Biometric Identification System using Lips

Reshmi M. P[1], V. J Arul Karthick[2]

[1]PG Scholar, Department of ECE, SNS College of Technology, Coimbatore, India
[2]Assistant Professor, Department of ECE, SNS College of Technology, Coimbatore, India
reshmimps@gmail.com
karthik.arul@gmail.com

Abstract: ***Visual information from the lips can be an effective candidate for facial biometrics applications when other facial organs are covered. In this paper identity recognition is determined by this lip features. Initially face detection is done by a very powerful method known as Viola and Jone's algorithm. To detect the lip contour, more gray scale characteristics from the lips are employed to resist the influences from various skin colors and environments. For capturing the features of the lips five various mouth corners are detected through the proposed system. These detected five points are used for further recognition purpose. Support Vector Machine (SVM) is used for the recognition stage as it gives better recognition.***

Keywords: Face Detection, Lip Extraction, Lip Recognition

1. Introduction

Numerous measurements and signals have been proposed and investigated for use in biometric recognition systems.A biometric can be based on either a person's physical or behavioural characteristics the most popular measurements are fingerprint, face and voice. Each of these biometric traits has their own pros and cons with respect to accuracy and deployment. Among these features, face recognition is able to work at a greater distance between the prospective users and the camera than other types of features yet; one critical issue of the face recognition system is that the system cannot work well if the target face is partially covered. Thus, considering a smaller part of a face for further recognition can be an effective way to solve this problem [1].

Lip is the tactile sensory organ constituting the visible portion of the mouth. Since the lip data can be captured at a distance, it represents a passive biometric as it requires no active user participation. The challenge of using the lip as a biometric lies in the area of uniqueness and circumvention. The use of the lip region as a means of human identification was first proposed through the concept of lip-prints. In fact it is a challenging issue. Here an algorithm is proposed to extract features from the can be used for recognition of persons by using support vector machine [9].

The process of scanning and matching can occur through verification or identification. In verification a one-to-one match takes place in which the user must claim an identity, and the biometric is then scanned and checked against the database. In identification, a user is not compelled to claim an identity; instead, the biometric is scanned and then matched against all the templates in the database. If a match is found, the person has been "identified." .

Early face-detection algorithms focused on the detection of frontal human faces, whereas newer algorithms attempt to solve the more general and difficult problem of multi-view face detection. That is, the detection of faces those are either rotated along the axis from the face to the observer or rotated along the vertical or left-right axis or both. The newer algorithms take into account variations in the image or video by factors such as face appearance, lighting, and pose.

Viola and jone's algorithm [7] is the best known and most popular feature extraction and this feature has been used in this paper. It is capable of processing images very rapidly. This technique uses a new image representation known as integral image and by using this features can be calculated easily. Then the efficient classification is done by Adaboost learning algorithm.

Lip region is extracted from the face region and more gray scale characteristics from the lip region is taken by a thresholding method known as Isodata method[6].It is used in picture processing to select an adequate threshold of gray levels for separating two classes.

The rest of the paper can be organized as follows in section II; we discuss the preprocessing steps of the proposed approach. Section III mainly focuses on the description of mouth corner detection, and in section IV deals with the lip recognition, section v presents the experimental results will be described in detail to demonstrate the effectiveness of the proposed approach. Finally the last section VI, presents our conclusion.

2. Pre Processing

Nowadays, many biometrics systems are present. Each of the biometrics has its own advantages and disadvantages. An overall diagram for the proposed method is given in figure 1.

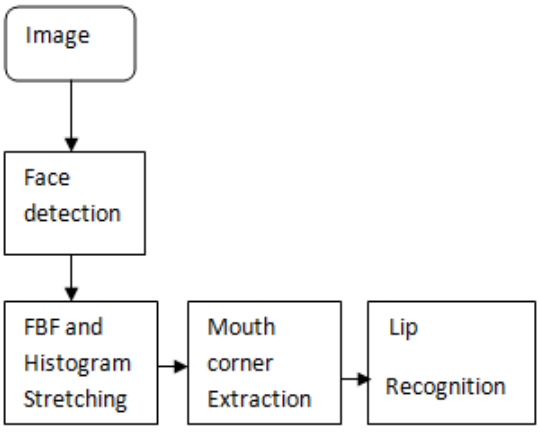

Figure 1: Flowchart of proposed system

The images are refined from Cohn–Kanade database which contains several face images. Selected face images are taken for the lip extraction purpose. The detailed explanation of the block diagram is as follows.

