Comparative Study of Facial Feature Extraction, Expressions and Emotion Recognition

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ABSTRACT

Facial recognition is one of the most relevant applications of image analysis. It is a true challenge to build an automated system which equals human ability to recognize faces. Facial Recognition is an unsolved problem and a demanded technology. The challenges for Facial Recognition extract of facial features, expression and emotions. In this paper we have study the facial extraction approaches, facial expressions and emotion recognition. By studding different approaches and attempt can be made to develop hybrid approach for facial feature extraction and recognition accuracy can be further improved using Artificial Neural Network approach and hybrid approach such ANFIS. By studying various methods we may have conclude that PCA with SVD is superior to PCA in terms of recognition rate for basic emotions.

Introduction

Neuropsychologist research and studies have determined that eyes, mouth and nose are amongst the most important features for recognition. The facial feature extraction based on corner detection of color images under normal lighting condition. The average detection rate for all of the expression and orientation is 89.15 for color images. Facial feature extraction from still frontal pose images and classification and hence emotion and mood of a person. Feed forward back propagation neural network is used as a classifier for classifying the expression of supplied face into seven basic categorized like surprise, neutral, sad, disgust, fear, happy and angry.

A lot of researchers gave up working in the face recognition problem due to the inefficiencies of the methods used to represent faces. Face recognition is a technology which recognizes the human by his /her face images. Recent advances in image analysis and pattern recognition open up the possibility of automatic recognition and classification of facial features, expression and emotions. The different approaches are available for the extraction of the

facial feature. The Geometry based, Template based, Color segmentation techniques and appearance based etc.

Feature extraction techniques such Discrete Cosine Transform (DCT), Fast Fourier Transform (FFT), Singular Value Decomposition (SVD).These techniques compared and it achieved 100% recognition accuracy on training and test dataset [4].

Methodology

Facial feature extraction

There are different methods which can be used for facial feature extraction:

i)   Discrete Cosine Transform (DCT)

ii) Fast Fourier Transform (FFT)

iii) Singular Value Decomposition(SVD)

In this paper author uses JAFFE database. The major facial features like eyes, eyebrows, mouth and nose which play an important role in recognizing facial expression [1]. In this paper author uses SUSAN edge detection operator, facial geometry, edge projection analysis. By using same JAFFE database author obtain 100% accuracy for training set and 95.26% accuracy for test set. Principal Component Analysis is a statistical technique used for dimension reduction and recognition [3]. Also PCA is used for extracting facial features. In this paper author compares PCA an Singular value Decomposition (SVD). The result shows that PCA with SVD is superior to PCA as far as recognition rate is concern.

Facial Expression

Facial expression is one of the most powerful, natural criteria for human beings to communicate their emotions and intentions. To recognize facial expression author extract facial features of facial organs such eyes, and mouth and recognize the particular expressions from changes in their shape or their geometrical features. In the recent year a lot of research work is going on automatic recognizing facial expression. In this paper author uses feed forward back propagation neural network as a classifier for classifying the expression of supplied face. Back propagation networks are most widely used neural network algorithm than other algorithms due to its simplicity, together with its universal approximation capacity.

About JAFFE database

Most of the researcher had used the JAFFE database for their experimental work. Database contains 213 images of 7 facial expressions including neutral posed by 10 Japanese female models. In this database, there are 7 test images and 7 train images. Each image has been rated on 6 emotions. All images are resized to a uniform dimension of 256X256.Also some researcher uses real data in their experimental work, which captures by webcam.

| Happy | Disgust | Surprise | Angry | Sad | Fear | Neutral |

Figure 1: Facial Expression using JAFFE database

Emotion Recognition

Recently various researchers focus their research work in emotion recognition field, because if computer are able to communicate with human being in proper way it is very beneficial in various field. Human communication has two main aspects; verbal and no-verbal. Facial expression, body movement and physiological reactions are the unit of non-verbal communication. Principal Component Analysis (PCA) is used for emotion recognition by using the extracted facial features and the author got 100% recognition accuracy on training and test dataset. In this paper author studied basic human emotions angry, disgust, fear, happy, sad and surprise along with neutral. Principal Component Analysis (PCA) is implemented with Singular value Decomposition (SVD) for feature extraction to determine principal emotions. Author show excellent classification results for all principal emotions. The proposed algorithm is implemented on both real time as well as JAFFE database. The problem of automatic facial feature extraction from a frontal posed image and classification and recognition of emotion and mood of a person studied by using neural network. Author carried out his work by using JAFFE database and he achieved 100% accuracy for training set and 95.26% accuracy for test set.

Technology

Most of the researcher used PCA, PCA with SVD, and Artificial Neural Network techniques to extract facial features, expressions, and emotions of human being [1,2,4].Feed forward back propagation neural network is used as a classifier for classifying the expression of supplied face into seven basic categories like surprise, neutral, sad, disgust, fear, happy and angry[1]. Basically author focuses on major portions of face such as eyes, mouth and nose. Initially face portion segmentation is done using morphological image processing operation and hence face localization face and then this image is resized to larger size so that facial feature components should appear prominent. In this paper author used supervised learning to train the back propagation neural network. The samples are collected from JAFFE database.

Conclusion and Scope for Future Research.

In this paper we have comparative studied the various methods of feature extraction, facial expressions and emotion recognition. Many researchers proposed PCA for classification. The experimental result shows that PCA with SVD is superior to PCA in terms of recognition rate. The combination of SUSAN edge detector, edge projection Analysis, and geometry distance measure is best combination to locate for gray scale images in constrained environments and feed forward back-propagation neural network is used to recognize the facial expression. 100% accuracy is achieved for training set and 95.26% accuracy is achieved for test set of JAFFE database which is promising. By studying above different approached and attempt can be made to develop hybrid approach for facial feature extraction and recognition accuracy can be further improved using Artificial Neural Network approach and hybrid approach such ANFIS.

Also there is scope in Automatic Facial Expression Recognition(AFER) we can take more complex image such as very large size 2D image or 3D images and also for better results we may take color images.

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