

We experimentally work over facial representation based on Local Binary Pattern (LBP) for individual free outward appearance acknowledgment. LBP components were proposed initially for texture analysis and as of late have been presented to speak to faces in facial pictures examination. The most critical properties of LBP elements are their resilience against light changes and their computational straightforwardness. We analyzed it on machine learning system, Support Vector Machine (SVM).

a. Local Binary Pattern(LBP)

The first LBP administrator was presented byOjala .Furthermore, was demonstrated an effective method for surface depiction. The administrator marks the pixels of a picture by thresholding a 3 * 3 area of every pixel with the inside worth and considering the results as a paired number (see Fig. 4 for an outline), and the 256-container histogram of the LBP names registered more than a district is utilized as a surface descriptor. The inferred double numbers (called Local Twofold Patterns or LBP codes) systematize nearby primitives including distinctive sorts of bended edges, spots, level territories, and so on (as indicated in Fig. 4), so each LBP code can be viewed as a smaller scale texton.

Fig -4 The original face image and the cropped image

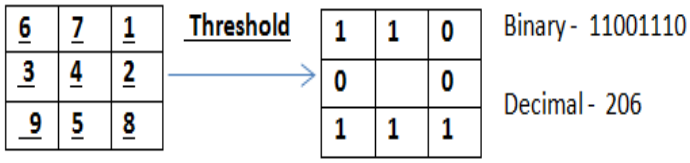

Fig.5 The original LBP operator

b. Support vector machine (SVM)

We embraced SVM as option classifiers for expression acknowledgment. As an effective machine learning method for information characterization, SVM performs an understood mapping of information into a higher (perhaps boundless) dimensional element space, and after that discovers a straight isolating hyperplane with the maximal edge to isolated information in this higher dimensional space.

Given a preparation set of named illustrations $\{(x_i,y_i)$, i= 1,……l} where $x_i \epsilon R^n$ and $y_i \epsilon \{1, -1\}$, another test illustration x is arranged by the following function :

$$F(x) = sgn\left(\sum_{i=1}^{t} \alpha_i\ y_i k(x_i\ ,x\right) + b) \quad (6)$$

where α_i are Lagrange multipliers of a double streamlining issue that depict the isolating hyperplane, K(. .) is a kernel function, furthermore, b is the threshold parameter of the hyperplane. The preparation test xi with ai> 0 is called bolster vectors, and SVM finds the hyperplane that amplifies the separation between the

bolster vectors also, the hyperplane. Given a non-straight mapping U that installs the data information into the high dimensional space, pieces have the typek(x_i , y_j) = { $\varphi(x)_i$, φ (y_j) }.

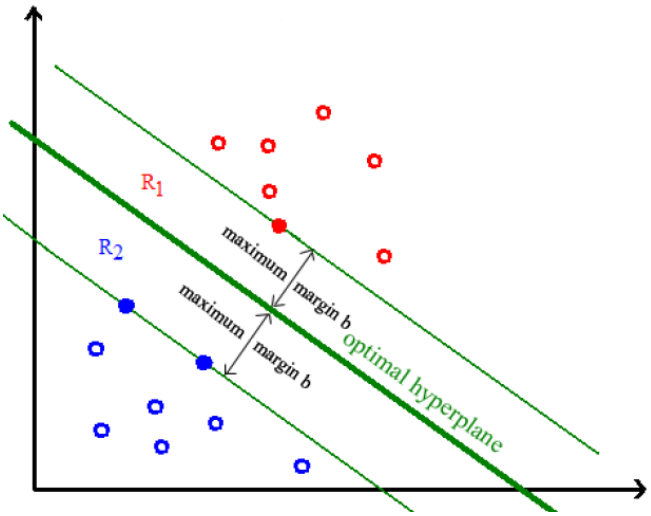

Fig.6 SVM Optimal Hyperplane

A special property of SVM is that it simultaneously minimizes the empirical classification error and maximizes the geometric margin. Therefore, it is also known as maximum margin classifiers.Viewing the input data as two sets of vectors in an n-dimensional space, a SVM will construct a separating hyperplane in that space maximizing the margin between the two data sets. Training a SVM consists of finding the optimal hyperplane, that is, the one with the maximum distance from the nearest training patterns, called support vectors.SVM optimal hyperplane is the one with the maximum distance from the nearest training patterns. The support vectors (solid dots) are those nearest patterns, a distance b from the hyperplane.

3. PROPOSED WORK

BBO is used for face recognition. Previously SVM using LBP is used for facial expression recognition. We further proposed BBO with SVM to recognize face and then facial expression of the that image. The block diagram of the proposed method is fig 7.

BIOGEOGRAPHY BASED OPTIMIZATION (BBO)

Biogeography is the investigation of geological dissemination of natural organic entities. It expects To figure out how species relocate starting with one island then onto the next.Biogeography is communicated as far as different components, for example, territory range, movement rate, displacement rate, environment suitability file (HSI) and suitability file variables (SIV).Every person is considered as a "natural surroundings" with a territory suitability list to quantify person. Suitability record variables (SIV) are those variables of a person by which we can describe tenability.

