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Human Emotion Recognition Using Face Detection

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ABSTRACT: Human emotion recognition plays an important role in the interpersonal relationship. The automatic recognition of emotions has been an active research topic from early eras. Therefore, there are several advances made in this field. Emotions are reflected from speech, hand and gestures of the body and through facial expressions. Hence extracting and understanding emotion has a high importance of the interaction between human and machine communication. This paper describes the advances made in this field and the approaches used for recognition of emotions through facial expressions. The main objective of the paper is to propose real time implementation of emotion recognition system.

KEYWORDS: Human Emotion Recognition, Facial Expression, Image Preprocessing, Face Detection, Emotions, Emotion detection

I. INTRODUCTION

We know that emotions play a major role in a Human life. At different kinds of moments or time Human face reflects how he/she feels or in which mood he/she is. Humans are capable of producing thousands of facial actions during communication that vary in complexity, intensity, and meaning. Emotion or intention is often communicated by subtle changes in one or several discrete features. Though much progress has been made, recognizing facial expression with a high accuracy remains to be difficult due to the complexity and varieties of facial expressions [1].

Generally human beings can convey intentions and emotions through nonverbal ways such as gestures, facial expressions and involuntary languages. This system can be a significantly useful, nonverbal way for people to communicate with each other. The important thing is how fluently the system detects or extracts the facial expression from the image. The system is growing attention because this could be widely used in many fields like lie detection, medical assessment and human computer interface. The Facial Action Coding System (FACS), which was proposed in 1978 by Ekman and refined in 2002, is a very popular facial expression analysis tool [2].

On a day to day basics humans commonly recognize emotions by characteristic features, displayed as a part of a facial expression. For instance happiness is undeniably associated with a smile or an upward movement of the corners of the lips. Similarly other emotions are characterized by other deformations typical to a particular expression. Research into automatic recognition of facial expressions addresses the problems surrounding the representation and categorization of static or dynamic characteristics of these deformations of face pigmentation [5].

II. PROBLEM DEFINITION

Human emotions and intentions are expressed through facial expressions and deriving an efficient and effective feature is the fundamental component of facial expression system. Face recognition is important for the interpretation of facial expressions in applications such as intelligent, man-machine interface and communication, intelligent visual surveillance, teleconference and real-time animation from live motion images. The facial expressions are useful for efficient interaction. Most research and systems in facial expression recognition are limited to six basic expressions (joy, sad, anger, disgust, fear, surprise). It is found that it is insufficient to describe all facial expressions and these expressions are categorized based on facial actions [7].

Detecting faces and recognizing facial expression is a very complicated task when it is vital to pay attention to primary components like: face configuration, orientation, location where the face is set.

III. HUMAN EMOTIONS

Emotion is an important aspect in the interaction and communication between people. Even though emotions are intuitively known to everybody, it is hard to define emotion. The Greek philosopher Aristotle thought of emotion as a stimulus that evaluates experiences based on the potential for gain or pleasure. Years later, in the seventeenth century, Descartes considered emotion to mediate between stimulus and response [8]. Nowadays there is little consensus about the definition of emotion. Kleinginna and Kleinginna gathered and analyzed 92 definitions of emotion from literature present that day [9]. They conclude that there is little consistency between different definitions and suggested the following comprehensive definition:

Emotion is a complex set of interactions among subjective and objective factors, mediated by neural/hormonal systems, which can:

1. Give rise to affective experiences such as feelings of arousal, pleasure/displeasure;

2. Generate cognitive processes such as emotionally relevant perceptual effects, appraisals, labelling processes;

3. Activate widespread physiological adjustments to the arousing conditions; and

4. Lead tobehaviour that is often, but not always, expressive, goal directed, and adaptive.

On the other hand emotion also adjusts the state of the human brain, and directly or indirectly influences several processes [8].

Fig1 is showing different Human emotions which are usable in order to achieve our goal.

