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Detecting Human Facial Expressions

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Abstract: Abstract: pc has been wide deployed to our daily lives; however human pc interaction still lacks intuition. Researchers shall resolve these shortcomings by augmenting ancient systems with human like interaction mechanism. Today, dedicated hardware usually infers the emotion from flesh measures. These are a substantial quantity of analysis done into the detection and implicit communication channels, as well as facial expressions. Most studies have extracted face expression for a few specific emotions in specific things. During this paper we have a tendency to uses a feature purpose pursuit technique applied to completely different facial image regions to capture basic emotions. We have a tendency to use grayscale pictures that area unit ethically not various. We have a tendency to use optical flow primarily based analysis to notice emotions from human facial image knowledge. Our proof of knowledge demonstrates the practicableness of our approach and shows promising for integration into varied applications.

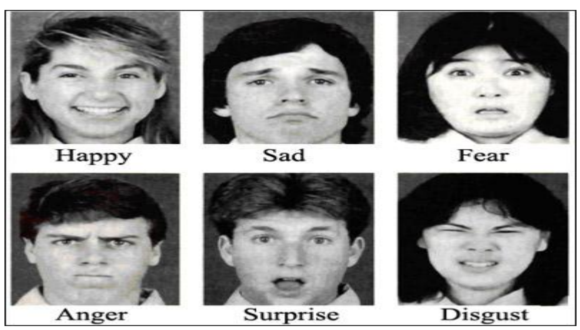
Index Terms—facial expressions, interaction, feature, emotion, intuition.

1. INTRODUCTION

Emotion detection from facial images is one of the most relevant applications of image analysis. It is a true challenge to build an automatic system which equals human ability to recognize emotions. Although humans are quite good in identifying emotions but an automated system can help us to recognize emotions and to use this skill in the different fields like Information security, Access management, Biometrics, Law enforcement, Personal security etc. Facial expression recognition can be utilized for automated analysis of human emotion.

Communication between humans is influenced by emotion. Interpersonal behavior is affected by facial expressions during communication. The study of human facial expressions started with Darwin (1965) in the 19th century and is still being studied. In 1971, Ekman and Frisen classified emotions into six primary categories, all universal across different ethics and cultural groups with each being represented by a unique facial

Six emotional categories are: Happiness, Sadness, Surprise, Fear, Anger and Disgust. Recent approaches for facial expression detection are Template Based Method Edward, Cootes and Taylor (1998) and Feature Based Method by Black and



Yacoob (1997). The difference between these two methods depends on the use of still images or Successive image sequences and whether they are template of feature based (Pantic & Rothkrantx, 2000). The template approach uses the average face for each category of emotion and classifies the

Fig 1. Six universal facial expressions

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individual facial expressions according to the best match of each feature template. The feature based approach uses a training set of images for different emotional expressions. The features are extracted from each emotion subset for all facial expressions and then are subsequently tested unseen facial images. Feature based technique involves detecting changes of the features in different facial parts. The selection of these facial parts (regions) is based on the Facial Action Coding System (FACS). The Facial Action Coding System is a human observed based system designed to detect changes in facial features.FACS consists of 44 anatomically based action classifiers, which individually or in combination can represent all visible discriminate expressions. The tracking algorithm used in this research was separately applied to the different facial image regions (Eyes and Lip) each represented by their points of interest. This approach was chosen to accelerate the computation and to classify the images based on the movement of individual facial regions rather than the entire face. This approach was to create independence for each facial feature and thus it was envisaged that the accuracy of the tracking process would be increased and thus achieve a better classification result.

The tracking algorithm generally compared the pixel values of a feature point to that of the surrounding pixels to determine their orientation. Misorientation of movement increases with changing light conditions faces whit glasses and facial hair. To minimize this, images of faces with glasses and facial hairs were not used in this research. The advantage of tracking feature points of individual facial regions allowed each area to be classified individually. Based on threshold, the feature points of a region were either discarded or used as input for the classifying process.

2. METHODOLOGY

2.1 *Skin Color Segmentation*

The facial image pre-processing includes: facial feature acquisition and face normalization (angle and size).Such Normalization‟ is necessary if the subjects in the images exhibit out of focal space motion. To compensate for this motion an affine transformation‟ is used (Weisstein, 2000). This transformation ensures no changes occur to the normalized face position and maintains magnification. Colored images of the dataset were then transformed into grey scale images and were resized into 256 X 256 pixel dimensions. Using FACS as a basis, the different facial regions were cropped from the image. The resultant of feature extracted formed the input data for the extraction process.

2.2 Face Detection

Face detection is a concept that includes many sub problems. Face detection algorithms usually share common Process. Firstly, few data dimension reduction is done. Few preprocessing could also be done to adapt he input image to the algorithm prerequisites, the next phase usually involves extracting facial features or measurements.

