



ANALYSIS OF FACE RECOGNITION USING SUPPORT VECTOR MACHINE

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ABSTRACT

This Paper Presents a Face Detection System with Expression Recognition Using Support Vector Machine. It plays an vital role in applications such as Video scrutiny, human computer interface and face illustration database management. The Face recognition with Expression gratitude system accomplishes facial expression recognition through two phases. The captured image is process first to identify the face and then the facial Expression recognized. The first two stages of the system deal with detecting and cropping the face using image processing, the third stage deal with converting the colors of the cropped image from RGB into grayscale and applying the appropriate smoothing filter. The fourth stage consist of feature extraction using support Vector machine, So as the extracted features are compared with training samples. It is automated hallucination systems designed and

implement using MATLAB. It extracts precise output that can be engaged in other fields of studies such as psychological assesment. Finally, the high precision of the result allow the future development of diffent application which respond to spontaneous facial expression in real time.

INTRODUCTION

The ability of humans to recognize a wide variety of facial expressions is consummate. Researchers in the recent past have been trying to automate this task on a computer, employing a arrangement of image/ video dispensation techniques, along with machine learning techniques like SVM. A brief survey of the accessible techniques for facial expression analysis is presented next.

Approaches for facial expression scrutiny from both standing images [3, 4, 5, 7, 11] and video [1, 2, 9, 10] have been planned in the literature. Since activist information



yields important cues, it is relatively easier to consider and recognize terminology from a temporal sequence of images (video). Ekman and Friesen [13] have produced a system for describing “all visually evident facial actions”, called the Facial Action Coding System, which has been referred to in new literature [6,8]. It is based on the list of all “Action Units” on a face that cause facial movements. There are 46 such AUs in FACS that description for changes in facial expression. Researchers have second-hand the FACS as the origin for their appearance gratitude research. For e.g., Lien et al [6], Have developed a computer vision system that specifically recognizes individual AUs or AU combinations in the upper face. Ding et al [8] note that discovering rules that relate AUs to specific terms related with emotional states – annoy, panic, pleasure, disgust, astonish and sadness, is difficult, since it cannot be defined by any regular mathematical function. This is where neural networks arrive into engage in recreation. Most of the approaches employing neural networks for facial expression recognition, involve a preliminary facial feature extraction / tracking step that employs a wide variety of methods like Point Contour

Detection Method [5], optical flow based tracking [2], etc. This is then followed by an appearance arrangement step in which different features extracted from the faces (for e.g., simple geometric coordinates and Gabor Jet coefficients [14], etc.) are feed into Neural Network structure (MLPs, RBFs, Hopfield Neural Nets, SVMs, etc.). [9] proposed a method in which the minimization is per-formed in a sequential manner by the fusion move algorithm that uses the QPBO min-cut algorithm. Multi-shape GCs are proven to be more beneficial than single-shape GCs. Hence, the segmentation methods are validated by calculating statistical measures. The false positive (FP) is reduced and sensitivity and specificity improved by multiple MTANN.

Detecting the face from color images poses various difficulties under varying lighting conditions, pose change and when there are additives on the face region like beard, moustache, etc. To overcome this, we applied certain preprocessing stages to my algorithm so that it detects the face region accurately with less error rate and low computational cost. In the first step, we would haul out and identify the face region



based on the skin color segmentation algorithm. There are lots of variations in the human race or lighting condition, so to accurately detect the skin patch region we converted the image into RGB, YCbCr and HSV color space. This would take advantage of all models and find out the all the skin region from images. Afterwards the face feature extraction process is applied which calculates the map values of different face features [15]. This threshold values and preprocessing values are passed to the feature vector of Linear SVM which would classify the image in face and non-face class. This classification is based on the training of the data set. Our data set consists of around 125 images with 305 faces.

The next section in this paper introduces the approach of the system that was designed and developed in this study. The originality and contribution in this work are through the use of the Kernel object detection algorithm for face detection, and the design and development of an support vector machine for feature extraction and classification of the facial expression. The paper end with some conclusion and future works.