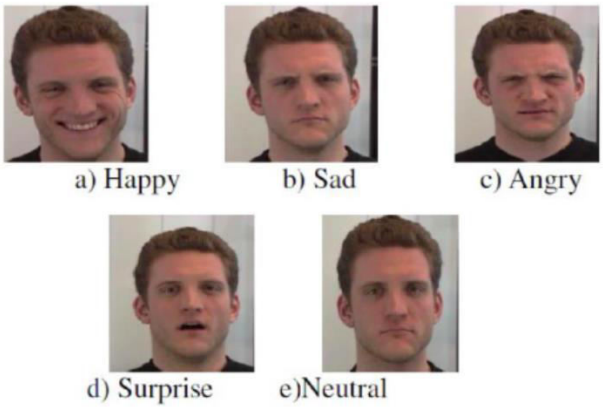

Fig. 1: Different Human Emotions

In spite of the difficulty of precisely defining it, emotion is omnipresent and an important factor in human life. People‘s moods heavily influence their way of communicating, but also their acting and productivity. Imagine two car drivers, one being happy and the other being very mad. They will be driving totally different. Emotion also plays a crucial role in all-day communication. One can say a word like `OK' in a happy way, but also with disappointment or sarcasm. In most communication this meaning is interpreted from the tone of the voice or from non-verbal communication. Other emotions are in general only expressed by body language, like boredom [10].

IV. SCOPE OF THE RESEARCH WORK

i. This research work deals with measuring the facial expressions of human beings.

ii. It does not deal with the rest of the body of humans.

iii. Since it is possible to run these algorithms in a real environment, a simulator is developed which will simulate the proposed work.

iv. Different types of tests will be implemented using the proposed strategy.

v. Visualization of the experimental results.

vi. Appropriate conclusions will be made based upon performance analysis.

Throughout the research work emphasis has been on the use of either open source tools technologies or licensed software.

V. RESEARCH METHODOLOGY

The step-by-step methodology to be followed for Human emotion recognition system.

A. Image Acquisition

Images used for facial expression recognition are static images or image sequences. Images of faces can be captured using a camera.

B. Face detection

Face Detection is useful in detection of facial image. Face Detection is carried out in a training dataset using Haar classifier and implemented through Opencv. Haar like features encode the difference in average intensity in different parts of the image and consists of black and white connected rectangles in which the value of the feature is the difference of sum of pixel values in black and white regions [4].

C. Image Pre-processing

Image pre-processing includes the removal of noise and normalization against the variation of pixel position or brightness.

i) **Grayscale Conversion:** For getting to reduce the information of images, image should be done by converting to grayscale. Each color image (RGB images) are composed of 3 channels to present red, green and blue components in RGB space. Below is the example to give the general ideal of the RGB color image.

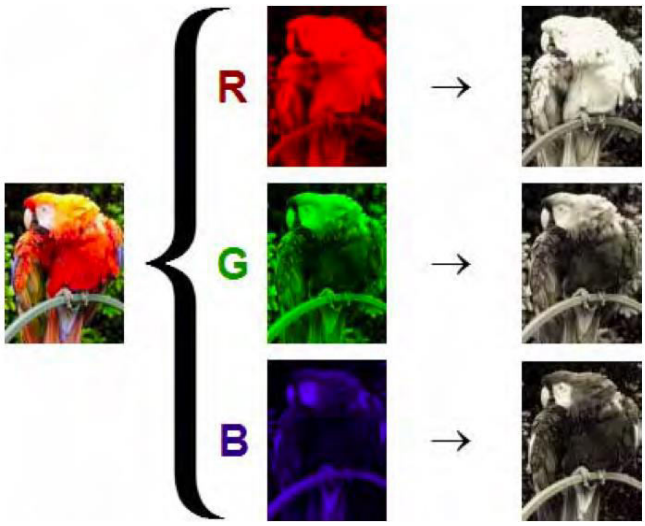

Fig. 2: Example of process of GreyScale Conversion

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Image is defined with grayscale level, which means pixels in images are stored in an 8-bit integer to represent color from black to white[11]. In addition, grayscale images are sufficient enough to process face detection.

ii) **Image Resizing:** Images are synthesized by numerous pixels which is the small unit in the image. Also, images are the 2-dimensional matrix pattern, every pixel in the images is represented by something information. For example, '0' is white and '255' is black in gray scale images. Because there is a lot of information to deal with, input images are employed in resizing processing to reduce the image resolution while keeping the same quantity. Below example is an illustration about the different resolutions to describe the same image.

Fig. 3: Example of process of

Image Resizing

The top-left side of each image is the resolution of each one. Left-side's image is the original.

