Research Paper

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Lip Segmentation Based on Edge Detection Technique

Computer Science

KEYWORDS : Face detection, Lip segmentation, Noise reduction, Edge extraction

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ABSTRACT

Face detection and lip segmentation is extreme area of research. This area related to gesture and speech recognition, done through detection of face features. Important face features are lip and eye. Here we have focus on lip segmentation from the face image. In this proposed model we have made use of edge detection and some morphological operation. The proposed algorithm is tested on 305 images which are taken under a standard condition. This algorithm has achieved 98.68% of success rate of lip segmentation.

1 Introduction

Lip detection is mainly used in gestures recognition. For communication gesture is used in daily life. E.g. face expression such as anger, smile, crying etc. This gesture recognition is main focus to identify lip contour on face region. Accurately and robustly tracking lip contour in image is especially difficult because lips are highly deformable, and they vary in shape, size and color. Also it has difficulty when there is a shadow area near the lip or the lip color is similar to that of the face. Figure 1 shows the points on the lip shift to wrong positions when lips are tightly closed. Figure 2 shows shadow area near lips. The lower lip contour jumps to the chin because of the shadow.

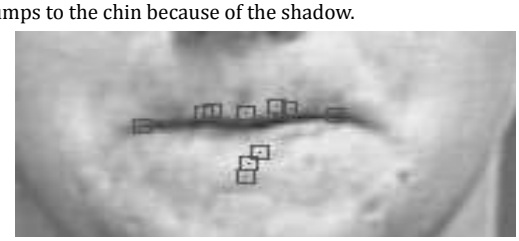

Figure 1: Lip is tightly closed.

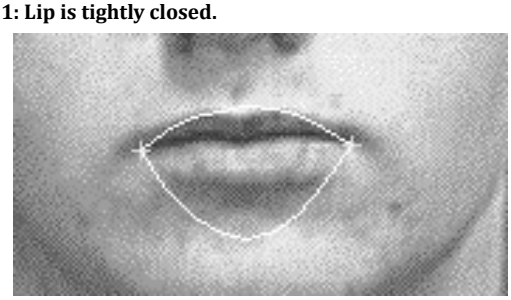

Figure 2: shadow on lip contour.

There are many techniques used by different researchers in various phases of lips segmentation detection. In this paper our goal is to track the lip segmentation in image of individual. The human face is automatically located in the first frame, and then noise reduction is done. To prepare image for processing phase, segmentation is done by edge detection. After that the lip segment automatically tracked in the image. This document has six sections. Introduction section is followed by a section of related work. In third section, the preprocessing is discussed. Section four describes lip segmentation in detail. In second last section of the paper, the result is discussed and finally conclusion is given.

2 Related Work

Here in this section overview of some of the research work related to lip contour detection and face and face feature extraction is given.

Yingli Tian et.al [1], Lip template location was initially given in this paper. To attain lip states (open, Close) the color and shape information is used. On over 5000 images this method has been tested. In almost 99% of the image sequences accurate tracking results were obtained. Erol ozgur et.al. [2], Lip Segmentation based on GMM's (Gaussian Mixture Models). We here will find the discussion on curve evolution using level-set method, lip corners extraction, adaptive color space training for lip and non-lip regions using Gaussian Mixture Models and on this paper face detection. Accuracy was obtained 85%. Mihaela gordan et.al [3], it is required to manually mark minimal number of points (6 to 12) on the mouth image in this paper. This method is basically based on the examination of gradient (edge) direction in the lips area. Edge detection was done by sobel edge detector. Rainer stiefelhagen et.al [4], Using a skin-color model, the eyes, lip-corners and nostrils the face is located and tracked inside the facial region. Roland Gocke et.al. [5], the saturation values for skin/lips, teeth, and oral cavity and template matching which are based on the basis of face tracking algorithm. They are utilized so that the combination of saturation and intensity are used to detect lip area throughout the algorithm. Nuria Oliver et.al. [6] , Tracking shape, classification of mouth and the human face was performed by hidden markov modes and 2D blob features in this paper. Result accuracies were very good. Aamer .S.S.Mohamed et.at.[7], The skin color which is the main feature of faces for detection is the content of this system and by using the neural networks the skin face is examined thereafter and its learnt from the feature of faces that it is classified whether face is comprised in the original image or not. The system has been tested on a dataset of upright frontal color face images from the internet and achived exellent detection rate. Siew Wen Chin et.al[8] , lips detection and tracking system based on watershed segmentation and skin/non-skin detection done to recognize the face region and the lips region is then detected from the face region in this paper. The input image into region is segmented by the watershed algorithm in this paper. In this method we found a good performance as far as the model results are concerned. Ali Atharifard et. Al[10], In this paper, by color segmentation and facial feature the face detection is done and geometric relations between them is detected. In YCbCr color spaces the skin color images are analyzed in this paper. One can find a weaker response around eye region in eye detection model cr color component and on the other hand the cb component has a storage value. In comparison with the other facial regions lip color region contains a strong red component and weak blue and green component..

