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Real-Time Best Smile Detection

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Abstract: ***The mental state of a person is judged by detecting smiles. The smile detection starts with face recognition. Our paper accurately detects a face in an image, identifies the person's mouth, and determines if they are smiling or not. Given a set of images of a person entry in our system, we can compare these images using algorithms to detect face and to detect automatically the corners and the features of the mouth, then we determine which picture has the best smile. This method was robust and gives us the best result to detect the best smiling face from the database that contains 200 images.***

Keywords: Face Detection, Smile Detection, corner detection, Haar Classifier.

1. INTRODUCTION

For a photo, the difference between a "bad" and a "good" image is often linked to the fact that the person in the picture is smiling or not [1]. That is to say, the most common facial expression that we see in humans is the smile [2]-[3]. It gives a positive impression on others and makes the photo more accessible. This reflects joy, happiness, admiration from a person. The mental state of a person is judged by detecting smiles [8]-[9]. The goal is to automatically detect a smiling subject in an image. Our intended use is in the digital photography industry, where this algorithm can be applied to automatically select the best image from a set of similar frameworks.
Several applications of this program, for example is that it could automate the state photo ID process, allowing pictures to be taken by computers that have the ability to check whether the subject is smiling or not. Other possible applications of the smile of identification are used in marketing to analyze customer feedback [12]-[14]. Camera manufacturers can include smile detection as a feature to determine the perfect moment to take a photo. In addition, the camera can use face detection to help calculate the distance of optimum focus in portraits [10], [11], [13].

Some camera programs on current smartphones now have the opportunity to take a series of pictures in quick succession. The phone recognizes faces in each photo, allowing the user to select the best face for each person in a group. The faces are then combined into one photo to create the perfect group. Our code could be implemented in this type of program by automating the process of selecting the best smile of each person in the group, automatically creating the perfect group photo at a time.
In this paper, we start the process by detecting the face of the input image. Then we identify the mouth of the person and check if the person is smiling or not. To identify the best smile, we compare all the images we have.

2. METHODOLOGY

2.1 Procedure

Given a set of images of a person into the system, it compares these images and determines which picture has the best smile. The images can be of the same person or of the several distinct individuals. To identify the subject's face in the photo using the Viola-Jones algorithm and the same algorithm is used to locate the subject's mouth.
Next, the corner detection algorithm Shi-Tomasi is performed through the mouth area; it locates the edges and characteristics of the mouth (smile wrinkles, teeth, mouth shape). It uses the points obtained from the corner detection; a polynomial second degree line of best fit is drawn.
By taking the derivative of the line of best fit it determine the concavity points, and from there one can determine whether the subject is smiling or not in the photo.

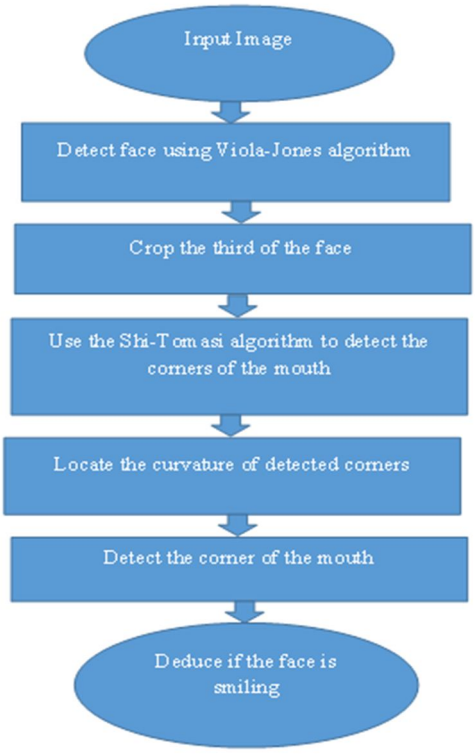

Figure 1 Program Overview.

2.2 Smile detection

To determine whether a subject is smiling or not, a combination of techniques is used. The first technique is tried simply to count all points of edge detection as a smiling person tended to produce more edges than someone without a smile, mainly due to the presence of teeth in a smile. However, they realized that this method was inaccurate when the subject gave a smile to the lips close together or was speechless but not smiling.

