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Expo Capture using Facial Recognition

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ABSTRACT

Facial expression analysis include several methods like personal identification and access control, video phone and teleconferencing, forensic applications, human-compute interaction, automatedsurveillance, cosmetology, and so on. The performance of the face detection certainly affects the performance of all the applications. Several methods have been proposed to detect human face in images like knowledge-based methods, feature-based methods, template based methods and appearance-based methods. Most of the facial expression recognition methods reported to date are focused on recognition of six primary : happiness, sadness, fear, anger, disgust and grief. In this paper we introduce an automated Face detection System which includes The automatic facial expression recognition system includes: Face Detector, Facial feature extractor for mouth, left and right eye, Facial Characteristic Point - FCP extractor and Facial expression recognizer.

Keywords: Automated face detector, Face recognizer, Capture, Machine learning, Automatic face expression.

I. INTRODUCTION

In the beginning, facial expression analysis was essentially are search topic for psychologists. However, recent progresses in image processing and pattern recognition have motivated research works on automatic facial expression recognition. In the past, alot of effort was dedicated to recognize facial expression in still images [1]-[7]. For this purpose, many techniques have been applied: neural networks ,Gabor wavelets and active appearance models. A very important limitation to this strategy is the fact that still images usually capture the apex of the expression, i.e., the instant at which the indicators of emotion are most marked. In their daily life, people seldom show apex of their facial expression during normal communication with their counterparts, unless for very specific cases and for very brief periods of time. The automatic facial expression recognition system includes:

Face Detector, Facial feature extractor for mouth, left and right eye, facial Characteristic Point - FCP extractor, Facial expression recognizer. The project mainly aims to come up with a solution to the facial expression recognition problem by Sub Problems dividing it into sub-problems of classification of some specific Action Units [8]-[23]. The projects scope includes not only the two class problems which tell about whether an Action Unit is on or off, but also the multi-class problems that will inform the user about multi occurrences of more than one Action Unit at the same time. For this, different methodologies and techniques for feature extraction, normalization, selection and classification. Solutions to these problems as well as taking the computational complexity and timing issues into consideration, the project objective is to implement face recognition in an optimum way in terms of run time onto the embedded system. Various algorithms and methodologies are studied and hardware resources planning will be done to achieve the goal [24]-[36]. This kind of face recognition embedded system can be widely used in our daily life in different sectors. We hope that human life can be greatly helped with this technology. Some typical applications are listed as follows: Business Meeting, Gathering, Education Teaching assistant, Audio-visual speech recognition (visual lip reading to enhance acoustic speech recognition).

II. LITERATURE SURVEY

The first person to write a detailed note about the various expressions and movement of head muscles was John Bulwer in his book „Pathomyotomia“. The next most important work about facial expression was written by Charles Darwin. Darwin wrote about the expression and means of expression in both humans and animals. A new scheme for describing facial movements was described by Ekman. This new scheme was the Facial Action Coding Scheme

(FACS). FACS combines 64 Action Units (AUs) and uses combination of AU to detect facial movement and gives information about the expression. The approaches to facial expression recognition system are: - geometric based approach, appearance based approach and hybrid based approach. The geometric feature measures the variations in shape, location, depth, distance of facial components like eyes, mouth, nose etc. Appearance features uses the variations in appearance of the face such as wrinkles, furious etc. It can be extracted from either specific region on the whole of a face. Facial features are extracted using Local Binary Pattern. Hybrid approach uses both geometric as well as the appearance based approach in order to extract facial feature.

In [1] The present methods of face detection technology can be broadly divided into two categories: Based on the statistical method and based on the knowledge method. Face location based on statistical method needs a large amount of prior knowledge as theoretical basis, and through kinds of methods such as self learning algorithm of neural network, the subspace dimensionality reduction method etc. Knowledge-based face detection method is to make full use of various characteristic parameters of human face

.Commonly used methods include the organ distribution method, color and texture, motion method, symmetric method, etc. In this system facial features can be detected by using parameters such as the distance between two eyes, mouth and eyes or eyebrows and eye or some other fixed characteristics; and the color as the main features of the face, the skin color detection can use a variety of color space such as HIS color space, the YCbCr color space and CIE color space.

