ISSN 23499842(Online), Volume 1, Special Issue 1(NCEE'15), May 2015
International Journal of Innovative Trends and Emerging Technologies

AUTOMATIC FACIAL EXPRESSION RECOGNITION USING GABOR FILTER WITH MATLAB

N.SEETHARAM[1], G.BALASUBRAMANI[2]
[1]PG Student (ME VLSI Design), [2]Associate Professor (ME VLSI Design)
[1,2]SREC, Vandalur, chaennai - 127
[1]Seetharam1000@gmail.com

*Abstract:*Nowadays face recognition applications attain great popularity in image analysis. Computer vision toolbox is used for fast and accurate extraction of feature points such as pupils, nostrils and mouth edges. It has a wide scope of applications in different fields like pattern recognition and commercial market. In various extraction methods proposed in the past, steady extraction was difficult due to influences such as individual differences, expression variations, face direction or illumination variations and so forth. These methods are better than the previous PCA technique in terms of extraction accuracy and processing speed. This proposed method achieves high position accuracy at a low computing cost by combining shape extraction with pattern matching. Results of testing facial images under various conditions show for 30 static images the feature point extraction rate was 94%. In the case of dynamic images the extraction rate for 20 was 90% at a speed of 10 trials/s, without using hardware. Finally Gabor filter is used to extract noise present in the image and facial expression should detect from input image.

Key :face detection, gabor filter, resolution computer vision toolbox, image processing toolbox

Introduction:

Already lot of paper are described about either face detection or filter techniques. Even though some paper initiate about the both concept their filtering image are not clear. In this paper described about gabor filter technique. The gabor filter also like also like a band pass filter. So it allow only rest of high and low frequently that mean it is intermediate between high and low pass filter. Then we get the filtered image as output act as input to face detection.

Description:

The input image as which is given then the face and the face parts should be detected it may be a coloured or gray scale image. Then the output noisy image which is given to the gabor filter. The gabor filter find if the input image as coloured image then it convert to the grey scale image. Then remove the unwanted noise in the image then it execute the output filtered image.

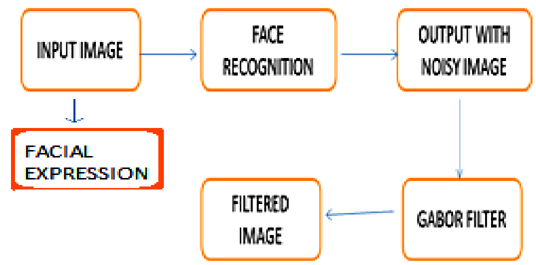

Figure 1 : General Block Diagram

Computer vision and image processing toolbox:

Computer vision and image processing toolbox are the tools related to matlab to process the image and find the face and face parts. The face parts include right eye, left eye, nose and mouth. The face parts detector use the variable as "detector" the bound the box between the parts. For user friendly identification the box should with different RBG colours. The box should be bounded by szing the image parts. The thickness of the bounding box may be varied according to the user usage.

Gabor filter:

The gabor filter give the noiseless image as output. It also called as band pass filter resizing then the image size also get increase then output image should be cleared. Eventhough the input image may be coloured image it convert for grayscale image. At image resizing the value should be converted into double value then further process will occur. The convolution of final gabor output is y(t).

Existing:

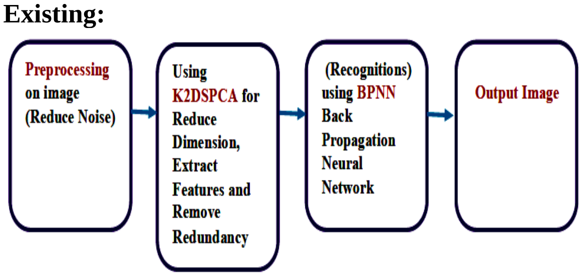

Figure 2 :K2DSPCA = Kernel Based 2- Dimensional Symmetrical Principal Component Analysis

Face recognition using Back Propagation Neural Network and for image dimensionally reduction using K2DSPCA (Kernel based 2-Dimensional Symmetrical Principal Component Analysis).face even in few seconds. In this paper, they discussed that previous techniques are slow and provide less accurate result, especially non linear face recognitions.

