Review on Biometric Identification Using Lip Prints

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Abstract: **Background/Objectives:** Study of biometric for human identification is trending nowadays. Several methods and algorithms have been suggested for the usage in biometric recognition system. "A biometric can be based on either a person's physical or behavioural characteristics." The key approach behind the means is to uniquely recognize humans by their inherent physical characteristics. Recognition or identification through these biometric features dissipates the issues related with the traditional approaches for identifying humans. Humans are identified or recognized through their physical characteristics and not by any external entity that they must provide for the process. **Methodology:** The paper presents a short review of all the methods used for the biometric identification using lips by various people. The various papers have been read and studied. The algorithms were analyzed. Then the methods have been implemented to show the output. **Results/Findings:** Biometric identification such as lip prints is used to recognize every individual. Lip shape and features have been detected using various algorithms.

Keywords— Lip extraction, feature extraction, Biometric identification, Cheiloscopy

I. INTRODUCTION

Biometric identification is a process by which human beings are being differentiated using their inherent physical traits. The various traits are being evaluated to show that they are different from each other and unique in nature. This feature makes them capable of the fact that they are used to uniquely identify humans. The various human traits which are used to uniquely identify human beings from one another are fingerprints, retina, iris scanning, lip prints, footprints etc. Amongst the mentioned characteristics, face recognition works at a grander area between prospective users and camera than new kinds of characteristics yet; one perilous problem of the face recognition system is that the system doesn't work well if the objective face is not completely visible. "Thus, considering a smaller part of a face for further recognition can be an effective way to solve this problem." The main application of biometrics is in forensics. Lip prints can be of a great value in forensics as if in crime scene if the lip prints are obtained then these can be used to differentiate and uniquely identify the person using the lip print. Many a times we might not get the finger prints or people might not be present for the iris and retina scanning. More over various works have been done to prove that fingerprints and retina scanning are capable of differentiating the human beings uniquely but only few works have been done that displays the uniqueness of lip prints. This paper presents reviews of the researches done on lip prints which is known as cheiloscopy. Lip prints are regular outlines as well as gaps forming wrinkles and grooves prevailing in the area of change of human lip. "The grooves present on human lips are unique to each person.""

II. BACKGROUND STUDY

Shokhan M.H and Khitam A.M in their paper "Biometric identification system by lip shape" discusses about a method of detection of the lip shape. The lip images which have been utilized for making a biometric identification system are of low resolution. The focus is mainly on the detection of the lip making the other features of the face unimportant and hence they have been discarded. Edge detection method has been utilized for the detection of lip from the face. The edge detection operator SUSAN(Smallest univalue segment assimilating nucleus) has been utilized. The operator is used to highlight the edges of the image. Once the edges are highlighted, the image has been converted into the desired colour scheme image. The scheme YCbCr has

been used because of the lip region being made of more red and blue components. The result of the above procedure is shown in Fig 1.

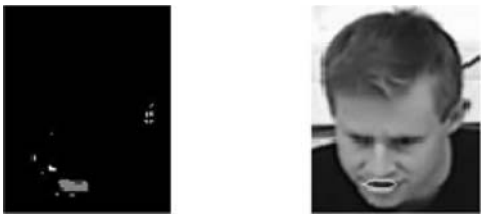


Fig. 1. Threshold version of image (left) and image detected (right)[2]

After the image has been changed to the desired color scheme, two things were done which are as follows:

- The lips have been located.
- The lips have been defined: For this four points were being marked horizontal minimum point, horizontal maximum point, vertical maximum point and vertical minimum point. With the help of these points the lip shape was detected as shown in Fig 2.

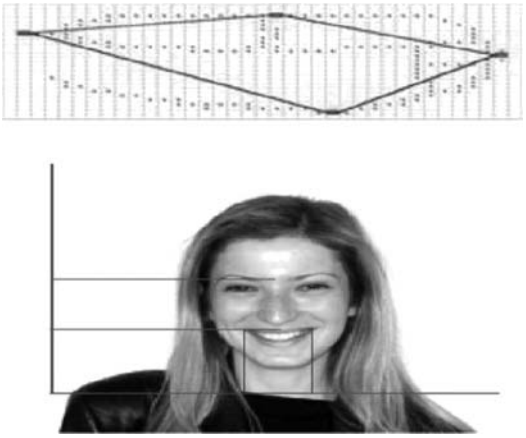


Fig. 2.2. Examples of maximum and minimum points selection [2]