2.1 Face Detection

Face detection is a computer technology that determines the locations and sizes of human faces in digital images. It **detects** facial features and ignores anything else, such as buildings, trees and bodies. Face detection can be regarded as a specific case of object-class detection. In object-class detection, the task is to find the locations and sizes of all objects in an image that belong to a given class.

Several algorithms are developed for face detection. Here the face detection is done by a powerful method known as Viola and Jone's algorithm. This face detection system is most clearly distinguished from previous approaches in its ability to detect faces rapidly. It is an extremely reliable and efficient face detection algorithm. This face detection procedure classifies images based on the value of simple features. It uses three kinds of features. Viola and Jones employed Adaboost for object detection and got good performance when applying to human face detection. Some mathematical theory shows that it is in fact a very powerful machine learning technique. Boosting algorithm automatically provides the appropriate weight for each one. Mainly this approach includes three contributions.

Three major contribution of the algorithm are Feature extraction, classification using boosting .Initially an integral image is calculated for determining feature very quickly. Compute the value of each rectangle feature for each integral image. A special representation of the sample called the integral image makes feature extraction faster.

The second is a simple and efficient classifier which is built using the AdaBoost learning algorithm to select a small number of critical visual features from a very large set of potential features.

AdaBoost learning algorithm is used to boost the classification performance of a simple learning algorithm. It does this by combining a collection of weak classification functions to form a stronger classifier.

The third contribution is a method for combining classifiers in a "cascade" which allows background regions of the image to be quickly discarded. This section describes an algorithm for constructing a cascade of classifiers which achieves increased detection performance while radically reducing computation time.

2.2 Lip Extraction

In a face region lip is present in the lower portion. Then the lip region is extracted from the face images by taking some estimations thus the lip region is extracted from the face images in the databases.

$$(i^2, j2) = (i^0 j^0 + 0.25 \times M) \quad (1)$$

$$(i^3, j^3) = (i^1 - N \times 0.6 j^1 - M \times 0.25) \quad (2)$$

Where(i^0,j^0) and (i^1,j^1) denote the origin and the top-right position of the face's bounding box of size , positions (i^2,j^2) and (i^3,j^3) and denote the origin and the top-right position of the estimated lip region of size .

2.3 Fast Box Filtering and Histogram Stretching

For eliminating the influences from the camera noise and various light changing fast box filtering and histogram stretching are using. It provides a contrast enhanced and smoothed result. Fast Box Filtering is to obtain an integral image which gives the summation of the gray scale values in the lip region. It is used to generate a noise free source with high processing efficiency. Histogram stretching means the histogram equalisation. Histogram stretching indicates the extension of gray scale values. The above three steps are included in the pre-processing steps. Next step will be the mouth corner detection.

3. Mouth Corner Extraction

Five mouth corners are extracted from lip region which contains left and right corner, upper corner, middle lip corner and lower lip corner. After histogram stretching, since the gradients of the left and right corners are always higher than other gradients, a further refining procedure is required. For this, the Isodata algorithm is adopted for automatically finding a threshold to filter out some weak gradients.

Isodata means Iterative Self Organising Data Analysis Technique. It is one of the classification based method in image segmentation. It is an unsupervised classification algorithm. The objective of this is to split a non homogeneous region into homogeneous region. It assigns an arbitrary initial value of a threshold.

The second step classifies each pixel to the closest class. In the third step mean values are calculated for each class and new threshold is calculated by averaging them. Then third and second step is repeating. This new threshold is using for the mouth corner detection.

3.1 Left and Right Lip Corner

The boundary between two lips is always darker than the neighbouring region. Here the left corner points are searching from zero to half of the width of the lip region. Usually the gray scale values corresponding for the left corner points will be less than the threshold calculated by the Isodata method. The procedure for locating right lip corner is similar to that left lip corner.

3.2 Upper Lip corner and Lower Lip Corner

The upper lip corner has a strong variation around the philtrum and the upper lip boundary. Here the upper lip pixels are searching within a line region of one pixel width. These lines will be perpendicular to the distance between the left and right mouth corner. The difference between the upper points should have a positive difference and smaller than an

adjustable threshold. The upper gray scale point will also higher than the threshold calculated by Isodata. The same concept is used for the lower lip corner.