They explained, whole input image was taken using a holistic approach which uses K2DSPA for feature extraction means reduction dimensions for high to low, extract all the most important features of data and remove all redundant values. In this paper after calculating the vector of extracted features are then compared with other sets using Back Propagation Neural Network (BPNN) for recognition. For conversion of input space into Kernel space, they generally use K2DSPA.Hasan*et al.*,proposed combination of more than one technique instead of a particular technique for face recognition called" Face Recognition Using Improved FFT Based Radon by PSO and PCA Techniques" they claimed that previous approaches using single techniques are computationally expensive. In this paper, they suggest for accurate face recognition Radon Transform (RT) with PCA and Linear Discrimenant Analysis (LDA) while using two-Dimensional images the Fast Fourier transformed (FFT) theorem is the core for Radon Transform. In this paper for face recognition, two phases use first phase is called enrollment phase of training phase the second is called testing phase, in enrollment phase the images are stored in database and in testing phase, the test image is compared to the database.

Kumar *et al.*, proposed a biometric based real time system using face recognition for attendance. In this paper, the author explained that their proposed system contained AdaBoost with Haar for face detection,AdaBoost is basically used for extraction of lower features and predict the accurate result. Therefore, AdaBoost is combined with Haar for achieving high-accuracy rate and performance improvement; Haar is mostly used for visual face detection like face detection and other object detection as well. In this paper discussed that Haar had the ability for fast decision for accept and reject the segment of the particular area of face image or other objects. Finally, in this paper, the authors perform an experiment on different images, After the experiment, they proved that the proposed system, combination of AdaBoost with Haar and PCA with Linear discriminant analysis provide high-accuracy rate for authentication of a person to enter a specific area and the system also store the authorized person in-time and out-time against the premises of interest.

Rana and Iyad proposed a new approach for face recognition called "Face Recognition Using Harmony Search-Based Selection Features" which give a better result when compared with the existing approaches.

They suggest HSA (Harmony Search Algorithm), which is an evolutionary and meta-heuristic algorithm using solving different type of problem (summarizing text, flood model calibration, *etc.*,) in various fields. The musicians are using the Harmony Search Algorithm for sitting their instruments improving for best harmony during music composition. They explained that Harmony Search Algorithm was based on three basic rules, first randomly selection value from the specific range, secondly value selection from harmony memory and thirdly select adjacent value. Harmony's presentation is done with two values for selection of extraction of features, if the presented value is zero, then the feature is selected if the presented value is 1 it means that the feature is not selected. In this paper, the authors perform the experiment on ORL database with distinct images using the combination of different techniques.

Face Recognition:

The technique used random transform (RT) with Principal Component Analysis (PCA), & linear Discriminant Analysis (LDA). In 2-D images Fast Fourier Transform (FFT) is the core for RT.

Face Detection :

- Ada boost with Haar for Face detection
- Ada boost for extraction of lower features
- Memory consuming and size

Drawback:

- Computational speed is low detect face only
- Detect only face

Algorithm:

The viola jones algorithm is used for finding the face, nose, right and left eye and mouth detector. The matlab have the computer vision toolbox with cascade object detector is utilized here.

ROBUST REAL-TIME FACE DETECTION (VIOLA JONES)

Face detection procedure classifies images based on the value of simple features. There are many motivations for using features rather than the pixels directly. The most common reason is that features can act to encode ad-hoc domain knowledge that is difficult to learn using a finite quantity of training data. For this system there is also a second critical motivation for features: the feature-based system operates much faster than a pixel-based

ISSN 23499842(Online), Volume 1, Special Issue 1(NCEE'15), May 2015
International Journal of Innovative Trends and Emerging Technologies

system. The simple features used are reminiscent of Haar basis functions which have been used by Papageorgiou et al. (1998).