The following technique was to plot the points of edge detection, since a minimum threshold is reached, and calculate the best-fit line to the resulting point cloud. This technique combined with our first technique has proven to be an effective combination to detect the concavity of the region of the subject's mouth and the density of edge points in this area, allowing us to determine if the mouth shaped a smile.

2.3 Algorithms

Viola and Jones

The best known is the method developed by Viola and Jones in 2001 to detect the presence of a face image in real time. The technique uses pseudo-Haar features. This technique is to define rectangular and adjacent areas. Then calculating the sum of the intensities of pixels of the image in these areas. The difference between black and white rectangles gives the characteristic of pseudo-Haar.

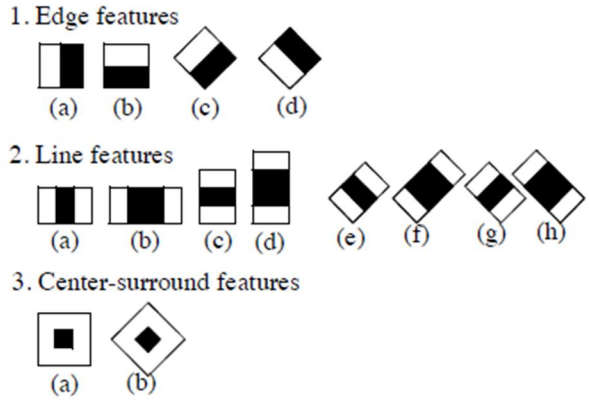

Figure 2 Examples of windows used to calculate the pseudo-Haar features [15].

The feature would be calculated by subtracting the sum of black pixels to the sum of white pixels (Figure 2). When Haar type wavelet passes over an image, the edges become more intense and can obtain a big difference between the white and black areas of wavelets (Figure 2) establishing a sufficiently high level of intensity, points above the threshold will probably edges. An image of a face presents many banks in different facial landmarks. To determine if a windowed region of the image is a face, several scans from different Haar features are made to ensure a high precision to detect a face [4].

Shi tomasi Corner detection

The angle sensing Shi-Tomasi is based on the Harris-Stephens corner detector [6-7], just with different threshold settings. We begin to explain the Harris corner detector. The basic idea of the Harris detector is that we should easily recognize the point in looking through a small window and moving a window in any direction should give a big change in intensity. This method is used to locate the mouth.

Then it uses the corners detected by using the Shi-Tomasi algorithm. It uses a least squares method to fit a second order polynomial to the detected edge points. In the second term control, we get a measure of the curvature of the points detected in the zone of the mouth.

3. PRODUCTION

This initiates a Viola-Jones detection function modified waterfall. Then, the image is input in the cascade system, giving an output of the coordinates of a box that surrounds the face (Figure3).

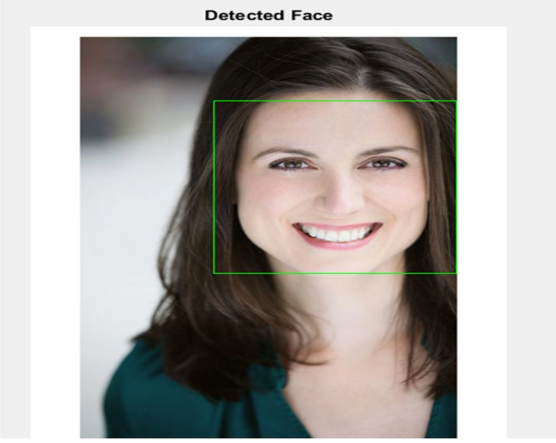

Figure 3 Detected face.

From the face detected the region for performing mouth mark is created. The lower third of the face region is isolated to perform the required mouth (Figure 4).

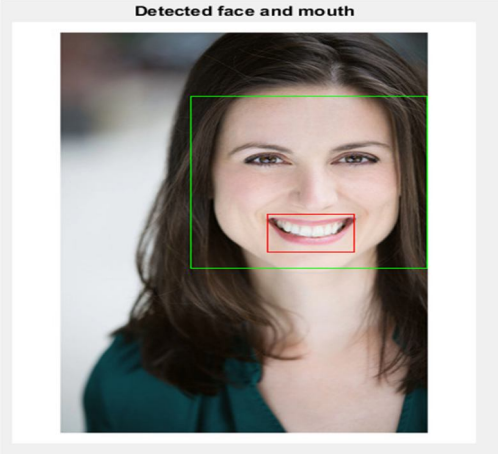

Figure 4 Detect face and mouth.