Fig2: Binary Face Conversion

Fig3: Face Detection

These will be weighted, evaluated or compared to decide if there is a face and where is it. Face detection is, therefore, a two class problem where we have to decide if there is a face or not in an image. This approach can be seen as a simplified face recognition problem. Second class is face detection, in this paper first we take an image and for face detection, first, we convert the RGB image to binary image. To convert it to binary image, we calculate the mean value of R, G and B components of each pixel and if the average value is below than 110, we

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replace that pixel by a Black pixel. Otherwise we replace it by white pixel. At the end we get the binary image. After this process we try to check the possibility of the image to be a face. For this purpose we calculate the height and width of the continuous white pixels.

If the height and width are greater than 50 and the ratio of height and width lies in between 1 and 2 then there is a possibility to have a face otherwise not. At the end of this process, we try to find the forehead from the binary image. We start from the middle of the image to find continuous white pixels after continuous black pixels. Our aim is to find the maximum width of white pixels by searching both horizontal direction and vertical direction. Then, we cut the face from the starting position of the forehead and its height will be 1.5 multiple of its width. Then we having a picture, in which will contain mainly the Eyes, Nose and Lip parts. Then we cut the RGB image according to the binary image.

$$Mid = \max\left(th(xi, y)\right) where \frac{W}{4} \leq i \leq \left(W - \frac{W}{4}\right)$$

2.3 Finding Region of Interests (ROI)

To obtain different region of interests from the facial image, we again convert the RGB image to binary facial image with the above discussed method. Now we consider the face width by W.

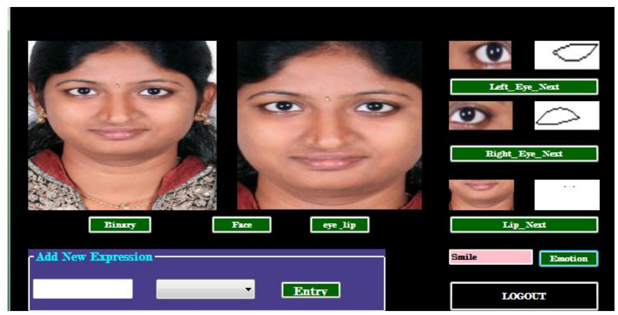
Eye Portion: For eyes detection, we scan from W/4 to (W- W/4) to find middle position of two eyes. The highest white continuous pixel along the height between the ranges is the middle position of two eyes. Then we find the starting high or upper position of two eyebrows by searching upper bounds. For left eye, we search W/8 to **Mid** and for right eye, we search from mid to W/8, here **Mid** is the middle position of eyebrows and eye connected, we place some continuous black pixels vertically from eyebrow to eye. For left eye vertical black pixels are placed in between Mid/2 to Mid/4 and for right eye position, the curves are in between Mid+(W-Mid)/4 to Mid + 3* (W-Mid)/4, and the height of black pixel lines are from the eyebrow starting

Height to (H-eyebrow starting height)/4.

2.4 Facial Feature Point Extraction

Where th(xi,y)= Total height of continuous White pixels

Apply Bezier Curve on Lip: In Lip box, there is lip and may be some part of nose. We convert the skin pixel to white pixels and other pixels as black. We also find some pixels which are similar to skin pixels and convert them to white pixels. If two pixels have RGB value difference less than or equal to value 10 then, we called them as pixels with same feature. So in the binary image, there are some black regions on Lip, nose and may some other little parts which are considered as similar pixels. Then we find the biggest connected region from those black regions and consider that region as Lip region. Because in Lip box, lip is the largest thing which is different than skin. To make Bezier Curve from this black region, we find the starting and ending pixels of the lip in horizontal. Then we draw tow tangents on upper lip from the starting and pixels ending point. For the lip lower part, we find two points with the similar process as with the upper lip.



We choose cubic Bezier curves to find the feature points from the lip.

$$\sum_{i=0}^{n} if \frac{Ri + Gi + Bi}{3} \geq 110 \ then \ I(xi, yi) = 255$$

Fig4: Extracted Feature Points

$$\sum_{i=0}^{n} if \frac{Ri + Gi + Bi}{3} < 110 \ then \ I(xi, yi) = 0$$

add the distance with the lower height of the eyes to determine the upper height of the box which will contain the lip, Now, the starting point of the box will be the $1/4^{th}$ position of the Left eye box and ending will be $3/4^{th}$ position of the Right eye box. The ending height of the box will be the lower end of the facial Feature image, so this part will contain only lip and may some part of the nose. Then we cut the RGB image according to the Lip box.

Then we find the lower position of two eyes by searching black pixels vertically. 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 image. Then we cut the upper position, lower position, left side and right side of two eyes from the RGB image.

