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Human Mood Classification Based on Eyes using Susan Edges

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Abstract - Human facial expression recognition plays important role in the human mood analysis. Human mood classification is done based on the facial features such as eyes, nose and mouth. The eyes plays dominant role in facial expression.Hence in this paper, instead of considering the features of the whole face, only eyes are considered for human mood classification such as surprise, neutral, sad and happybased on the Susan edge operator.

Keywords- Mood classification, Facial features, feature extraction, Susan edge operator

I. INTRODUCTION

Human Facial expression recognition plays an important role in the human mood analysis which involves threesteps viz. face detection, feature extraction and expression classification. Extensive research work has been done in this area yet efficient and robust facial expression system need to be developed. Thegeneric algorithm uses horizontal sobel edges to compute bounding box containing eye and eyebrow [1].Facial expressions into emotion categories are happy, sad, disgust and surprise. Facial Action Coding System(FACS) code derived descriptions are computed by Latent Semantic Analysis (LSA) and probabilistic Latent Semantic Analysis (PLSA) to detect basic emotion [2] .Susan operator is used tolocate corners of eyes and used toset the initial parameter of eyes templates based on threshold&locatingsimilarity of pair to detect two eyes which has greatly reducedthe processing time of templates. [3].an algorithm for Structured Connectivity face model proposed for the recognition of the Human facial expressions [4].The facial feature points are detected from each region containing facial feature with the so called SUSAN corner detector. The eyebrow regions and the eye regions are rectanglesthat just contain each individual facial feature. The eyebrowregions and the eye regions are located by using both the EIM and the ESM[5]. Detection of eyes is very important in face Feature extraction. The valley point searching with directional projection and the symmetry of two eyeballs to locate eyes.SUSAN(Smallest Uni-value Segment Assimilating Nucleus) is used toextract the edge and corner points of local feature area. [6]

A classification rate (CR) which is higher than the CR obained using all features. The system also outperforms several existing methods, evaluated on the combination of existing and self-generated databases [7]. Novel Hybrid Facial Geometry Algorithm (HFGA) for facial feature extraction to classify facial expressions based on feed forward backpropagation neural network (BPNN) and Adaptive Neuro-Fuzzy Inference System (ANFIS) classifiers for expression classification and recognition [8].In this process, facial features like eyebrows, eyes, mouth and nose are extractedusing SUSAN edge detection operator, facial geometry, and edgeprojection analysis [9].The combination of SUSAN edge detector and facial geometry distance measure is best combination to locate and extract the facial feature for gray scale images in constrained environments if the images are frontal view and clear images without any obstacle like hair [10]. The Longest Line Scanning (LLS) algorithm along with Occluded Circular Edge Matching (OCEM) algorithm proposed to detect the iris center under normallighting conditions with unexpected noise. LLS is faster, but it is sensitive to noise and thedistribution of edge pixels [11]. In [12], face detection algorithm to obtain precise descriptions of the facial features in videosequences of American Sign Language (ASL) sentences, where the variability in expressions can be extreme. Eyes may have very distinct shapes pupil size, and colors.

SUSAN edge detector segment face part from the face image in which potential geometrical features are used for the determination of facial expression such as surprise, neutral, sad and happy[13]. Facial Action Coding System (FACS) action units and the methods which recognizes the action unit's parameters using facial expression data that are extracted (happy, sad, disgust, surprise). Various kinds of facial expressions are present in human face which can be identified based on their geometric features appearance features and hybrid features [14].Image segments are converted intofiltering images with the help of CH approach by varyingdifferent threshold values instead of applying morphological operations [15].Eye candidates are detected using a color based training algorithm and six-sigma technique operated on RGB, HSV and NTSC scales [16].Different technique that HSV as well as Lab color spaces are employed for removing unwanted pixels in the image and SVM classify the left region in the image as eye or non-eye[17].

An automatic system proposed to find neutralfaces in images using location and shape features.Using these features, a window is placed in the detected and normalized face region. Face and facial point features foreach face, the eye features are extracted by ellipse fittingbased on the binary image of the face [18].Robustness of emotion recognition (all 7 emotions) systems are used to improve by the use of fusion-based techniques [19].Detection of facial region with skin color segmentation and calculation of feature-map for extracting two interest regions focused on eye and mouth [20].In this paper an approach to the problem of facial feature extraction from a still frontal posed image is addressed and classification of facial expression is used for the analysis of emotion and mood of a person using eyes. Experiments are carried out on JAFFE facial expression database. Four basic expressions like

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surprise, neutral, sad and happy are considered. The rest of the paper is organized as follows. Section II highlights on data collection, section III presents proposed methodology, section IV gives experimental results and analysis, section V presents conclusion and future scope and last section gives references used.

II. DATA COLLECTION

In this work JAFFE (Japanese Female Facial Expression) database developed by Kyushu University for Japanese women expression is used. The JAFFE database is made up 213 individual images of ten persons, and each person shows anger, disgust, fear, happiness, sadness, surprise and neutral. Few sample images are as shown in Figure-1.

Figure1. Samples images from JAFFE database

III. PROPOSED METHODOLOGY

Happy **Neutral** **Sad** **Surprise**

Facial expression recognition is proposed in the block diagram as shown in the Figure-2.