Our final detection step is to define the location of the corners in the mouth Box. This is done using the Shi-Tomasi algorithm (Figure 5).

Figure 5 Detected mouth.

From the points detected by the Shi-Tomasi algorithm, we find the corner density parameters and curvature (Figure 5).

3.1 Decision tree

It uses the decision algorithm to define the image having the best smile (Figure 6).

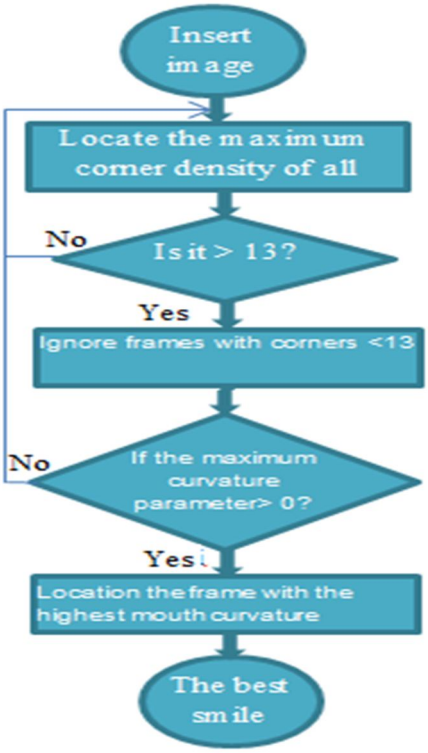

Figure 6 Decision algorithm.

4. OUR RESULTS

It takes 4 images to choose the best smile

Figure 7 Distingue 4 images to select the best smile.

When determining the best smile of this set of images, the following calculation data is used in the decision tree code.

Table 1. Area density and mouth curvature settings for 4 images.

a) Picture	(1) Corner density	(2) Mouth curvature
1	15	0.0040
2	16	0.0079
3	31	0.0111
4	13	0.0075

Photos two and three contain a high number of corner points, but the number three and four have a greater curvature. Since pictures third photo reached the minimum threshold and the greatest curvature, it was selected as the best smile photo of the whole.

In this method the best smile more is comparing to the same person, then onto different persons for having the best smile among them (Figure 8 and Figure9).

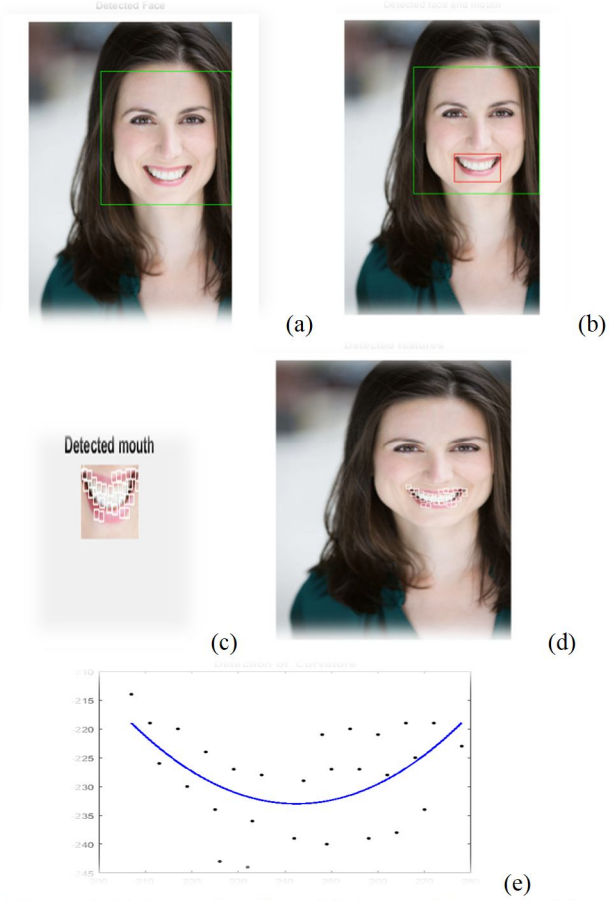

Figure 8 (a).Detection face, (b). Face with mouth, (c). Mouth, (d). Features and (e). Curvature in the 5 successive images.