II. Face Detection

The face Detection with Expression Recognition System accomplishes facial expression recognition through two phases. The captured image is proposed first to detect the face, and then the facial expression is recognized. The first phase of face detection is done in two stage by detecting and cropping the face using image processing.

A.Face Recognition Using Haar like Feature

Generally, when taking a photograph of the face, the face area is not the only area taken but also the background. If a program separately extracts only the face area from the image, we can reduce the processing time through facial recognition set of Region of Interest (ROI) and increase the reliability by removing unnecessary information prior to feature extraction like background image.

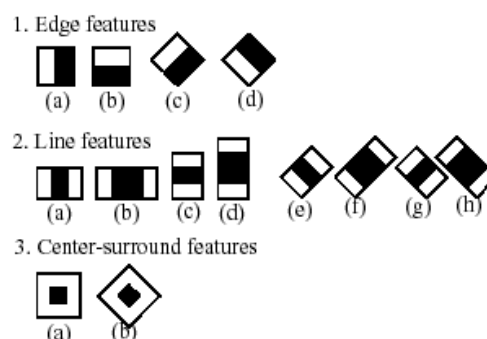


Figure 1: Haar-like Feature Mask



In this paper, we use “Haar-like” feature for face recognition. “Haar-like” mask can be a quick operation because the only required operation is sum in the process of obtaining a feature value. Furthermore, due to the detection of feature in the local region of the image, it is a little robust feature descriptor to occlusion. Thus, it has high reliability for face recognition than simple color -based face recognition algorithm or projection method. Figure 1 show the Haar-like features used in a particular classifier is specified by its shape.

B. Artificial Neural Network

An artificial neural network (ANN) is a flexible Mathematical structure which is capable of identifying complex nonlinear Relationships between input and output data sets. Artificial neural network models have been found useful and efficient, particularly in problems for which the characteristics of the processes are difficult to describe using physical equations

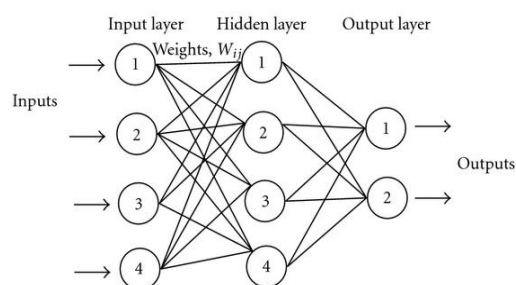


Figure 2: Three-layered feed-forward artificial neural network configuration.

Generally, an artificial neural network consists of an input layer of neurons, one or two hidden layers of neurons, and a final layer of output neurons. Figure 2 shows a three-layer artificial neural network structure.

The detection rate and the false positive rate of the cascade are found by multiplying the respective rates of the individual stages. A detection rate of 0.9 and a false positive rate on the order of 10^{-6} can be achieved by a 10 stage cascade if each stage has a detection rate of 0.99 and a false positive rate of about 0.30. To train the cascade system, the following steps should be respect;

- Set target detection and false positive rates for each stage.



- Keep adding features to the current stage until its target rates have been met.
- If the overall false positive rate is not low enough, then add another stage.
- Use false positive from current stage as the negative training examples for the next stage.

C. Image Cropping

Once the face has been detected by the Kernel algorithm, a simple MATLAB routine was written to crop the face image by detecting the coordinates of the top-level corner, the height and width of the face enclosing rectangles. The cropped image is then saved in a predefined folder to be used in the facial expression recognition stage.

III. Facial Expression Recognition

The Second phase is the facial expression recognition which is accomplished in three stages. First the facial image is preprocessed by resizing it and converting it to grayscale. Then ,feature extraction is done using SVM Support Vector Machine with Kernel algorithm.

A.Facial Image Preparation

In order to recognize the facial expression in the cropped image of the previous phase, the image has to be resized to 64 x 64 pixels. Next the RGB image is converted into grayscale by eliminating the hue and saturation information while retaining the luminance.