Gauss model is used in this method. Each point on the face image can use the model of skin color to calculate each point probability. Then skin improved grayscale is established based on skin color probability values of these points. The higher probability regions of skin color in the gray scale are chosen as the candidate region of human face.

Here, first the pictures will be transferred to the YCbCr color space from RGB space through the low pass filter in order to reduce the effect of high frequency noise. The gray level of each pixel point value is determined, the skin area is processed and other background regions are separated.

The processing done here is morphological processing. The main methods in morphological processing are corrosion *X* and expansion *Y*.

Edge exists widely in the object and the background, objects and between element and element. Therefore, it is an important feature of image detection and extraction techniques. Commonly we use one order and two order derivative to describe and edge detection.

First the eyes and lips region is estimated, and then the Canny edge detection is used to determine the exact position of the eyes and lips

(1) Smooth the image using Gauss filter.

(2) To calculate the gradient magnitude and direction by means of finite first-order partial derivative. A first-order differential convolution template:

(3) Use gradient direction to suppress the non maxima on the gradient magnitude.

(4) Using double threshold algorithm connecting edge; through suppression non maxima we can remove the false edge beside real, the false edge beside false edge need to further removed to draw the edge contour clearly.

In [2] Automatic Facial Expression Recognition By Som Based Algorithm, It involves in three sub-problems: 1) face detection, 2) facial expression feature extraction, and 3) expression classification. This paper presents an automatic facial expression recognition system based on self-organizing feature maps, which provides an effective solution to the aforementioned three sub-problems.

A human-observer-based system called the Facial Action Coding System (FACS) has been developed to facilitate objective measurement of subtle changes in facial appearance caused by contractions of the facial muscles. The approaches to facial expression recognition can be divided into two classes in many different ways. In one way, they can be classified into static-image-based approaches and image sequence- based approaches. While the static image based approach classifies expressions based on a single image. The image sequence-based approach utilizes the motion information in an image sequence. In another way, they can be classified into geometrical feature-based approaches and appearance-based approaches. The geometrical feature-based approach relies on the geometric facial features such as the locations and contours of eyebrows, eyes, nose, mouth, etc. As for the appearance based approach the whole- face. In this paper we propose a simple approach to implement an automatic facial expression recognition system based on self-organizing feature maps (SOMs) The SOM algorithm is a well-known unsupervised learning algorithm in the field of neural networks. A modified self-organizing feature map algorithm is developed to automatically and effectively extract facial feature points. Owing to the introduction of the SOMs, the motion of facial features can be

more reliably tracked than the methods using a conventional optical flow algorithm.

The proposed automatic facial expression recognition system can automatically detect human faces, extract facial features, and recognize facial expressions. The inputs to the proposed automatic facial expression recognition algorithm are a sequence of images since dynamic images can provide more information about facial expressions than a single static image.

The first step for facial expression recognition is to solve the face detection sub- problem. Face detection determines the locations and sizes of faces in an input image. In this paper, we adopt the method proposed by Viola and Jones to detect faces from images.

After the face in the first image frame has been detected, the next step is to extract necessary information about the facial expression presented in the image sequence. In general, there are two types of facial features can be extracted: geometrical features and appearance features. While the appearance features can be extracted on either the whole face or some specific regions via some kinds of filters (e.g., Gabor wavelets filter), geometrical features focus on the extraction of shapes and locations of intransient facial features (e.g., eyes, eyebrows, nose, and mouth). The SOM algorithm is one of the most popular unsupervised learning algorithms in the research field of neural networks. The principal goal of SOMs is to transform patterns of arbitrary dimensionality into the responses of one- or two-dimensional arrays of neurons, and to perform this transform adaptively in a topological ordered fashion. After locating the four critical regions (i.e., the eyes, the nose, and the mouth), the next step is to extract the motion information of these facial features.