Image has 3000 pixels in width and 2000 pixels in height which means it has 3000 x 2000 = 6,000,000 pixels or 6 megapixels. If the image has been resized into 1000 pixels in width and 600 pixels in height, the image only has 0.6 megapixels. At least the system only uses 1/10 timing to handle it. However, if you had to adjust the size of the image, it will also affect the face detection rate.

iii) **Histogram Equalization:** Histogram equalization is a statistical method of images processing. It works as a statistical histogram of color distribution of the average scattered in the histogram, so that the distribution of a histogram graph homogenization.

This method usually increases the contrast of the input images.[11] In face detection systems, The left-hand side of below images is resized grayscale images. Another is output images after proceeding the processing of histogram equalization. You will see very significant results.

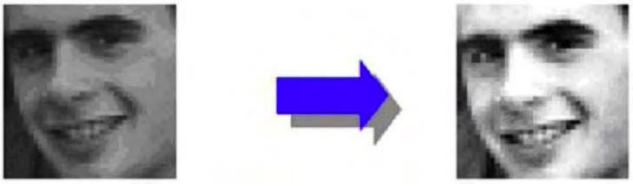

Fig. 4: Example of process of Histogram Equalization

D. Feature Extraction

Selection of the feature vector is the most important part in a pattern classification problem. The image of face after preprocessing is then used for extracting the important features. The inherent problems related to image classification include the scale, pose, translation and variations in illumination level [4].

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E. Classification

The dimensionality of data obtained from the feature extraction method is very high so it is reduced using classification. Features should take different values for objects belonging to different classes so classification will be done using Support Vector Machine algorithm.

i) **Support Vector Machines:** SVM is widely used in various pattern recognition tasks. SVM is a state-of-the-art machine learning approach based on the modern statistical learning theory. SVM can achieve a near optimum separation among classes. SVMs is trained to perform facial expression classification using the features proposed. In general, SVM are the maximal hyperplane classification method that relies on results from statistical learning theory to guarantee high generalization performance.

Kernel functions are employed to efficiently map input data which may not be linearly separable to a high dimensional feature space where linear methods can then be applied. SVMs exhibit good classification accuracy even when only a modest amount of training data is available, making them particularly suitable to a dynamic, interactive approach to expression recognition [6].

An ideal separation is achieved when the hyperplane and the training data of any class is the largest. This separating hyperplane works as the decision surface. SVM has been successfully employed for a number of classification tasks such as text categorization, genetic analysis and face detection [7].

Given a training set of labeled samples:

$$D = \{(xi, yi|xi\ \varepsilon R\ ,yi\varepsilon\{-1,1\}\}\ i=1 \qquad (1)$$

A SVM tries to find a hyperplane to distinguish the samples with the smallest errors.

$$w.\ x - b = 0 \qquad (2)$$

For an input vector xi, the classification is achieved by computing the distance from the input vector to the hyperplane. The original SVM is a binary classifier [3].

VI. HOW EMOTION RECOGNITION SYSTEM WORKS

Consider the Fig 5 in which required steps are given for emotion recognition.

