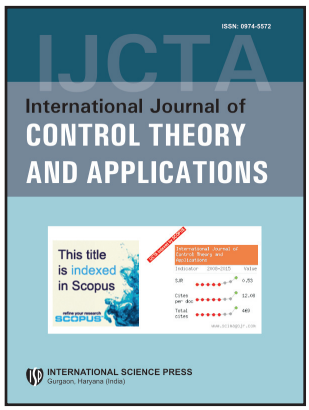

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Retrieving Facial Expressions from Video Frames using MATLAB

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Abstract: A human face does not only recognize an individual but also communicates useful information about a person's emotional situation. A face recognition system is a computer application for repeatedly identifying or verifying a person from a digital image or a video frame from a video foundation. The principle of this paper is to extend a system that detects human emotions through successive video frames. Emotions of a person can be detected using facial expressions because the most expressive way a human can show his emotions is through facial expressions. In this paper a new algorithm based on a set of images to face emotion recognition has been proposed. This process involves four stages pre-processing, edge detection, feature extraction, face detection. It presents a face recognition system that is developed using MATLAB which recognizes the input face from a set of training faces. And also analysis the face recognition using edge detection method which extracts the edges of an image.

Keyword: Facial expressions face detection, face recognition, human emotions, video frames, MATLAB.

1. INTRODUCTION

The ability to detect changes in facial expressions is very significant as we can recognize expression and mental conditions of a person. The main issue of construction a facial expression recognition system is face detection and alignment, image normalization, feature extraction, and classification. There are number of techniques which we use for recognizing the facial expression. In an well-organized algorithm for motion detection based facial expression recognition using optical flow proposed an efficient algorithm for facial motion detection. This technique is based on optical flow technique which extracts the essential motion vectors [1].

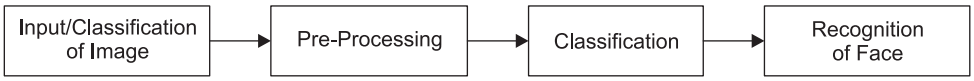

Figure 1: A Generic Representation of Face Detection

Facial expression recognition (FER) system is mainly used to provide good human-computer-interface so that computers can able to recognize the emotion of the user and propose operations in comeback to the mood of the user. Human-computer-interaction can become more natural if computers are able to understand human emotions and their behavior.

Fear, surprise, sadness, happiness, anger and disgust are six basic emotions that generally established. These emotions can be classified as negative and positive emotions [2]. Fear, anger, disgust and sadness are negative emotions and the majority of people do not like them whereas happiness is a positive emotion and everybody wishes to enjoy it. Anger is the most dangerous emotion and at some point in this emotion a person can hurt other decisively.

In this paper emotion detection system using facial expressions has been implemented. Firstly, video frames are captured using a built in webcam or external video device. Then face extraction and cropping is carried out from these video frames and a training and test database is prepared. Then a low dimensional face space is constructed of training database using principle component analysis (PCA) and emotions are detected using Euclidean distance between various feature points of test image to the train images.

1.1. Image Processing

Image processing is any form of signal processing for which the input is an image, such as a photograph or video frame, the output of image processing may be either an image or a set of individuality or parameters related to the image. Image processing usually refers to digital image processing, but optical and analog image processing are also potential.

1.2. Edge detection Based face Recognition

Since the existing face recognition method had low quality and accuracy. This section describes another method to recognize the face for security purpose. Edge detection is an essential preprocessing step in many computer vision algorithms. Within this paper we realize the Canny Edge Detector using MATLAB. The Canny edge detector is a popular method for detecting edges that start to eve an image by folding it with a Gaussian of a given sigma value [3]. Once the gradient magnitude of the image has been compute, a process called 'non maximum suppression' is perform in which pixels are concealed if they do not include local maxima.

2. LITERATURE REVIEW

The facial image pre-processing includes: video of the facial expressions gathering and image frame extraction. Colored images of the facial expressions were then changed into grayscale images. During the preprocessing process, the facial expression video succession will extract into facial image frames that are appropriate for further processing. First, the given input facial expression of video sequence is converted into frames, which are RGB (colored) frames. Colored frames of the data set were then converted into grayscale images. The resultant five feature regions (both eyebrows, both eyes and mouth) formed the input data for the extraction process [4].