To track landmark points, we adopt a two-stage neighborhood correlation optical flow tracking algorithm. At the first stage, we adopt the optical flow method to automatically track the 137 landmark points in the image sequence. We adopt the cross correlation optical flow method. Cross correlation of a T×T template in the previous image, and a W×W searching window at the present image is calculated and the position with the maximum cross-correlation value which is larger than a pre-specified threshold is located at the present image. There are total 137 neurons in the four regions. Basically, the displacement vectors of these 137landmark points located on the SOMs are used for the facial expression recognition. The displacement of each landmark point is calculated by subtracting its original position in the first image from the final position in the last image of the image sequence. The 137 displacements have to be normalized in some way before they are inputted to a classifier. Therefore, there are 20 displacement vectors to represent the left. eye region. Finally, a multi layer perceptron (MLP) with the structure 140×10×10×7was adopted for the classification of the seven expressions including six basic facial expressions.

In [3] Effectual Approach for Facial Expression Recognition System, The whole system is implemented on the dataset of 150 images of frontal facial expressions of happy, sad, neutral, anger and disgust by using MATLAB. The images are collected from the Karolinska Directed Emotional Faces (KDEF) database. We empirically evaluate the facial representation based on local binary pattern (LBP) features. Then recognition performed by KNN classifier with LBP features.

This paper proposes a fast and efficient approach for facial expression recognition that recognizes five principle expressions happy, sad, neutral, anger and disgust. The recognition system follows a procedure that includes preprocessing, face detection, feature extraction and expression recognition to recognize and classify the expression. Face detection is the primary need of expression recognition system. Facial feature extraction includes the detection of nose, eyes and mouth parts from the face as facial information.

The Facial Expression Recognition System divides the task of expression recognition into three major parts: preprocessing, facial feature extraction and expression classification.

The step by step processes for facial expression recognition are as follows: (1) Pre-processing, Preprocessing is the most important and the required step of the image processing. It is performed to get uniform and noise free image for further processing. This step includes the following functions: Facial feature extraction is the second foremost part of the facial expression recognition system. This comprises three phases: face boundary detection, detection and cropping of ROI (region of interest), and feature extraction. Face boundary detection phase is performed to identify the face in the image that contains eyes, nose and mouth. After that, segmentation is performed to identify the region of interest. In this research work eyes and mouth are taken as region of interest for the processing.

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(3) Face boundary detection phase is also a very important step for the facial expression recognition. In this phase, the face boundary is detected and for that Viola Jones Method is used. Viola Jones method is a widely used method for face detection, its training is slow but detection is extremely fast and efficient. It is scale and location invariant detector.

Segmentation of ROI: Segmentation of image means partitioning the image into multiple parts. In this system, segmentation is used to detect the interested regions such as eyes and mouth from images and for that also Viola Jones method is adopted. Face boundary detection and segmentation of ROI collectively the face detection process performed by the adopted method (Viola Jones).

Feature Extraction: In this phase the features for cropped eyes and mouth images are extracted and stored for classification. Now for feature extraction Local Binary Pattern (LBP) operator is used in this system. The LBP operator is an image operator which transforms an image into an array or image of integer labels describing small scale appearance of the image. These labels or their statistics, most commonly the histogram are then used for further image analysis.

(4) Facial Expression Recognition is the final step for Recognition System. This module uses KNN (K Nearest Neighbor) classifier. The K Nearest Neighbor algorithm is a non-parametric method used for classification and regression. The input consists of K closest training examples in the feature space. The output is a class membership.

In [4] Automatic Facial Expression Recognition Based On Hybrid Approach, Recognition for facial expressions can be divided into three phases:

i. Face detection
ii. Feature extraction (facial features)

Classification.