More specifically, we use three kinds of features. The value of a two-rectangle featureis the difference between the sum of the pixels within two rectangular regions. The regions have the same size and shape and are horizontally or vertically adjacent. A three-rectangle featurecomputes the sum within two outside rectangles subtracted from the sum in a center rectangle. Finally a four-rectangle feature computes the difference between diagonal pairs of rectangles. Given that base resolution of the detector is 24 × 24,

Figure 3: Example rectangle features shown relative to the enclosing detection window. The sum of the pixels which lie within the white rectangles are subtracted from the sum of pixels in the grey rectangles. Two-rectangle features are shown in (A) and (B). Figure (C) shows a three-rectangle feature, and (D) a four-rectangle feature. quite large, 160,000. Note that unlike the Haar basis, the set of rectangle features is overcomplete.

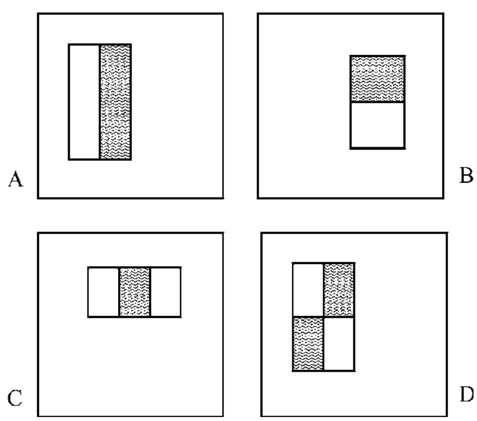

Figure 3: Example rectangle features

Integral Image

Rectangle features can be computed very rapidly using an intermediate representation for the image which we call the integral image.4 The integral image at location *x*, *y* contains the sum of the pixels above and to the left of *x*, *y*, inclusive:

$$ii(x, y) = \sum_{x' \leq x, y' \leq y} i(x', y'),$$

where*ii* (*x*, *y*) is the integral image and *i* (*x*, *y*) is the original image. Using the following pair of recurrences: (where *s*(*x*, *y*) is the cumulative row sum, *s*(*x*,−1) = 0, and *ii* (−1, *y*) = 0) the integral image can be computed in one pass over the original image. Using the integral image any rectangular sum can be computed in four array references. Clearly the difference between two rectangular sums can be computed in eight references. Since the two-rectangle features defined above involve adjacent rectangular sums they can be computed in six array references, eight in the case of the three-rectangle features, and nine for four-rectangle features.

$$s(x, y) = s(x, y-1) + i(x, y) \qquad (1)$$

$$ii(x, y) = ii(x-1, y) + s(x, y) \qquad (2)$$

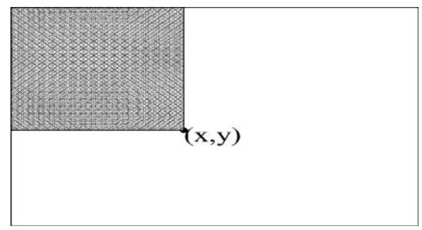

Figure 3: The value of the integral image at point (x, y) is the sum of all the pixels above and to the left.

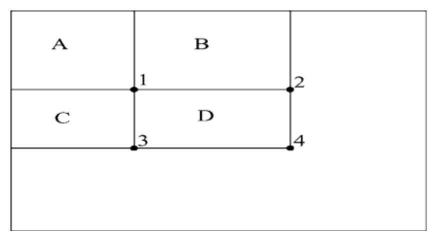

Figure 4: The sum of the pixels within rectangle D can be computed with four array references.

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). (1999). The authors point out that in the case of linear operations (e.g. *f* · *g*), any invertible linear operation can be applied to *f* or *g* if its inverse is applied to the result. For example in the case of convolution, if the derivative operator is applied both to the image and the kernel the result must then be double integrated:

$$f * g = \int \int (f' * g').$$

The authors go on to show that convolution can be significantly accelerated if the derivatives of *f*

ISSN 23499842(Online), Volume 1, Special Issue 1(NCEE'15), May 2015
International Journal of Innovative Trends and Emerging Technologies

and *g* are sparse (or can be made so). A similar insight is that an invertible linear operation can be applied to *f* if its inverse is applied to *g*:

$$(f'') * \left(\int \int g\right) = f * g.$$

Viewed in this framework computation of the rectangle sum can be expressed as a dot product, $i \cdot r$, where *i* is the image and *r* is the box car image (with value 1 within the rectangle of interest and 0 outside). This operation can be rewritten

$$i \cdot r = \left(\int \int i\right) \cdot r''.$$

The integral image is in fact the double integral of the image (first along rows and then along columns). The second derivative of the rectangle (first in row and then in column) yields four delta functions at the corners of the rectangle. Evaluation of the second dot product is accomplished with four array accesses.