3 Pre-Processing

Detection and tracking of the lip contour is an important issue in various areas. These methods work quite well in detecting front view of single face lips. Image background is not any fixed color or pattern. Although this model is completely automatic. In this model some image is collected through internet and from standard digital camera. Distance between camera and face should between 1 to 2 feet as it will contain more clear pixels informa-

tion. Following figure 3 shows image taken by digital camera.



Figure 3: original image

Original image were given to this model for further processing. First step is to detect face part from image. It is done using cascade classifier approach. So we will detect only face part from original image.

As size of image is too big so to improve system performance the next step is resize image using nearest-neighbor interpolation approach. Make varying size image into uniform format. So the size of image becomes compatible for further processing.

In the next step to reduced noise from image, smoothing is performed after resizing, by which image became clearer. We have done it by averaging RGB of current pixel by surrounding four pixels. We have access RGB of a pixel by three different color channels (i.e. Red color channel, Green color channel, Blue color channel).

The next process for normalization is conversion of RGB image to GRAYSCALE image. Using canny method, edge detection is performed on grayscale image. There is different approach for edge detection using sobel, prewitt etc. following figure 4 shows result of different method for edge detection.

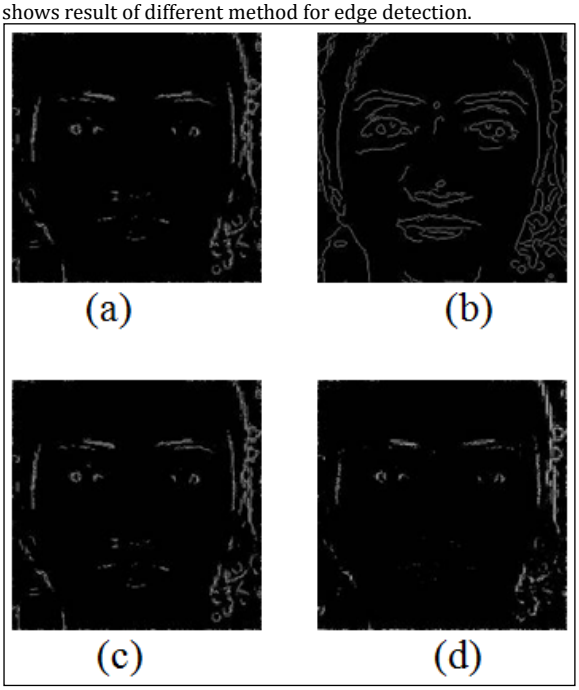

Figure 4: sample for edge detection by different methods (a) prewitt edge detection (b) canny edge detection (c) sobel edge detection (d) Roberts edge detection. Clarity for edge result is good in canny method.

From this result and Raman Maini et. at [9] decided to use best method for edge detection that is canny approach. In human face lips position is important aspect for lips detection. To search the lips, the approximate positions of the lips corners are on the lower part of face after nose and before chin. In this model lips detection was mainly based on lips position. Because every person has unique lips with different size, shape and color. For further processing, take edge from lower part of image near about 75% to 90%.

This image requires thickness of 3 pixels in square manner with dilation approach, which removes gap between edges at some point. Dilation resolves this problem. Figure 5 shows Dilation approach result.



Figure 5: Dilation approach

Dilation is mathematical morphological operation which is denoted by

$$A \oplus B = \{Z \mid B \cap A \neq \emptyset\} \quad (1)$$

Where,

A and B is set in Z

A is image of edge

B is set of 3 pixels

Ø is empty set

After dilation to get region of area for finding lip contour, filling operation is performed on edge. It will fill holes which gives complete closed regions.

Mathematical representation of fill operation is.

$$X K = (X K\text{-}1 \oplus B) \cap Ac \quad K=1,2,3\ldots(2)$$

Where,

X is same size as the array containing A (Except at the locations in X corresponding to the given point in each hole, which we set to 1).

AC is complement of A used to set limits the result to inside the region of interest.

4 Lip segmentation

Label each connected components of image. It returns set of segments that collectively cover the image. Using regionprops with BoundingBox property, we can measures a set of properties for each labeled region. It return structure having x, y, w, h for labeled region of image.