Detect the face from the image is first important phase. Next and the most important phase is the mechanism for extracting the facial features from the facial image. The extracted facial features are either geometric features such as the shapes of the facial components (eyes, mouth, etc.) and the locations of facial characteristic points (corners of the eyes, mouth, etc.), or appearance features representing the texture of the facial skin in specific facial areas including wrinkles, bulges, and furrows. Appearance-based features include learned image filters from Principal Component Analysis (PCA), Gabor filters, features based on edge-orientation histograms, etc. or hybrid-based include both geometric and appearance features. The final phase is the classifier, which will classify the image into the set of defined expressions. There are six universally recognized expressions Angry, Disgust, Fear, Happy, Sad and Surprised (a facial expression into one of the basic facial expressions. Generally existing approaches for facial expression recognition systems can be divided into three categories, based on how features are extracted from an image for classification. The categories are geometric-based, appearance-based, and hybrid-based. Geometric-based Approach:

The geometric feature measures the variations in shape, location, distance of facial components like mouth, eyes, eyebrows, nose etc. First, they normalize an input image by using an affine transformation so that the distance between irises becomes 20 pixels. From the distance between the irises, the length of the vertical lines is empirically determined. The range of the acquired brightness distributions is normalized to [0,1] and these data are given further to a trained neural network NN for expression emotional classification.

A multi-detector technique is used to spatially sample the contours and detect all facial features. A rule-based classifier is then used to recognize the individual facial muscle action units (AUs).

Appearance-based Approach:

The appearance features present the appearance (skin texture) variations of the face, such as wrinkles, furrows, etc. It can be extracted on either the whole face image or specific regions in a facial image. At first, two expression classes are selected based on the distance from the test image to the seven templates. The final classification is then done via a K-nearest neighbor classifier with the weighted Chi-square statistic.

Hybrid-based Approach:

Hybrid features uses both geometric and appearance based approaches to extract features. Geometric positions of set of fiducial points (34 facial points) and multiscale & multi orientation gobor wavelet coefficient extracted from the face image at the fiducial points are the two approaches used for feature extraction.

This paper proposes an automatic system for facial expression recognition, a system will addresses the problems of facial expression recognition about how to detect a human face in static images and how to represent and recognize facial expressions presented in those faces by using a hybrid approach for facial feature information extraction and then

classification of the facial expressions into the six basic emotions (anger, disgust, fear, happy, sad and surprise) in addition to the neutral one. After entering the image that contains the face which will begin The first phase; face detection process and segment the face image, Then extract feature vector (geometric feature and appearance feature) by apply the feature extraction process on face image. The final phase; uses this feature as an input into the radial basis function artificial neural network to recognize the facial expressions.

III. SYSTEM REQUIREMENTS

Hardware used are: System Processor: Pentium IV or later, Bus: 32- Bit, RAM: 512MB DDR RAM, Hard drive: 20GB, Display: SVGA Color, Key board: Windows compatible, Web Camera (OPTIONAL). Software used are : IDE: Microsoft Visual Studio, Operating System: Windows 7/8, .NET Framework 4.0, A Forge Framework.

IV. PROPOSED SYSTEM

When a facial expression changes, facial muscles may contract or expand. As a result, the facial landmark position as well as the area‟s texture changes. In this method, the face is first detected from an image and then landmarks are detected. Some of the facial patches those are active when the expression changes are extracted. These patches are located below the eyes, around the nose, mouth and in between eyebrow.

This system consists of 6 modules:- Contrast stretching, skin colour conversion, connected component labelling, binary conversion of the image, eye and mouth extraction procedure and detecting Bezier curves.

Contrast stretching (often called normalization) is a simple image enhancement technique that attempts to improve the contrast in an image by „stretching‟ the range of intensity values it contains to span a desired range of values. Skin colour conversion converts the image into two colours :- black and white. The skin area is made white and all the remaining area is transformed into black. Connected-component labelling is an algorithmic application of graph theory, where subsets of connected components are uniquely labelled based on a given heuristic. Binary conversion of the image assigns binary value to the pixels in the image. Eye and mouth extraction procedure is used to extract eye and mouth position. Final step detects Bezier curve and groups the image.