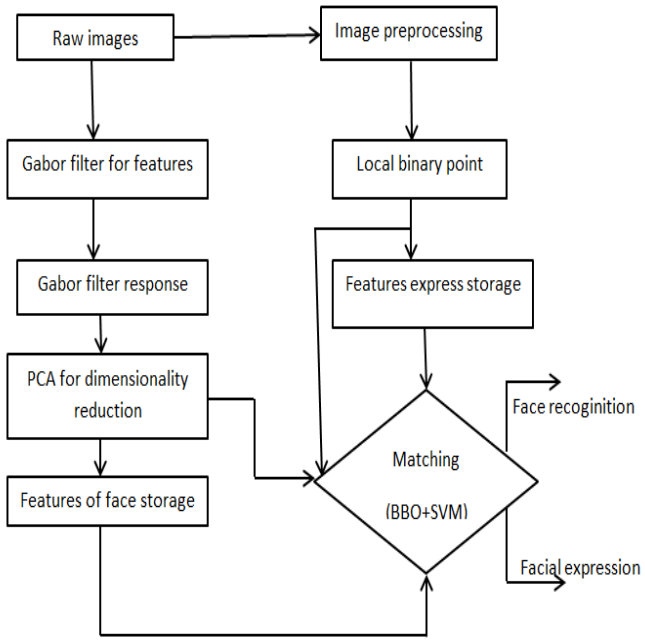

Fig .7 Block diagram of BBO with SVM using LBP

i) Suitability index variable

The environment speaks to a conceivable arrangement (ideal elements). The environment includes of a few Suitability Index Variable (SIV). Highlights removed from each and every picture speak to a SIV.

ii) Habitat suitability index variable

Every natural surroundings is assessed on the premise of habitat suitability index variable (HSI). Living space Suitability Index can be considered as a quality return by the wellness capacity. A Natural surroundings is viewed as rich in components on the off chance that its HSI quality is closer to the perfect natural surroundings HSI quality and on the off chance that its esteem is far from the perfect HSI esteem then the environment is considered as a poor environment containing less elements. In view of the HSI esteem we can simply recognize great arrangement and the awful ones. With a specific end goal to enhance the terrible arrangements we can relocate certain arrangement of chose components from the perfect answer for awful ones. We have utilized standard mean as the wellness capacity of

the methodology.Subsequent to adding to the preparing model we utilize Euclidean separation to figure the coordinating score between the elements of test picture and that of preparing model test picture and that of preparing model.

iii) **Distance calculation**

After the improvement of train model from the preparation set pictures, we ascertain the similitude lattice utilizing the lattice which contains the components separated from test set of pictures. The separation used to figure the similitude framework is 'Euclidean'. Euclidean separation is the straight line distance between two focuses introduce in a dimensional space. For instance, the Euclidean separation between any two focuses x_i and y_j in N-dimensional space is

$$D = \sqrt{\sum_{i=1}^{N}(x_i - y_i)^2}$$

Extricate the components from the preparation set and test set in frameworks as indicated in Fig. 2 utilizing Gabor channel and PCA. Let's say "train_data" is a framework contains highlight extricated from preparing set and "test_data" contains components separated from test set.

1) Compute the HSI value for the whole train data using fitness function. It will be treated as ideal HIS
2) Apply BBO for 120 (number of SIVs) cycles and in every cycle do the accompanying

- Compute HSI esteem for the SIV (or segment) of the picture exhibit in test_data lattice.
- Contrast the calculated HSI esteem and perfect HSI.
- In the event that ascertained HSI quality is near to perfect HSI do nothing. Go to next cycle.
- On the off chance that figured HSI is not near to perfect HSI at that point perform relocation to progress test_data.

3) Compute likeness framework from train_data and test_data utilizing Euclidean separation and plot the obliged bend.

Fig- 8 Algorithm of BBO methodology

Table -1 Confusion table of 7-class facial expression recognition using BBO with SVM

	Anger (%)	Disgust (%)	Joy (%)	Fear (%)	Sadness (%)	Surprise (%)	Neutral (%)
anger	93.0	5.4	0	0	6.8	0	11.5
disgust	0	99.3	1.2	5.6	0	0	0
joy	2.1	5.0	98.7	1.3	2.0	0.8	10.0
fear	0	0	35.5	85.6	3.3	0.4	6.5
sadness	15.6	0.8	0	0	97.5	6.8	24.6
surprise	1.0	0	2.7	2.9	0	99.2	1.2
neutral	2.8	1.5	0	0	11.0	1.5	99.0

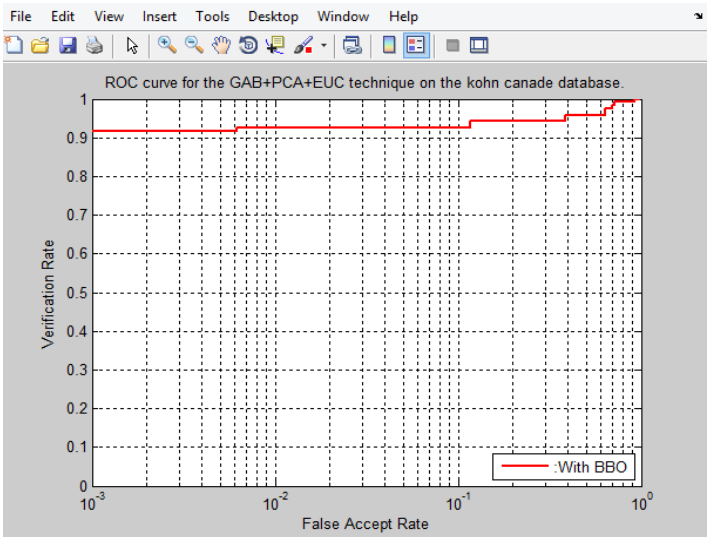

Fig .9 ROC curve for BBO with SVM technique

4. CONCLUSION

In this paper we propose an efficient algorithm of biogeography-based optimization with support vector machine using LBP. The proposed algorithm tries to find out the better performance. The performance is evaluated using the standard Cohn Kanade face

database. The table shows the better verification than the normal facial expression recognition using LBP with SVM.

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