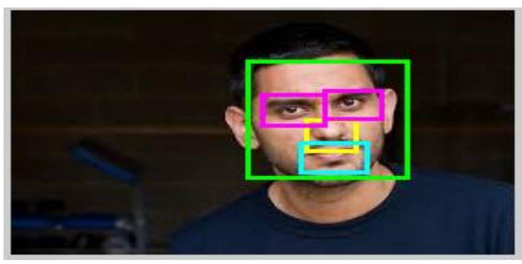

Figure 5: Face recognition

Figure 6: Cropped Image

Gabor Energy Filters

The real and imaginary components of a complex Gabor filter are phase sensitive,i.e., as a consequence their response to a sinusoid is another sinusoid. By getting the magnitude of the output (square root of the sum of squaredreal and imaginary outputs) we can get a response that phase insensitive and thusunmodulated positive response to a target sinusoid input. In somecases it is useful to compute the overall output of the two out of phase filters.One common way of doing so is to add the squared output (the energy) of eachfilter, equivalently we can get the magnitude. This corresponds to the magnitude(more precisely the squared magnitude) of the complex Gabor filter output. In thefrequency domain, the magnitude of the response to a particular frequency is simplythe magnitude of the complex Fourier transform, i.e.

$$\|g(f)\| = \left|\frac{k}{a}\hat{w}\left(\frac{f - f_o}{a}\right)\right.$$

Note this is a Gaussian function centered at f0 and with width proportional to a.

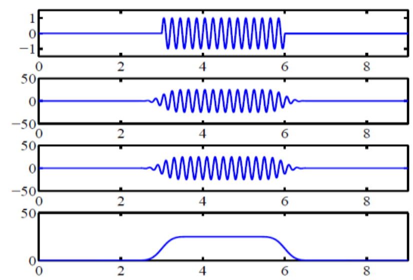

Figure 7: Top: An input signal. Second: Output of Gabor filter (cosine carrier).Third: Output of Gabor Filter in quadrature (sine carrier); Fourth: Output ofGabor Energy Filter

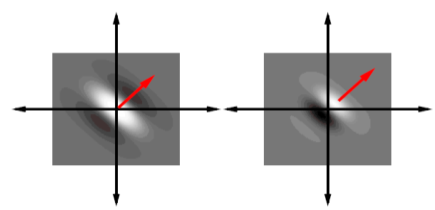

Figure 8: The real and imaginary parts of a complex sinusoid. The images are128 × 128 pixels.The parameters are: u0 = v0 = 1/80 cycles/pixel,P = 0 deg.

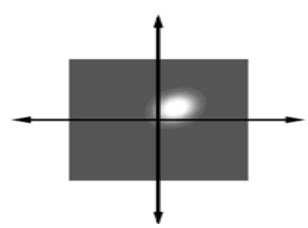

Figure 9: The Fourier transform of the Gabor filter.

Prior to the compilation of the FACS in 1977, most of the facial behavior researchers were relying on the human observers who would observe the face of the subject and give their analysis. But such visual observations cannot be considered as an exact science since the observers may not be reliable and accurate. Ekman et al. questioned the validity of such observations by pointing out that the observer may be influenced by context. They may give more prominence to the voice rather than the face and furthermore,

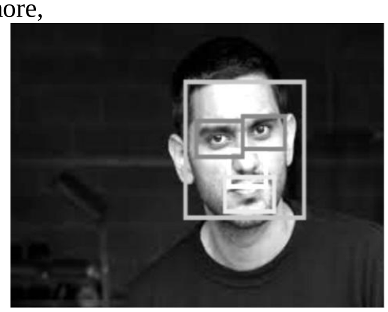

Figure 10 : Filtered Image

The Facial Action Coding System(FACS)

the observations made may not be the same across cultures; different cultural groups may have different interpretations.