3.3 Middle Point

The middle point lies between one by third distances of the left and right lip corner points. The boundary between two lips is always darker due to the shadow. This feature is used to find the middle point. Here two thresholds are considering for finding the middle points. The gray scale difference between the middle points should have a positive difference and greater than one of the thresholds.

4. Lip Recognition

To effectively distinguish each individual more features are extracted from the lip region. Support Vector Machine (SVM) is used for the lip recognition purpose. It is technique for data classification.SVM considered to be useful than neural network. The goal of SVM is to produce a model which predicts the target values of the test data. Here different persons can be distinguished by SVM using the extracted features and also considering the normalised heights of upper and lower lips. The software used for recognition is Libsvm.

5. Results and Discussions

Experiments are performed on gray level images to verify the proposed method. These images are represented by 8 bits/pixel. Face Image used for experiments are shown in below figure.

Figure 2: Input Image Database

The next step is applying face detection on the above images. It is performed by the Viola and Jone's algorithm. Cohn-Cande database is taken. The face detected outputs are given below in Fig.3.

Figure 3: Face Detected Output

Then the lip region is extracted from the above face images by taking some approximations. Extracted lip regions are given in the Fig.4.

Figure 4: Lip Extracted Output

For eliminating the noises and camera influences Fast Box Filtering is applying. The Fast box filtered output is given in the figure 5.

Figure 5: Fast Box Filtered Output

Again smoothening and contrast enhancement are done by Histogram Stretching. This output is shown in figure 6.

Figure 6: Histogram Streching Output

Then the five mouth corners are detected by the proposed method. The Five mouth corners are indicated by the yellow circles. The marked mouth corners are given in Fig.7.

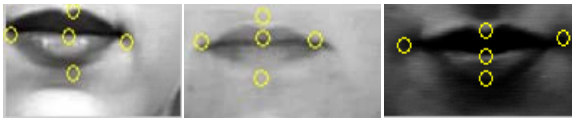

Figure 7: Marked mouth Corners

Again each person is distinguished by support vector machine.

6. Conclusion

The face region is directly detected by the powerful method, namely, Viola and Jones' face detection algorithm from an image. This face detection system is most clearly distinguished from previous approaches in its ability to detect faces extremely rapidly. This increase in speed will enable real-time face detection applications on systems where they were previously infeasible. In addition to this, the system can be implemented on a wide range of small low power devices, including hand-held's and embedded processors. It presents an approach for face detection which minimizes the computation time while achieving high detection accuracy. This has broader application in computer vision and image processing. Then the lip region can be easily extracted from the detected face. Lip biometric system is applicable when other facial organs are covered and it is a challenging issue in the biometric systems.

References

[1] CaetanoT.S, Barone D.A.C, "A probabilistic model for the human skin color," in Proc. 11th Int. Conf. Image Anal. Process. 2001.
[2] Chao-Yu Lin,Jing-Ming Guo, " Impact of the Lips for Biometrics", Image Process, vol. 21, no. 6, June 2012..
[3] Chora M, "The lip as a biometric," Pattern Anal. Appl., vol. 13, no.1, pp. 105–112, Feb 2010.

[4] Hosseini M.M, Ghofrani S, "Automatic lip extraction based on wavelet transform" in Proc. Intell. Syst, vol. 37, 2009.
[5] Kass M, Witkin A, and Terzopoulos .D, "Snakes: Active contour models," Int. J,and Comput. Vis, vol. 1, no. 4, pp. 321–331, Jan. 1988.
[6] Otsu N, "A threshold selection method from gray-level histograms, IEEE Trans. Syst., vol. SMC-9, no. 1, pp. 62–66, Jan 1979.
[7] Viola .Pand Jones M, "Robust real-time face detection," Int. J. Comput. Vis., vol. 57, no. 2, pp. 137–154, May 2004.
[8] Wang S.L,Lau W.H,Leung S.H, "Automatic lip contour extraction from color images," Pattern Recognit., vol. 37, no. 12.
[9] R. E. Fan, P. H. Chen, and C. J. Lin, "Working set selection using second order information for training support vector machines," J.vol. 6, pp. 1889–1918, Dec. 2005.
[10] R. C. Gonzalez and R. E. Woods, Digital Image Processing