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Facial Expression Prediction for Lie Detection

Anand. A. S
[1]PG Student, Department of MCA, CHMM College for Advanced Studies, Kerala, India

Abstract: *Facial expressions change is due to contraction and expansion of facial muscles, which alters the position of connected regions in the face. This muscle in the face that can change the shape of face area. This paper attempts to understand the contribution of different facial areas toward automatic expression recognition for lie detection. The proposed system can analyze lie detection among criminal suspects during interrogation. Based on these facial clues, we get the result from a trained eye. Here we use, parameters of eyes and lip for detecting the facial expression. The first step is to localize the face, followed by detection of connected regions. The lip and eyebrow corners are detected from the respective region of interest. Then we perform the expression generation algorithm in expression generation stage. In this algorithm, bi-linear transformation is used to manipulate the facial parameters. Thus, we can recognize some expressions like happy, angry, sad, fear, surprise. So, the system can assume lie from a suspect using the facial expressions.*

1. Introduction

The human-computer interaction (HCI) area will be effective, if a computer system can recognize the emotions from humans. Emotional states, which have a great role in the face, which can predict the mood of a person. So, if we are able to predict facial expressions, we can also learn something about the human emotions and moods. The major goal of this research is to design Automatic Facial Expression Recognition System (AFERS) which can take any human face images as input and recognize and classify some expressions such as class of angry, disgust, fear, happy, neutral, sadness, and surprise. This research points in the investigation of analyzing expressions from a human image and prediction of emotion from that image. These emotion predictions that can be easily applicable in crime management. While interrogation, facial expression predictions are helpful for lie detection from the suspect. Analyzing the emotional state of a suspect that can predict, how much he revealing truth.

1. Facial Expression Prediction

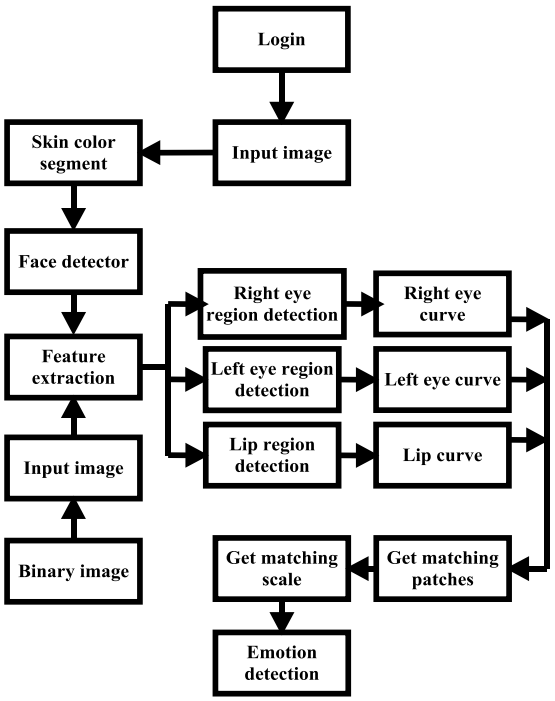

Figure1*:* - Processes in emotion detection

2. Emotion detection processes

In emotion detection, there are several steps, include:-

Skin color segmentation
Face detection
Eyes detection
Lip detection
Emotion detection
Lie detection

Using all the above steps, we can easily identify one's emotion according with their facial expressions.

2.1 Skin Color Segmentation

In skin color segmentation, first we should contrast the inputted image. Then process skin color

segmentation. Then, we have to identify the highest connected region from the current image. After that process, we have to find the probability to become a face of the highest connected region. If the highest connected region has the probability become a face, then a new form will open with highest connected region. If the highest connected regions height & width is greater than or equal to 50 and the height: width ratio is between 1 to 2, then it will be facing.

