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Industrial Security System with Face Recognition and Authentication with GSM

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Abstract:

Face recognition is an integral part of biometrics. In biometrics basic traits of human is matched to the existing data and depending on result of matching identification of a human being is traced. Facial features are extracted and implemented through algorithms which are efficient and some modifications are done to improve the existing algorithm models. A face recognition system using the SIFT (Space invariant feature transformation) algorithm was implemented. The algorithm is based on Image features approach which represents a SIFT method in which a small set of significant features are used to describe the variation between face images. Experimental results for different numbers of faces are shown to verify the viability of the proposed method. In this project an approach to the detection and identification of human faces is presented and then recognizes the person by comparing characteristics of the face to those of known individuals is described. And we use a High resolution camera for capturing the images and will send SMS to owners mobile if unauthorized person will enter in to office.

Face recognition includes analysis of an image andextracting its facial features which will help to discriminate itfrom others. Scale invariant feature transform (SIFT) to extractdistinctive invariant features from images can be used to performreliable matching. The features extracted are invariant torotation, image scale and illumination. Systematic investigationof face recognition using SIFT features has been done. Being highdistinctive features, every feature can be matched correctly withhigh probability against a huge database of features from manyimages. Result shows that SIFT is flexible recognition algorithmas compared to Contour matching algorithm for heterogeneousimages. Both the algorithms are experimentally evaluated onAT&T, YALE and IIT-KANPUR databases with moderatesubject size. Though Contour matching provides computationalsimplicity, SIFT provides efficient face recognition techniqueunder pose, expression and varying illumination condition.

Experimentally it confirms that Contour matching outperformswhen the database is small but for large databases ScaleInvariant Feature Transform (SIFT) gives more than 90%recognition rate.Real-time facial expression analysis is an important yet challenging task in human computer interaction. This paper proposes a real-time person independent facial expression recognition system using a geometrical feature-based approach. The face geometry is extracted using the modified active shape model. Each part of the face geometry is effectively represented by the Census Transformation (CT) based feature histogram. The facial expression is classified by the SVM classifier with exponential $\chi 2$weighted merging kernel. The proposed method was evaluated on the JAFFE database and in real-world environment.

Scale invariant feature trnsform:

SIFT is an algorithm in computer vision to detect and describe local features in images. The algorithm was published by David Lowe in 1999 . Applications include object recognition, roboticmapping andnavigation, imagestitching, 3Dmodeling, gesture recognition, video tracking, individual identification of wildlife and match moving.

Overview:

For any object in an image, interesting points on the object can be extracted to provide a “feature description” of the object. This description, extracted from a training image, can then be used to identify the object when attempting to locate the object in a test image containing many other objects. To perform reliable recognition, it is important that the features extracted from the training image be detectable even under changes in image scale, noise and illumination. Such points usually lie on high-contrast regions of the image, such as object edges. Another important characteristic of these features is that the relative positions between them in the original scene shouldn’t change from one image to another.

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For example, if only the four corners of a door were used as features, they would work regardless of the door's position; but if points in the frame were also used, the recognition would fail if the door is opened or closed. Similarly, features located in articulated or flexible objects would typically not work if any change in their internal geometry happens between two images in the set being processed.

However, in practice SIFT detects and uses a much larger number of features from the images, which reduces the contribution of the errors caused by these local variations in the average error of all feature matching errors.An extraction method for the facial area on a natural background using variable inter-frame subtraction and color information is presented in this paper. We have proposed a human-face extraction technique using the HSV color model and have confirmed the effectiveness of this method experimentally.

However, the color black, which is expected to have a lower saturation in the HSV color model, can not be shown accurately. In a conventional system, this feature has some adverse effects on human-face extraction. To cope with this problem, a modified HSV color model was adopted. In the proposed transformation, the saturation is defined as a distance from a chromatic color.

This representation has the following advantage: (1) Black is represented as a color with lower saturation. (2) White human skin colors are conspicuous in the conventional system, but they will be emphasized in the proposed system.However, an adequate frame interval must be evaluated for obtaining sufficient movement information between frames.

The most adequate number for obtaining differential images between frames was set in this method. From a computer simulation using 8636 images, 3764 images (97.84%) were correctly extracted. With respect to the extraction of facial parts such as: eyes, mouth, eyebrows, color information and its special mutual relationship were mainly used.

Furthermore, the specific areas of a face which are used for feature extraction in order to understand facial expressions were extracted. This process must be executed on all faces taken from an arbitrary angle.

Blockdiagram:

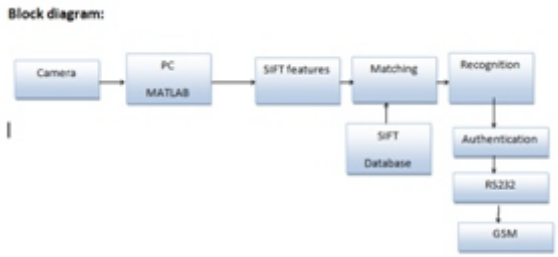
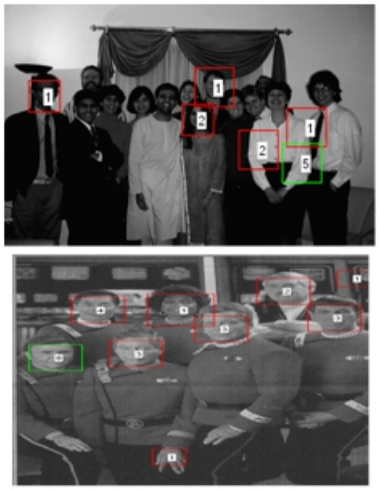


Fig.1 Proposed Model

Euclidean distance:

We present a new Euclidean distance for images, which we call image Euclidean distance (IMED). Unlike the traditional Euclidean distance, IMED takes into account the spatial relationships of pixels. Therefore, it is robust to small perturbation of images. We argue that IMED is the only intuitively reasonable Euclidean distance for images. IMED is then applied to image recognition. The key advantage of this distance measure is that it can be embedded in most image classification techniques such as SVM, LDA, and PCA. The embedding is rather efficient by involving a transformation referred to as standardizing transform (ST). We show that ST is a transform domain smoothing. Using the face recognition technology (FERET) database and two state-of-the-art face identification algorithms, we demonstrate a consistent performance improvement of the algorithms embedded with the new metric over their original versions.