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V. SYSTEM ARCHITECTURE

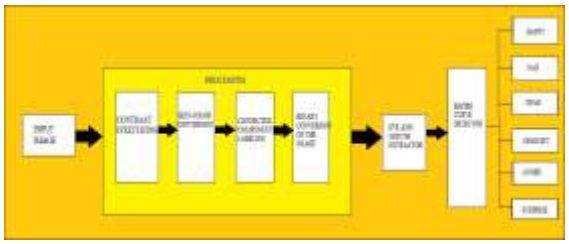

Figure1: System Architecture

Contrast stretching (often called normalization) is a simple image enhancement technique that attempts to improve the contrast in an image by „stretching‟ the range of intensity values it contains to span a desired range of values, e.g.

the full range of pixel values that the image type concerned allows. It differs from the more sophisticated histogram equalization in that it can only apply a linear scaling function to the image pixel values. As a result the „enhancement" is less harsh. (Most implementations accept a gray level image as input and produce another gray level image as output.)

Contrast stretching: do min max contrast stretching of the image. Find the minimum and maximum values of the pixels in an image, and then convert pixels from the source to destination like ((pixel-min) / (max-min))*25

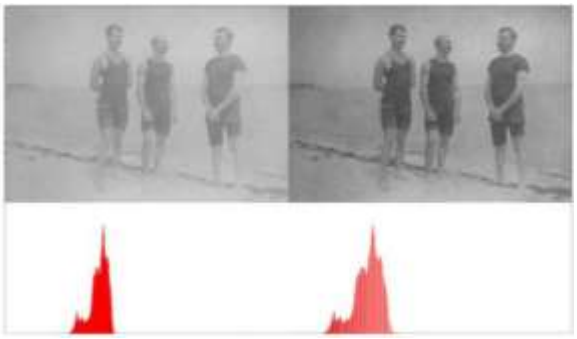

Figure2. Contrast Stretching

A binary image is a digital image that has only two possible values for each pixel. Typically the two colors used for a binary image are black

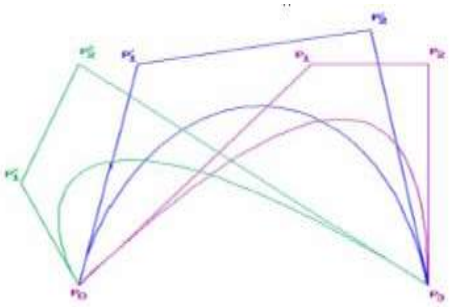

Figure3: Bezier curves with their control points

and white though any two colors can be used. The color used for the object(s) in the image is the foreground color while the rest of the image is the background color.

Figure4. Bezier curves with their control points

An eye extraction procedure:

(a) A morphology-based edge image.

(b) Initial rectangular blocks to confine the eyes.

(c) Final landmark points for eye contours.

(d) Extracted eye contours.

A mouth extraction procedure:

- A morphology-based edge image
- Initial rectangular block to confine the mouth.
- Final landmark points for mouth contours.
- Extracted mouth contours

Detecting Bezier Curves:

A Bezier curve is a parametric curve frequently used in computer graphics and related fields. Bezier curves are also used in the time domain, particularly in animation and interface design.

Figure 5. Face data (Normal and Happy)

VI. CONCLUSION

This project proposes a new approach for recognizing the category of facial expression . We have constructed the expression models by using average Bezier curves from several subjects. In this project,

four different facial expressions of more than 20 persons pictures have been analyzed. In this project, 3rd order Bezier curve has been used to identify the face outlines and expressions. The adoption of the cubic Bezier curves means only four control points are sufficient to represent a curve. Although this method has been implemented for a few persons, but the experimental results nevertheless demonstrate that our system is reliable if the images represent a distinct view of the faces and are low resolution images. There is a lot of scope for the project to explore, for e.g. by improving the Eye-Lip detection procedure, and trying out the project for images taken at different angles and higher resolutions.

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