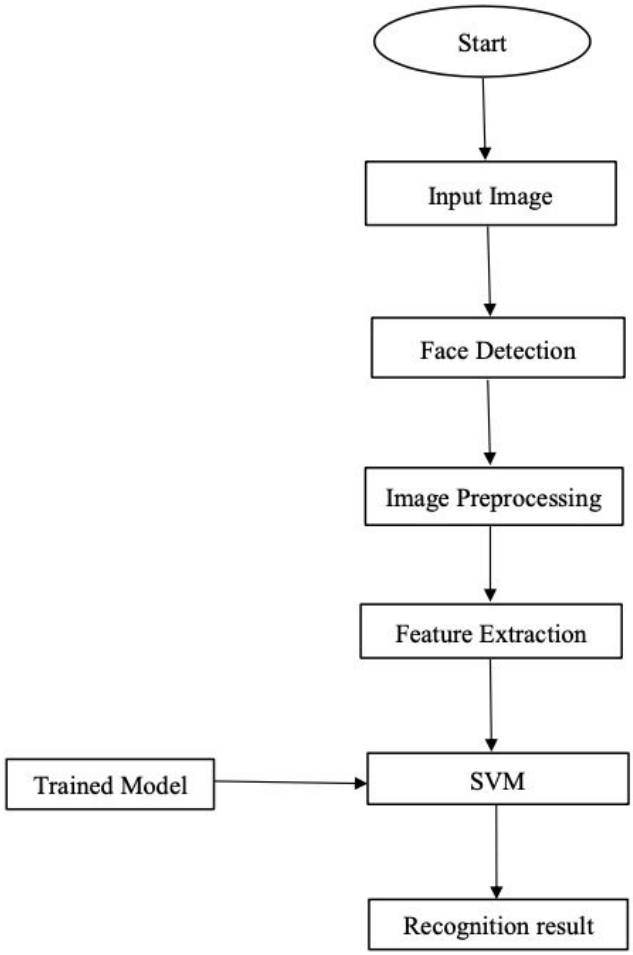

Fig. 5: How Emotion Recognition System works

VII. DEVELOPED SIMULATOR

In this section I am going to define the design of my system that is how it looks like or what will happen if you give this kind of input. Fig. 6 shows my proposed system when it runs for the first time.

In this system I have added 1 input button, and 2 output/result sections.

a. Start Capture button for inputting the face detected.
b. First output/result section for displaying the detected face.
c. Second output/result section for displaying the emotion recognized.

Fig.7 is showing the output of my proposed system when it will actually be implemented.

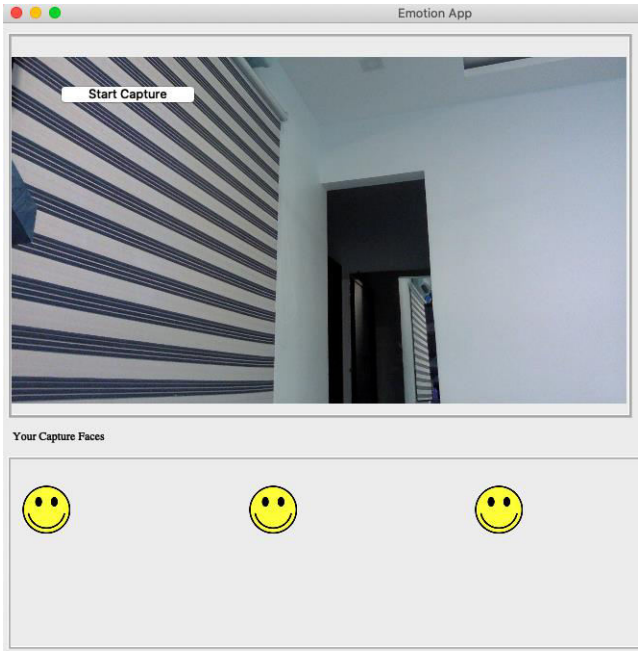

Fig. 6: How Human Emotion Recognition System looks.

VIII. PERFORMANCE RESULTS

To measure the performance of proposed algorithms and methods and check the results accuracy, the system has been evaluated using Precision. The same datasets were used for both training and testing by dividing the datasets into training samples and testing samples in the ratio of 7:3. The Precision from the dataset was 83.6142%.

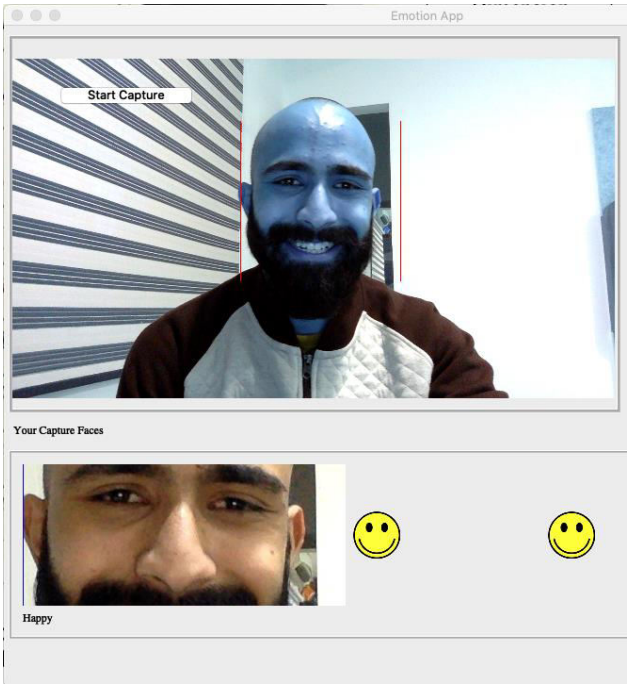

Fig. 7: Result of Human Emotion Recognition System.