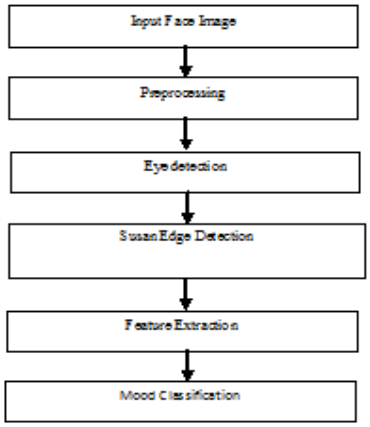

Figure-2: Block diagram of the proposed system

The proposed method detects the face part depending upon the measurement given. In which the algorithm crops the selected facial part from the image which is then divided horizontally into two parts depending upon the central point of the image located. SUSAN algorithm[3,10] selects the larger area in the face such as eye and ignoring smaller regions such as mouth and nose. The SUSAN algorithm then generates binary image of the eye, which is de-noised.

In this paper we used MATLAB R2012a ,detailed steps in the proposed system are as follows.

Step1:Preprocessing**:** In the given input image, quality of image is enhanced by different filters such as median filter, average filter, wiener filter according to noise present in image, improving contrast of image by histogram equalization,adoptive equalization etc .Holes are filled in the region of interest for good segmentation results using morphological operations.

Step 2:Eye Detection**:** Edge detector such as Sobel, canny, pewit etc are applied on the image to detect edges on the given image and face boundary is located by using suitable threshold value. Further, facial feature candidate are located based on Geometrical configurations of a human face. It is assumed that in most of the faces the vertical distance between eyes and mouth are proportional to the horizontal distance between the two centers of eyes. The regions satisfying these assumptions are considered as potential eye candidates.

Step 3:SUSANedge detection**:** There are various edge detectors such as Sobel, Canny, Prewitt are used but they can only detect the edges. But SUSAN operator having advantages to locate corners of regions in addition to edges. So to improve accuracy of feature point extraction SUSAN operator is applied on face area to detect far and near cornersof eyes and mouth regions.

Step 4:FeatureExtraction**:**Geometrical features such as area, height and width of the eye features are extracted for the purpose of expression recognition.

Step 5:Mood Classification: Facial expressions such as surprise, neutral, sad and happy are recognized based on the statistical featuresof each expressions satisfying the condition for the classification of human mood.The algorithm matches with the facial expression templates with the features of query face. The expression having the highest match with the template is considered the mood of the query face. Comparison of the results are made for both eyes and mouth.

IV. EXPERIMENTAL RESULTS AND ANALYSIS

In this work 100 images were selected by choosing 20 images from five persons each from JAFFE database.Sample experimental results are shown in Figure-3 and statistical results are tabulated in Table-I for facial expressions based on eyes. Similarly experimental results are shown in Figure-4 and statistical results are tabulated in Table II for the facial expressions based on mouth.

Table 1

Feature used	Success rate
Based on Eyes	64%
Based on Mouth [13]	86%
Based on Eye and Mouth [20]	78.8%

Figure-3**:**Sample results of Facial expressions based on eyes

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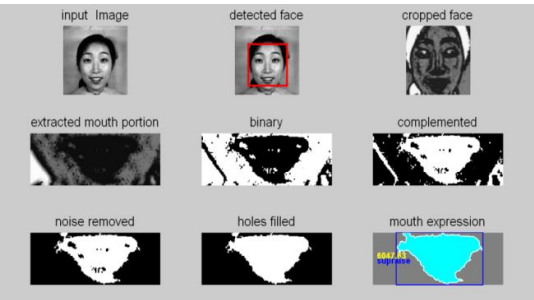

Figure-4:Sample results of Facial expressions based on mouth

Table-2:Statistical values of mouth features

Expression	Mouth area range between		Width	Height
	Min	Max		
Sad	3646.748000	4102.591500	43.220000	5.620000
Normal	4102.591500	5014.278500	43.220000	5.620000
Happy	5014.278500	5470.122000	43.220000	5.620000
Surprise	5470.122000	6080.965500	43.220000	5.620000

Table 3:Comparison results of facial expression

Expression	Range of Eye area		Width	Height
	Min	Max		
sad	2688.216000	3024.243000	5.140000	11.940000
normal	3024.243000	3696.297000	5.140000	11.940000
happy	3696.297000	4032.324000	5.140000	11.940000
surprise	4032.324000	4368.351000	5.140000	11.940000

Table III shows the comparison of different experimental results between JAFFE database of the four different facial expressions (happy, Neutral, Sad, Surprise).

V. CONCLUSIONS

Human mood analysis is getting very good attention from the research community for which facial expression recognition plays very important role. In this paper, different expressions of people are classified using eye feature using SUSAN edge detector. Proposed system is tested on widely used standard JAFEE database in which facial expressions of different people in different moods are consideredas benchmark testing samples. Proposed method is compared with both eyes and mouth features and found better results with mouth due to its more variations in geometrical aspects. Hence both eyes and mouth features contribute equally significance in the recognition of facial expressions and human mood classification.

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