Lip Portion: For the detection of lip, we determine the Lip Box. And we consider that lip must be inside Lip Box. First we determine the distance between the forehead and eyes.

4. CONCLUSION

This study has investigated the possibility to detect the four facial expressions happy, surprise and sad in image sequences by applying a tracking algorithm. After detecting some region of interests like Lip, Left Eye and Right Eye from facial image, we are finding some feature points from them. We find six feature points from each ROI Lip, Left Eye and Right Eye. Then we compare the extracted feature points from the image to our database and according to the match of feature points we detect the emotion category. Also after capturing some feature points we save them in the database to make database stronger if there is no match found for a specific facial image. Then from the database we found the range of values supported by the different feature vectors. Feature Vectors helps us to make our algorithm simpler and more accurate. For future work we will try to find the range of some emotion categories like Anger and Disgust with the help of our experimental data. As Anger and Disgust categories are difficult to find because the range of feature points for these emotion categories bit similar to facial expression category Happy.

REFERENCES

[1] B. Fasel and J. Luettin, "Automatic facial expression analysis: A survey," *Pattern Recognit.*, vol. 36, no. 1, pp. 259–275, 2003.

[2] P. Ekman, E. T. Rolls, D. I. Perrett, and H. D. Ellis, "Facial expressions of emotion: An old controversy and new findings discussion," *Phil. Trans. Royal Soc. London Ser. B, Biol. Sci.*, vol. 335, no. 1273, pp. 63–69, 1992.

[3] A. Mehrabian, *Nonverbal Communication*. London, U.K.: Aldine, 2007.

[4] M. Pantic and I. Patras, "Dynamics of facial expression: Recognition of facial actions and their temporal segments from face profile image sequences," *IEEE Trans. Syst., Man, Cybern. B*, vol. 36, no. 2, pp. 433– 449, Apr. 2006.

[5] J. Wang, L. Yin, X. Wei, and Y. Sun, "3-D facial expression recognition based on primitive surface feature distribution," in *Proc. IEEE Conf. Comput. Vis. Pattern Recognit.*, Jun. 2006, pp. 1399–1406.

[6] Y. Lijun, C. Xiaochen, S. Yi, T. Worm, and M. Reale, "A high-resolution 3-D dynamic facial expression database," in *Proc. 3rd Int. Conf. Face Gesture Recognit.*, Amsterdam, The Netherlands, Sep. 2008, pp. 1–6.

[7] S. M. Lajevardi and Z. M. Hussain, "Emotion recognition from color facial images based on multilinear image analysis and Log-Gabor filters," in *Proc. 25th Int. Conf. Imag. Vis. Comput.*, Queenstown, New Zealand, Dec. 2010, pp. 10–14.

[8] L. Torres, J. Y. Reutter, and L. Lorente, "The importance of the color information in face recognition," in *Proc. Int. Conf. Imag. Process.*, vol. 2. Kobe, Japan, Oct. 1999, pp. 627–631.

[9] P. Shih and C. Liu, "Comparative assessment of content-based face image retrieval in different color spaces," *Int. J. Pattern Recognit. Artif. Intell.*, vol. 19, no. 7, pp. 873–893, 2005.

[10] Z. Liu and C. Liu, "A hybrid color and frequency features method for face recognition," *IEEE Trans. Image Process.*, vol. 17, no. 10, pp. 1975– 1980, Oct. 2008.

[11] M. Mansoorizadeh and N. M. Charkari. Multimodal information fusion application to human emotion recognition from face and speech.Multi.Tools and App, 2009.

[12] O. Martin, I. Kotsia, B. Macq, and I. Pitas. The enter-face‟05 audio-visual emotion database.In ICDEW ‟06,Washington, DC, USA, 2006.

[13] M. Paleari, R. Benmokhtar, and B. Huet.Evidencetheory-based multimodal emotion recognition. InMMM‟09, pages 435–446, Berlin, 2008.

[14] J. Pittermann, A. Pittermann, and W. Minker.Handling Emotions in Human-Comp. Dialog.Springer,Dordrecht (The Netherlands), 2009.

[15] B. Schuller, S. Steidl, and A. Batliner. The interspeech2009 emotion challenge.In Proc. Interspeech 2009.

[16] N. Sebe, I. Cohen, and T. G. T. Huang. Multimodalapproaches for emotion recognition : A survey. In Proc.of SPIE, volume 5670, pages 56–67, January 2005.

[17] P. Viola and M. Jones. Robust real-time face detection.Int. J. of Comp. Vision, 57(2):137 – 154, 2004.

[18] O. Yamaguchi, K. Fukui, and K. Maeda. Face recognition using temporal image sequence. In Proc. of AFGR,pages 318–323, 1998