Lip of individual human being has been detected exclusively by Reshmi M.P and Arul Karthick in the paper "Biometric identification system using lips". The algorithm used is Viola and Jone's algorithm because of the rapidness of the algorithm in detecting the face . The algorithm makes use of three different characteristics. At first, an integral image has been built for determining the characteristic and henceforth the value of respective rectangle characteristic has been calculated for every primary image. The second step consists of building a classifier. To build a classifier, AdaBoost learning algorithm has been used which selects a small no. of visual characteristics from a big set of values. The third step is to combine classifiers forming a "cascade" which does the work of discarding the background details. These were the steps to detect the face. After the face has been detected, the process for extracting the lip has been followed. For this numerous calculations has been carried out making the use of the source and the top right position of the face. To eliminate the camera noise fast box filtering and histogram stretching were used. Fast box filtering gives the outline of the gray scale values and Histogram stretching represents the extension of gray scale values. After the noise and the extra lights has been eliminated, the extraction of the mouth corners has been done. There are five mouth corners which have been extracted and those are: left and right corner, upper corner, middle lip corner and lower lip corner." For finding these corners "ISODATA (iterative self-organizing data analysis technique)" has been utilized. It is an unsupervised classification algorithm. The corners are extracted as follows:

- Left and right corner: the edge between these is all the time darker than the adjacent region.
- Upper lip corner and lower lip corner: these have much difference around the philthrum and the upper and lower lip boundary respectively.
- Middle point: it lies between one by third distances of the left and right corner.

After the detection of the face and the lips, the last step in the procedure is recognizing the lip as shown in Fig 3. For this, a classification technique namely "Support Vector Machine (SVM)" has been utilized. This technique makes a model which predicts the target values of the data tested.

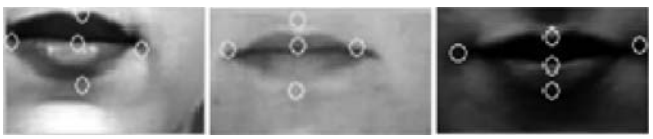


Fig. 3. Lips detected through unsupervised classification algorithm

Saptarshi Bhattacharjee in the paper "Personal identification from lip print features using a statistical model" proposed a method which identifies humans by statistically analyzing the lip prints. This makes use of Fast match and accurate match algorithm. The first step has been to convert the original image to the gray scaled image. The background's unwanted elements and the noise of the gray scaled image has been reduced by the process of clustering. Clustering has been carried out around the pixels of maximum as well as minimum intensity value so that the image could get dichotomized into the background and lip print pixels. The next step has been done to find out the grooves in the image. For this, canny edge detection method has been utilized. The canny edge method has been applied on the gray scaled image which results in enunciation of all the grooves present in image. For the next step which is feature extraction two algorithms has been used. The two algorithms are ats match algorithm and accurate match algorithm. In the former algorithm , the cardinality of the edge set acquired through canny edge detector has been used for normalizing the data acquired through sobel edge detector. Thereafter, a feature vector has been defined for upper as well as lower lip and therefore consisting of eight elements i.e. four elements for each. Feature vector ***F*** consists of elements H_{norm}, V_{norm}, D_{1norm} and D_{2norm}. This was fast match algorithm. In accurate match algorithm the process is similar to the former algorithm. The only difference is, primarily the image is resized to an image of greater size and thereafter the image is fragmented into 2x2 sub blocks as shown in Fig 4. Feature matrix is been calculated.

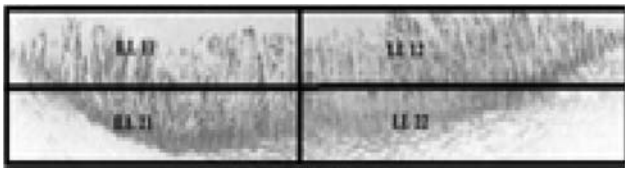
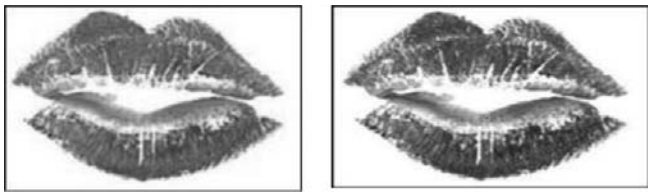


Fig. 4. Lip division according to feature matrix [1]

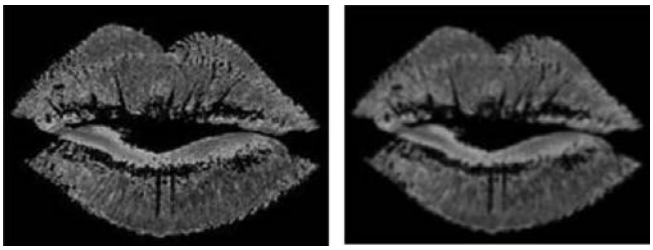
Feature matrix has been calculated for upper as well as lower lip prints. For the acceptance, the feature vectors have been compared to the test samples. The samples for four individuals were used.

Samir Kumar Bandyopadhyay, S Arurkumar, Saptarshi Bhattacharjee described how human beings can be identified using lip prints in their paper "Feature extraction of human lip prints." The lip prints are taken on a white background and it is converted into gray scale, Average gray level value is calculated using k-means clustering algorithm. Fast Fourier Transform is applied on the image. The first element of the transformed matrix contains the sum of all the intensity values. This value when divided by the total number of pixels in the image gives the average intensity value. This is assumed to be the initial threshold value. The image is segmented into object and background pixels, thus creating two sets as shown in Figs. 5 & 6. The average of each set is computed."



a **b**

Fig. 5 a). Captured image b) Gray scaled image [3]



c **d**

Fig. 2.6. Image after c) thresholding d)Passing through 7x7 Gaussian filter [3]

Smoothening has been carried out a number of times by repetitively utilizing Gaussian filter. This has been done so that the noise present in the image gets reduced and hence, just the significant grooves of lip prints are into consideration as shown in Fig 7.