B. System Configuration and Support vector Machine Learning Procedure.

In machine learning, task of deducing a category from supervised training data is known as Supervised Learning. In supervised learning the training data consist of a set of training examples, where each example is a pair consisting of an input and an anticipated output value. A supervised learning algorithm analyzes the training data and then predicts the correct output categorization for given data-set input. For e.g. Teacher teaches student to identify apple and oranges by giving some features of that. Next time when student sees apple or orange he can easily classify the object based on his learning from his teacher, this is called supervised learning. He can identify the object only if it is apple or orange, but if the given object was grapes the student cannot identify it.



which is most productive for our application.

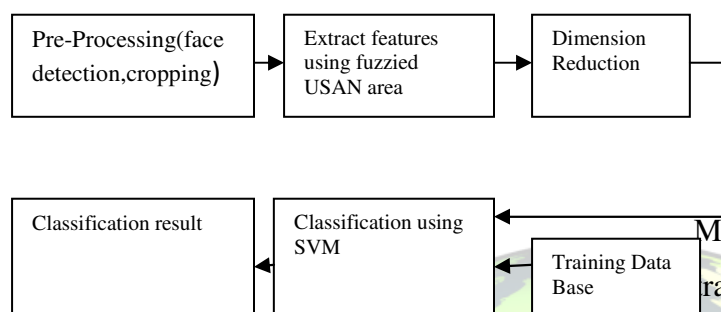


Figure 3: Block Diagram of Face Recognition using Support Vector machine

There are many folds advantages of using the supervised learning approach of Support Vector Machine (SVM). They are very effective when we have very high dimensional spaces. Also, when number of dimensions becomes greater than the existing number of samples, in such cases too SVM is found to be very effective. SVM uses a subset of training point also known as support vectors to classify different objects hence it is memory efficient. Support Vector Machines are versatile, for different decision function we can define different kernel as long as they provide correct result. Depending upon our requirement and application we can choose types of kernel

IV. Result and Conclusion

The implementation was done on MATLAB. The proposed algorithm was trained and evaluated on the dataset of around 125 images containing 305 face images. This dataset was build from my collection of photographs and some random images from internet. The test images consisted of images with different lumination condition – night time, daytime and combination of them. The image formats acceptable to the algorithm are jpeg, png, bmp, etc. The dataset consist of images of size ranging from 400x320 to 2000x1800. If the size of the image is more than 2000x1800 then it would create problem in processing the image.

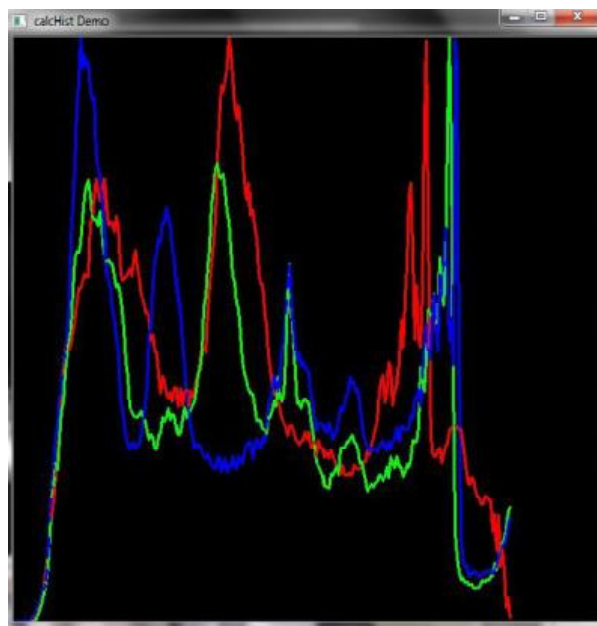


Figure 4. Histogram calculation for RGB image

In conclusion face detection algorithm using the skin color detection, edge detection, facial feature extraction and using the concept of different color space. After these pre processing stages, the algorithm utilizes the highly powerful concept of Support Vector Machine (SVM) to classify the image into face and non-face region. We have significantly reduced the misclassification errors. The computation time for our algorithm is very less and the accuracy on the image data set of 125 images with 305 face image is around 90% with error rate of approximate 16%. We overcame the limitation of detecting one

face from image using skin color algorithm; by combining the concept of different color space and face feature extraction process.

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