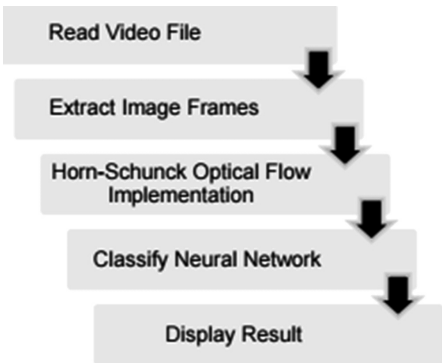

Figure 2: Flow charts of Facial Expression Change Detection

The face is detected automatically and facial landmarks are detected and tracked. The features then are input to classification algorithms and all the procedures are required to perform classification and calculate an inter-system consistency score [5].

Skin color of every person can be dissimilar due to distinction in light conditions. An appropriate color space should be used for modeling skin color and identifying a cluster linked with skin color in this space. Based on the comparison of the various color spaces for face detection, the YCbCr color space is chosen because it is extensively used in video compression standards. RGB color space of the input image is distorted into YCbCr color space so that the luminance value can be alienated from the chrominance value [6].

Their paper defines a system that automatically detects human emotions on the basis of facial expressions. The techniques followed are more suited thus restrictive the latency in response. Moreover, it further takes a step to improvise the emotion detection technique using Cubic Bezier Curve Implementation which is more adaptive and resurfaces the ones with greatest significance. The system works well for faces with different shapes, complexions as well as skin tones and senses basic six emotional terminologies. The system even handles face rotations across x-axis and fetches precise results for horizontal rotations [7].

The Facial Action Coding System (FACS) is the most commonly used system for the analysis. The Facial activities are characterized into three basic levels: Top level, Middle level and Bottom Level. The facial feature tracking, AU recognition and expression recognition represent the facial activities in three levels from local to global analysis. The main objective of this paper is to introduce a probabilistic and dynamic framework based on Dynamic Bayesian Network for spontaneous facial expression analysis and recognition. The framework allows recognizing facial expression in spontaneous interactions from an image sequence [8].

3. METHODOLOGY

The technique involves following steps:

4.1. Acquiring Images

Images are taken for sample data. They can be saved images or can be captured with the help of camera.

Figure 3: Six images with six universal facial expressions selected from facial expression database

4.2. Image Pre-Processing and Resize

The image pre-processing procedure is a very important step in the facial expression recognition task. The aim of the pre-processing phase is to obtain images which have normalized intensity, uniform size and shape. Finally, the images were scaled to the same size of 128 × 128 pixels.

4.3. Edge Detection

Edges are detected by using commands of image processing tool box in MATLAB. Through edges we got end point of features from the images like eyes and lips.

Edges in an image often are defined as the local maxima of the slope. Edge detection is an important task in image processing. It is a main tool in model recognition, image segmentation, and scene analysis. An edge detector is basically a high pass filter that can be practical to extract the edge points in an image [9].

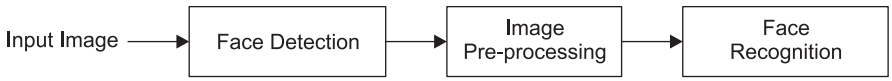

Figure 4: Block Diagram

Figure 5: Various views of Images with different illumination

Algorithm

Step 1: Get the edge map image (edge (I, *j*)) from RGB image using sobel operator.

Step 2: For each pixel (I, *j*), get the corresponding H and S values.

Step 3: If (color histogram (H, S) > skinthresold) and edge (I, *j*)

Step 4: Find the different regions in the image by implementing connectivity analysis using 8-connected neighborhood.

Step 5: Find height, width and centroid for each region and percentage of skin in each region STEP 6. For each region, if (height/width) or (width/height) is within the range (goldenration ± tolerance) and (percentage of skin > percentage of threshold) then the region is a face, else it is not face.

4. Face Feature Extraction

One common method is to take out the shape of the eyes, nose, mouth and chin, and then differentiate the faces by distance and scale of those organs. The selection face features is crucial to face recognition. To locate vital feature belongings of angle invariance is use. The five facial form points have been used, all features are in the form of distance.