Facial Action Coding is a muscle-based approach. It involves identifying the various facial muscles that individually or in groups cause changes in facial behaviors. These changes in the face and the underlying (one or more) muscles that caused these changes are called Action Units (AU). The FACS is made up of several such action units. For example:

- AU 1 is the action of raising the Inner Brow. It is caused by the *Frontalis*and *Pars Medialis*muscles,
- AU 2 is the action of raising the Outer Brow. It is caused by the *Frontalis*and *Pars Lateralis*muscles,
- AU 26 is the action of dropping the Jaw. It is caused by the *Masetter*, *Temporal* and *Internal Pterygoid*muscles,

and so on. However not all of the AUs are caused by facial muscles. Some of such examples are:

- AU 19 is the action of 'Tongue Out',
- AU 33 is the action of 'Cheek Blow',
- AU 66 is the action of 'Cross-Eye',

and so on. The interested reader can refer to the FACS manuals for the complete list of AUs.AUs can be additive or non-additive. AUs are said to be additive if the appearance of each AU is independent and the AUs are said to be non-additive if they modify each other's appearance. Having defined these, representation of facial expressions becomes an easy job. Each expression can be represented as a combination of one or more additive or non-additive AUs. For example 'fear' can be represented as a combination of AUs 1, 2 and 26. Figure show some examples of upper and lower face AUs and the facial movements that they produce when presented in combination.

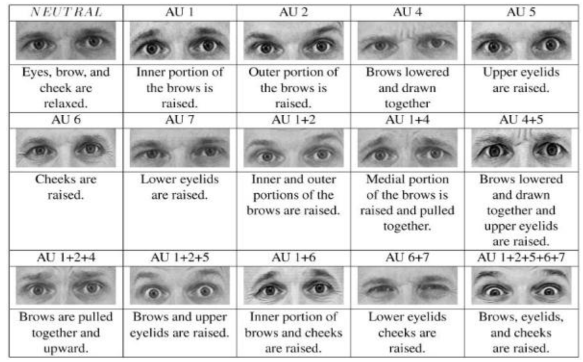

Figure 11 : Facial Expression

CONCLUSION

This paper not only detect the face of the human being it also extract the parts of face like right eye, left eye, mouth, then vialo jones algorithm will increase the speed of the computational calculation. Then face parts should be specified with different colours. The contribution is a new technique for computing a rich set of image features using the integral image. In order to achieve true scale invariance, almost all face detection systems must operate on multiple image scales image pyramid, reduces the initial image processing required for face detection . In future project will add the gabor filter to get the noiseless image

REFERENCES

[1] H. S. Lee and D. Kim, "Generating frontal view face image for pose invariant face recognition", Pattern Recognition Letters, vol. 27, (2006)

[2] R. Chellappa, C.L. Wilson, and S. Sirohey, "Human and machine recognition of faces: A survey," Proc. IEEE, vol. 83, pp. 705–740, 1995.

[3] B. Efraty, M. Papadakis, A. Profitt, S. Shah, and I.A. Kakadiaris, "Facial component-landmark detection," in Proc. 9th IEEE International Conference on Automatic Face and Gesture Recognition, Santa Barbara, March 2011.

[4] S. Akamatsu, T. Sasaki, H. Fukamachi, and Y. Suenaga. Robust face identification by pattern matching based on KL expansion of the Fourier spectrum. Trans. I.E.I.C.E. (D-II), J76, No. 7, pp. 1363.1373 (July 1993) (in Japanese).

[5] M. Turk and A. Pentland.Eigenfaces for recognition.J.Cognitive Neuroscience, 3(1):71–86, 1991.

[6] M. Tipping and C. Bishop. Probabilistic principal component analysis.Journal of the Royal Statistical Society B, 61,611-622, 1999.