Sqeuclidean Distance:

The most common measure of the distance between two points:

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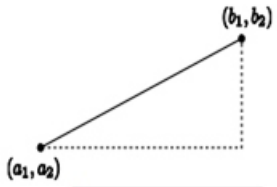
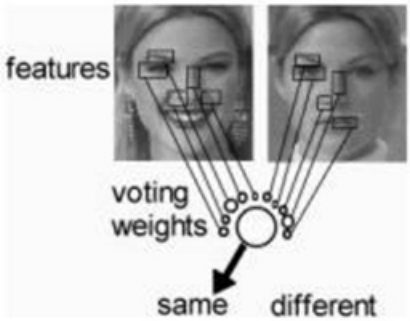
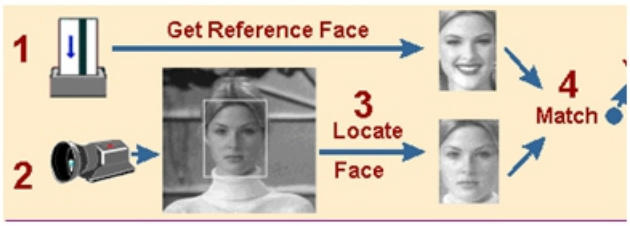


$$d = \sqrt{(b_1 - a_1)^2 + (b_2 - a_2)^2} \qquad (1)$$

We often use the squared Euclidean distance as well. It can be extended to any number of dimensions. In vector notation, the squared distance is

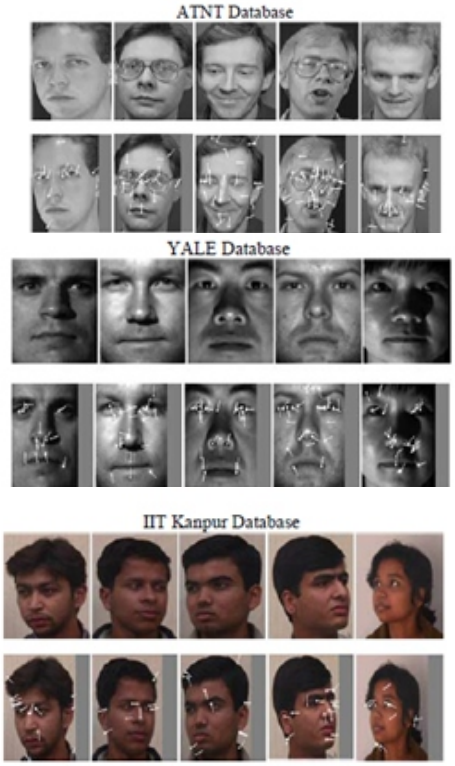
$$d^2 = (\mathbf{b} - \mathbf{a})^T(\mathbf{b} - \mathbf{a}). \qquad (2)$$





Results:

For synthetic investigation of SIFT algorithm experiments have been conducted on ATNT, YALE and IIT kanpur databases, executed on an Intel core 2 Duo CPU running on 2.26 GHz with 8 GB RAM with windows OS (64 Bit) and OpenCV1.1(Visual studio 2008).with the mentioned hardware response time is 0.4 secs for ATNT, YALE and IIT kanpur database, there are 20 subjects and each subject has 5 different facial views representing different poses, varying lighting conditions and expressions.Each image is digitized and stored as 92 X 112 pixel array. The file is in JPEG format. For conducting the experiments on three different databases.three separate training and test set has been set. Each person which includes 60 images totally and the testing set consist of the remaining. in the experiment, highly distinctive key points are extracted for all the images in the training data set. Corresponding coordinates of these key points are maintained in the array. Corresponding extracted highly distinctive key points.



Face recognition using SIFT algorithm and Contour matching has been studied. Face recognition based on Contour matching method is easy to implement due to its simplicity. But in contour matching shape of the contours get affected by titling or panning of a face. Similarly the varying lighting condition or two images with different expression of a same person also give the false contour lines, which in turns lower the recognition rate. Face recognition using Scale Invariant Feature Transform outperforms in many aspects. SIFT provides efficient face recognition results under varying lighting condition, scale, pose and expression. Our proposed efficient SADK matching algorithm of face recognition based on SIFT has given better results in terms of accuracy and efficiency. We experimented with three challenging data bases. Experimental results show that our SIFT based face recognition method is robust to illumination changes(YALE), changes in facial expressions(ATNT) and partial head movememnts including frontal, +45° and -45° (IIT Kanpur). In our experiment images with +90° and -90° and non ideal images taken by the camera are not included.Usingmanhattandistance,Euclideandistance,discrete cosine transform we are finding the facial parts.Though the effect due to these are not examined, but left open for further study. The experimental results show that the approach yields a high recognition rate and is applicable in real-time facial expression analysis.

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After face recognition ansms will to send to the registered mobile number using GSM module. Matlab and GSM modules are interfaced using serial communication.

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