4.5. Face Detection

Face localization aims to establish the image position of a single face, this is a simplify detection problem with the assumption that an input image contains only one face. The main concern of face recognition is to identify all image regions which contain a face not considering of its direction, background and lighting conditions. Such task is difficult since faces can have a vast assortment in terms of shape, color, size or texture [10]. By using threshold to separate skin region from an image for face detection was selected in this algorithm.

Figure 6: Edge information of few face images

4.6. Emotion Detection

Detection of emotions is based on the calculation of distances between various features points. In this step relationship between distances of testing image and neutral image is done and also it selects the best likely match of testing image from train folder. It also detects the emotions on the basis other distances intended. And the final results are displayed.

4.7. Emotion Recognition using Matlab

The study done by computationally efficient approach for edge detection which additional leads to classification of facial expression recognition from static facial images. The various algorithms are used to produce the characteristic facial appearance such as lips and eyes. Firstly the images will be loaded in the train folder and test folder. After this these images are analyzed by series of algorithms and techniques to enhance the image

input, maintain strength and removing noise from image. Second algorithm detects the edges of image. From the edge points various distances between features is designed and principal component analysis is used for data reduction and next algorithm detects the face[7].

4.8. Training Classifier

Training classifier is Feed-forward neural network which uses back-propagation algorithm to train the classifier for input data next to given target data i.e. all six emotions. The trained classifier is then replicated to test new real world data and identify all six essentials emotions i.e. Happy, Sad, Anger, Fear, Surprise and Neutral. In the proposed system the characteristic areas are extracted manually, automatic characteristic area extraction can be done. Mix Emotions like Happy and Surprise, Sad and Fear from an image can also be detected.

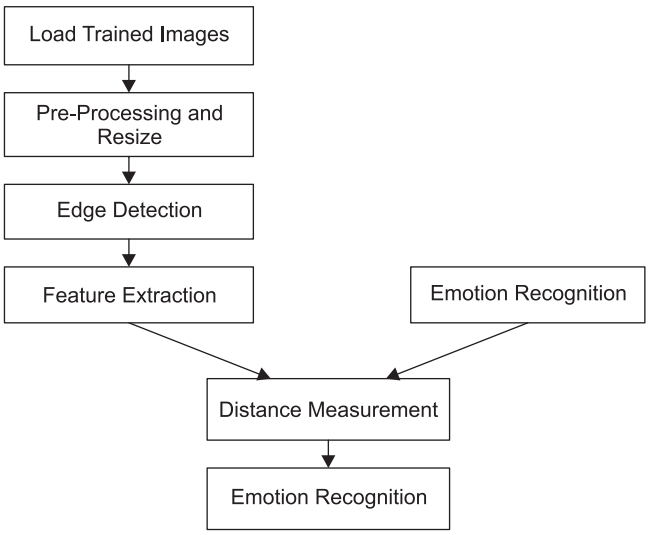

Figure 7: Functional block diagram of the facial recognition system

4.9. Distance Measurement

Euclidean distance is used to calculate the distance between various feature points. If the features have n-dimensions then the generalized Euclidean distance formula between the feature points (x, y) is given by

$$\text{Euclidean Distance}(x, y) = \sqrt[2]{(x1 - y1)^2} + \sqrt[2]{(x2 - y2)^2}, \ldots, \sqrt[2]{(xn - yn)^2}$$

Figure 8: Some instances of emotion representation for happiness, sadness, fear, surprise, anger and disgust respectively

They proposed an accurate and high speed emotion detection system. The color and feature based detections were adopted to find skin-color fast and selected candidate blocks carefully. The major contribution of this paper is that the proposed method can detect edges of the images and from that edges distance between various features is calculated by using Euclidean distance Formulae. This distance is different for every image posing different emotions. On the basis of this distance emotions are classified.

4. CONCLUSION

The proposed system is implemented on MATLAB R2015b as it provides image processing toolbox which contains various methods related to image compression, enhancement, processing etc… The major contribution of this paper is that the proposed method can detect edges of the images and from that edges distance between various features is calculated by using Euclidean distance Formulae. This distance is different for every image posing different emotions. On the basis of this distance emotions are classified.. Further improvement is possible in future as an improved edge detection method can detect edges in color images.

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