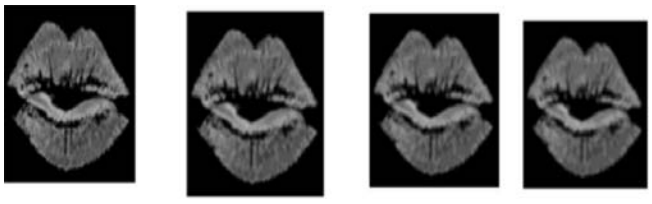
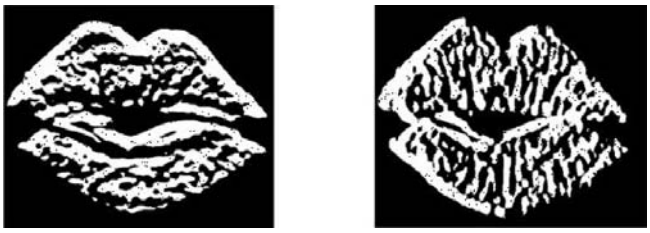


Fig.7. Gaussian filter applied four times for smoothing effect. [3]

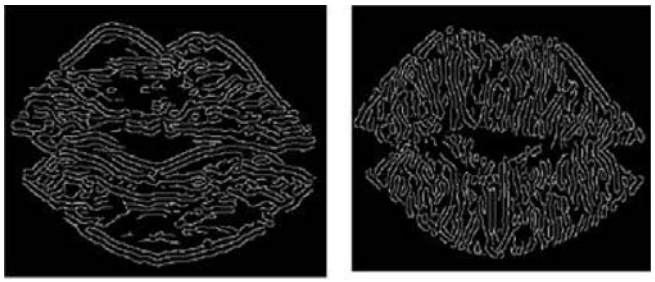
Sobel Edge Detector and Canny Edge Detector have been used for the detection of the characteristics of the

lips like vertical as well as horizontal grooves. Primarily, the paper dealt with statistical data like upper to lower lip height as well as width ratio and even anatomical verification by the study of physical indentations and grooves patterns in lip prints and matching them. Sobel edge detector does the work of finding the most prominent changes and canny edge detector detected the weak edges. "The sobel operator yielded the approximate absolute value of the gradient which corresponded to the edge, the Canny operator showed the placements of the tracked intensity discontinuities as an input. Non-maximal suppression technique has been applied to detect whether the gradient magnitude assumes local maximum in the direction of the gradient as shown in Figs. 8 & 9.



a b

Fig. 8 a). Horizontal sobel b)Vertical sobel operator applied. [3]



a b

Fig. 9. Applying canny edge detector on Fig.2.8 (a) and (b). [3]

The "proposed method has achieved promising recognition results for well detected lips images and it motivates us to recognize person based on lip.

III. COMPARATIVE STUDY

A comparative study of all the papers studied has been summarized as shown in Table 1.

Table 1. Comparison of the Review Papers

S. No.	Paper	Methods used	Result	Gaps
1.	Biometric identification system by lip shape by Shokhan M.H. and Khitam A.M.	Edge detection methods	Identification of lip by extracting lip shape from the face	No study on lip prints were done
2.	Biometric identification system using lips by Reshmi M.P. and V.J. Arul Karthick	Face detection viola and jone`s algorithm Lip detection (ISODA) iteractive self organizing data analysis technique	Extracts lip from the face	identification of individuals done by lip shape and not by lip prints
3.	Personal identification from lip print features using a statistical model by Saptarshi	Canny edge detection. Feature extraction: fast match and accurate match agorithm	Uniqueness of every individuals is shown.	Sample space is very less. The data of only four people has been used.
4.	Feature extraction using lip prints by Samir Kumar Bandyopadhyay, S. Arun Kumar, Saptarshi Battacharjee	Sobel and Canny edge detection.	The method detects the lips images and recognises the person based on lips.	The lip print must be taken on white background only. It is less effective for forensics and real time biometric identification.

IV. CONCLUSION

Biometric identification systems based on lip print are of great interest and have received very less scientific literature. Very few literature works have been done on the biometric identification through the lip prints and there exists few considerable loop holes. The methods have achieved promising recognition results for well detected lips images which helps in recognizing person based on their lip. Few of the major loopholes are few works only recognises the lip shape and not much work have been done on features of lip prints , few papers consists of very less sample space like data of only

four people as been used. Feature extraction algorithms must be used to extract minute features which will not only identify individuals effectively, but also provide easy and accurate results of an individual.

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