IX. CONCLUSION

This project proposes an approach for recognizing the category of facial expressions. Face Detection and Extraction of expressions from facial images is useful in many applications, such as robotics vision, video surveillance, digital cameras, security and human-computer interaction. This project's objective was to develop a facial expression recognition system implementing the computer visions and enhancing the advanced feature extraction and classification in face expression recognition.

In this project, seven different facial expressions of different persons' images from different datasets have been analyzed. This project involves facial expression preprocessing of captured facial images followed by feature extraction using feature extraction using Local Binary Patterns and classification of facial expressions based on training of datasets of facial images based on Support Vector Machines. This project recognizes more facial expressions based on ISED Indian face dataset.

Experiment results on the dataset, ISED dataset -- provided by IIT-Kharagpur, India -- show that our proposed method can achieve a good performance. Facial expression recognition is a very challenging problem. More efforts should be made to improve the classification performance for important applications. Our future work will focus on improving the performance of the system and deriving more appropriate classifications which may be useful in many real world applications.

X. FUTURE WORK

Face expression recognition systems have improved a lot over the past decade. The focus has definitely shifted from posed expression recognition to spontaneous expression recognition. Promising results can be obtained under face registration errors, fast processing time, and high correct recognition rate (CRR) and significant performance improvements can be obtained in our system. System is fully automatic and has the capability to work with images feed. It is able to recognize spontaneous expressions.

Our system can be used in Digital Cameras wherein the image can be captured only when the person smiles. In security systems which can identify a person, in any form of expression he presents himself. Rooms in homes can set the lights, television to a person's taste when they enter the room. Doctors can use the system to understand the intensity of pain or illness of a deaf patient. Our system can be used to detect and track a user's state of mind, and in mini-marts, shopping centers to view the feedback of the customers to enhance the business etc.

REFERENCES

[1] Shan, C., Gong, S., &McOwan, P. W. (2005, September). Robust facial expression recognition using local binary patterns. In Image Processing, 2005. ICIP 2005. IEEE International Conference on (Vol. 2, pp. II-370). IEEE.
[2] Bhatt, M., Drashti, H., Rathod, M., Kirit, R., Agravat, M., &Shardul, J. (2014). A Studyof Local Binary Pattern Method for Facial Expression Detection. arXiv preprint arXiv:1405.6130.
[3] Chen, J., Chen, Z., Chi, Z., & Fu, H. (2014, August). Facial expression recognition based on facial components detection and hog features. In International Workshops on Electrical and Computer Engineering Subfields (pp. 884-888).
[4] Happy, S. L., George, A., &Routray, A. (2012, December). A real time facial expression classification system using Local Binary Patterns. In Intelligent Human Computer Interaction (IHCI), 2012 4th International Conference on (pp. 1-5). IEEE.
[5] Chibelushi, C. C., &Bourel, F. (2003). Facial expression recognition: A brief tutorial overview. CVonline: On-Line Compendium of Computer Vision, 9.
[6] Michel, P., & El Kaliouby, R. (2005). Facial expression recognition using support vector machines. In The 10th International Conference on Human-Computer Interaction, Crete, Greece.
[7] Michel, P., & El Kaliouby, R. (2003, November). Real time facial expression recognition in video using support vector machines. In Proceedings of the 5th international conference on Multimodal interfaces (pp. 258-264). ACM.
[8] C. L. Lisetti, D. E. Rumelhart ―Facial Expression Recognition Using a Neural Network‖ In Proceedings of the 11 th International FLAIRS Conference, pp. 328—332, 2004.

[9] C. Busso, Z. Deng , S. Yildirim , M. Bulut , C.M. Lee, A. Kazemzadeh , S.B. Lee, U. Neumann , S. Narayanan Analysis of Emotion Recognition using Facial Expression , Speech and Multimodal Information, ICMI'04, PY, USA, 2004.
[10] L. Franco, Alessandro Treves ―A Neural Network Facial Expression Recognition System using Unsupervised‖ Local Processing, Cognitive Neuroscience Sector – SISSA.
[11] Tsang Tat Man. Image-based Face Detection System.