Representation of image region

x and y: axes point

w-width

h-height

These elements are used to find region with maximum width where its width is greater than height. This region considers as lips and region is Highlighting in figure 6.

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Figure 6: Lip segmentation.

Now to segment only lip contour find row and column of rectangle region. Then Find maximum and minimum row and column point, and then find out all pixels that lies down in between this point are highlighted. Figure 7 show only lip region from box area.



Figure 7: Lip Contour

5 Experimental Results

This model was tested on 305 images including male and female. Images are taken from digital camera. During photography the camera was positioned in front of the face and provided for full face view. And also it requires proper light on face. By performing testing it gives overall 98.68% result, in this result we have also included some un-precise images as they have also covered non lips part.

Result of model describe in various category like face detection, lip segmentation and lip contour extraction. Further lip contour have different category like over, under, exact lip extraction. Following table 1 shows face detection result.

	Male	Female	Total	Percentage
Success	151	153	304	99.67
Unsuccess	-	01	01	0.33
Total	151	154	305	100

Table 1: Face Detection Result

From above table 1, out of 305 images, correct face detection ratio for male and female is 304 images. Image fails to detect face result is 01 image. Image fails to detect face because face is not shown fully. Following table 2 shows lip segmentation result.

	Male	Female	Total	Percentage
Success	151	149	300	98.68
Unsuccess	-	04	04	1.32
Total	151	153	304	100

Table 2: Lip Segmentation Result

In above table 2, Lip segmentation result is 300 images out of 304 face images. Failure result is 04 images. Face images fails to detect lip segmentation due to some color differences and light shadow near to lip area. Following table 3 shows lip contour result.

	Male	Female	Total	Percentage
Over segmentation	60	32	92	30.67
Under segmentation	65	83	148	49.33
Lip	26	34	60	20
Total	151	149	300	100

Table 3: Lip Contour Result

In above table 3, lip contour segmentation has different category wise result. For over segmentation result is 92 images. In under segmentation result is 148 images. Exact lip shape including some un-precise image have result 60 images.

Figure 8, 9 and 10 shows successful images for face detection, lip segmentation and lip contour result respectively. Lip contour result include over, under and exact lip contour images respectively.



Figure 8: Face Detection Result



Figure 9: Lip Segmentation Result



Figure 10: Lip Contour Results

Figure 11 shows unsuccessful result for lip segment. In image lighting is not proper so image edge is not clear. This model is not work properly when Image has similar lip and surrounding skin color so detection is very difficult. This model is also not properly working on image of person having occlusion on face.



Figure 11: Unsuccessful result

6 Conclusion

This model used many preprocessing techniques, edge detection by canny method and height and width comparison for lip contour detection. This model works more effectively and gives 98.68% result for image sequences. In this model we can still improve accuracy of result by extracting perfect lips region. This accuracy is good but we still need improvements in increasing the robustness of the proposed method.

REFERENCE

| [1] Yingli Tian , Takeo Kanade, Jeffrey F. Cohn. Robust Lip Tracking by Combining Shape, Color and Motion (2000). | [2] Erol Ozgur, Berkay Yilmaz, Harun Karabalkan, Hakan Erdogan, Mustafa Unel. Lip Segmentation Using Adaptive Color Space Training (2008). | [3] Mihaela Gordan, Constantine Kotropoulos, Ioannis Pitas. Pseudo automatic Lip Contour Detection Based on Edge Direction Patterns (2002). | [4] Rainer Stiefelhagen, Uwe Meier, Jie Yang. Real-time lip-tracking for lip reading (1997). | [5] Roland Gocke, J Bruce Millar, Alexander Zelinsky, and Jordi Robert-Ribes. Automatic Extraction of Lip Feature Points (2000). | [6] Nuria Oliver, Alex Pentland , Vision and Modeling group, M.I.T.Media Arts and Sciences Laboratory. Lips and Face Real Time Tracker with Facial Expression Recognition.(1999). | [7] Aamer .S.S.Mohamed, Ying Weng, Stan S Ipson , Jianmin Jiang. Face Detection based on Skin Color in Image by Neural Networks (2008). | [8] Siew Wen Chin, Kah Phooi Seng, Li-Minn Ang, King Hann Lim. New Lips Detection and Tracking System. International MultiConference of Engineers and Computer Scientists 2009 Vol-I | [9] Raman Maini & Dr. Himanshu Aggarwal Study And Comparison of Various Image Edge Detection Techniques International Journal of Image Processing (IJIP), Volume (3) : Issue (1). | [10] Ali Atharifard, and Sedigheh Ghofrani. Robust Component-based Face Detection Using Color Feature. World Applied Sciences Journal 13(4): 847-857, 2011 |