2.2 Face Detection

In face detection, first we need to convert the binary image from the RGB image. For binary image conversion, we should compute the average value of RGB for each pixel, and if the average value is below than 110, then replace it by pixels of black, and otherwise we replace it by pixels of white. From this process, we will get a binary image from the RGB image. Then, we should find the forehead from the binary image. We can scan from the center of the image, then try to find some continuous pixels of white after a continuous pixel of black. After that process, we should compute the maximum width of white pixels by searching vertical both left and right site. Then, if the new width, which is the lesser half of the previous maximum width, then we can break the scan, because when we reach to the eyebrows, then this situation will again arise. After that, we can crop the face of the starting position of the forehead and its high will be 1.5 multiplied by its width. Finally, we have an image which only contains eyes, nose and lip. Then we can cut the RGB image corresponding to the binary image.

2.3 Eye Detection

In eyes detection process, we should convert the RGB face to its binary face. Now, we can consider the face width by W. Scan it from W/4 to (W-W/4), to find the center position of the two eyes. The highest continuous pixels of white along the height range between the center positions of two eyes. By searching vertical, we need to find the starting high or upper position of the two eyebrows. For left eye, we should search w/8 to mid and for right eye we compute from mid to w – w/8. Here w is width of image and mid is a center position between two eyes. There may be some pixels of white between the eyebrow and eye. To make the eye and eyebrows connected, we should plot some continuous pixels of black vertically from eye to the eyebrow. For left eye, the black pixel-lines are vertically plotted in between mid/2 in mid/4 and for right eye the lines are plotted in between mid-+(w-mid)/ 4 to mid-+3*(w-mid)/ 4 and height of the black pixel-lines are from the eyebrow starting height to (h- eyebrow starting position) /4. Here w is the width of image and mid is center position of the two eyes and h is the height of the image. Then, vertically we should find the lower position of the two eyes by searching pixels of black. For left eye, we can search from the mid/4 to mid - mid/4 width, and for right eye, we can search mid + (w-mid) / 4 to mid-+3* (w- mid) / 4 width from image lower end to starting position of the eyebrow. Then by horizontally, we need to find the right side of the left eye by searching black pixel from the mid position to the starting position of black pixels in between the upper portion and lower portion of the left eye. And the left side for right eye we search mid to the starting position of pixels of black in between the upper portion and lower portion of right eye. The left side of the left eye is the starting width of the image and the right side of the right eye is the ending width of the image. Then we cut the upper position, lower position, left side and the right side of the two eyes of the RGB image.

2.4 Lip Detection

In lip detection, we obtain the lip boundary, and we assume that lip must be inside the lip boundary. So, find the distance between the forehead and eyes. Then we add the distance to the lower height of the eye to determine the upper height of the boundary which will contain the lip. Now, the starting point of the boundary will be the ¼ position of the left eye boundary and ending point will be the ¾ position of the right eye boundary. And the ending height of the boundary will be the low end of the face image. So, this boundary will contain only lip and may some part of the nose. Then we will cut the RGB image according the boundary. So, for detection eyes and lip, we only need to convert the binary image from RGB image and some searching among the binary image.

2.5 Emotion Detection

Emotion detection that can recognize with the help of parameters mentioned above. ie., parameters of lips and eyes. These values are taken as default values in algorithms, and the changes in the values will reflect the changes in expressions. Due to the expansion and contraction of facial muscles, the default parameter values will also be changed. By this the actual expressions and emotions that can be easily recognized by this system. In this system we use these emotions for lie detection.

2.6 Lie Detection

In several criminal cases, while interrogation the system can detect lies from the suspect, through their emotions and expressions. In addition to this feature, the system can be enhanced to include features such as detecting heart beat, body temperature, pulse rate etc. to detect lies from a suspect.

3 Conclusion

This paper helps to detect false hood from facial expressions. This concept is helpful in future robotics. Lie can be detected from a suspect by checking his facial expressions by detecting the changes in eyebrows, eyes and lips. In future, we can enhance this system by including the pulse rate, heart beat ,body temperature etc. for detecting lies.

4 References

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