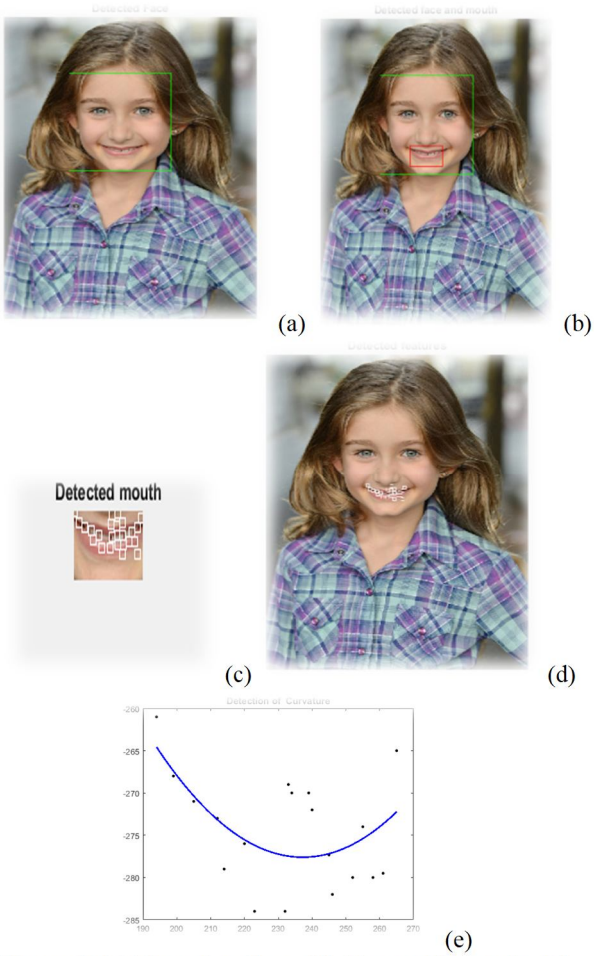

Figure 9 (a).Detection face, (b). Face with mouth, (c). Mouth, (d). Features and (e). Curvature in the 5 successive images.

The best smile is number 8 as it has the greater curvature, and meets the minimum number of data items (Table 2) and Figure 9.

Table 2. The results obtained for 20 images.

Picture	Corner density	Mouth curvature
1	63	0.0045
2	81	-9.6942-04
3	24	0.0051
4	12	-0.00034
5	10	0.0031
6	15	0.0040
7	16	0.0079
8	31	0.0111
9	13	0.0075
10	44	-0.0024
11	23	0.0029
12	108	0.0039
13	32	0.0086
14	37	0.0088
15	91	0.0032
16	57	9.9288e-04
17	24	0.0070
18	103	0.0019
19	14	0.0045
20	51	0.0058

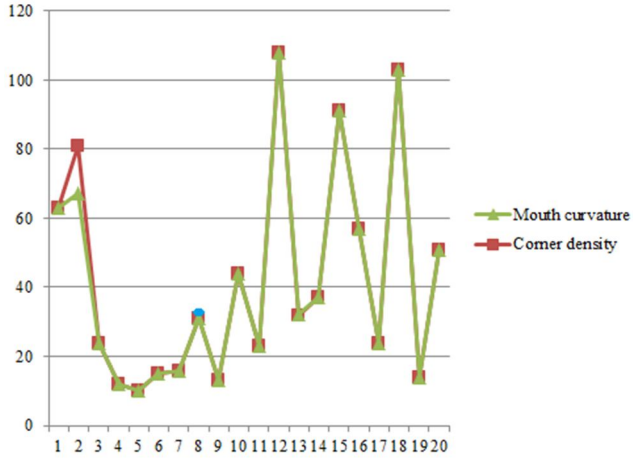

Figure 10 The best smile is number 8.

5. CONCLUSION

By detecting the characteristics and detection corners, we could detect if the person was smiling or not in the photo with Face Detection. This automatic identification of Smiles has many potential applications, including: enhanced camera functionality for advanced functionality.

In the future, we would try to update our model of mouth so that we can support a greater rotation of the head and scaling of the size of the face.

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