A Survey Paper For Face Recognition Technologies

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Abstract

The locality preserving projections algorithm (LPP) is a recently developed linear dimensionality reduction (DR) algorithm that has been frequently used in face recognition and other applications. However, the projection matrix in LPP is not orthogonal, thus creating difficulties for both reconstruction and other applications. As the orthogonality property is desirable, orthogonal LPP (OLPP) has been proposed so that an orthogonal projection matrix can be obtained based on a step by step procedure; however, this makes the algorithm computationally more expensive. Therefore, in this paper, we propose a fast and orthogonal version of LPP, called FOLPP, which simultaneously minimizes the locality and maximizes the globality under the orthogonal constraint. As a result, the computation burden of the proposed algorithm can be effectively alleviated compared to the OLPP algorithm. Experimental results on two face recognition data sets and two hyperspectral data sets are presented to demonstrate the effectiveness of the proposed algorithm.

Index Terms- Face features, feature selection, local binarypattern.

Introduction

Humans often use faces to recognize individuals andadvancements in computing capability over the past few decades now enable similar recognitions automatically. Early face recognition algorithms used simple geometric models, but the recognition process has now matured into a science of sophisticated mathematical representations and matching processes. Major advancements and initiatives in the past ten to fifteen years have propelled face recognition technology into the spotlight. Face recognition can be used for both verification andIdentification (open-set and closed-set).

In face recognition system it identifies faces present in the images and videos automatically. It is classified into two modes:

1. Face verification (or authentication)

2. Face identification (or recognition)

In face verification or authentication there is a one-to-one matching that compares a query face image against a template face image whose identity is being claimed. In face identification or recognition there is a one-to-many matching that compare a query face image against all the template face images in the database to determine the identity of the query face image. Another face recognition scenario involves a watch-list check, where a query face is matched to a list of suspects (one-to-few matches). The performance of face recognition systems has improved significantly since the first automatic face recognition system was developed by Kaneda (T. Kaneda, 1973). Furthermore, face detection, facial feature extraction, and recognition can now be performed in real-time for images captured under favorable (i.e. constrained) situations. Although progress in face recognition has been encouraging, but still there are some unconstrained tasks where viewpoint, illumination, expression, occlusion, accessories, and so on vary considerably. It is natural, nonintrusive, and easy to use. There are many biometric systems but among the six famous biometric attributes considered by Tietmeyer (R. Tietmeyer, 2000), In a Machine Readable Travel Documents (MRTD) system facial features scored the highest compatibility, such as enrollment, security system, machine requirements, renewal, surveillance system and public perception.

1.1 Face Recognition Processing

Face recognition is a visual pattern recognition problem. There, a face as a three-dimensional object subject to varying illumination, pose, expression and so on is to be identified based on its two-dimensional image (three-dimensional images e.g., obtained from laser may also be used). A face recognition system generally consists of four modules as depicted. Face detection segments the face areas from the background. In the case of video, the detected faces may need to be tracked using a face tracking component. Face alignment is aimed at achieving more accurate localization and at normalizing faces thereby whereas face detection provides coarse estimates of the location and scale of each detected face. Facial components, such as eyes, nose, and mouth and facial outline, are located; based on the location points, the input face image is normalized with respect to geometrical properties, such as size and pose, using geometrical transforms or morphing. The face is usually further normalized with respect to photometrical properties such illumination and gray scale. After a face is normalized geometrically and photo-metrically, feature extraction is performed to provide effective information that is useful for distinguishing between faces of different persons and stable with respect to the geometrical and photometrical variations. For face matching, the extracted feature vector of the input face is matched against those of enrolled faces in the database; it outputs the identity of the face when a match is found with sufficient confidence or indicates an unknown face otherwise. Face recognition results depend highly on features that are extracted to represent the face pattern and classification methods used to distinguish between faces whereas face localization and normalization are the basis for extracting effective features. These problems may be analyzed from the viewpoint of face subspaces or manifolds, as follows.

II. LITERATURE SURVEY

Face recognition has been an active research area over last 40 years. The face recognition research has several disciplines such as image processing machine learning approach, pattern recognition, computer vision, and neural networks. Classification is the main problem. In the process of face recognition it includes, to train the face images from the known individuals and then to classify the newly coming test images into one of the classes. The problem of face recognition is easily solved by Humans where limited memory can be the main problem. The problems or limitations for a machine learning face recognition system are:

1. Facial expression change
2. Illumination variation
3. Ageing
4. Pose change
5. Scaling factor (i.e. size of the image)
6. Frontal vs. profile
7. Presence and absence of spectacles, beard, mustache etc.
8. Occlusion due to scarf, mask or obstacles in front.

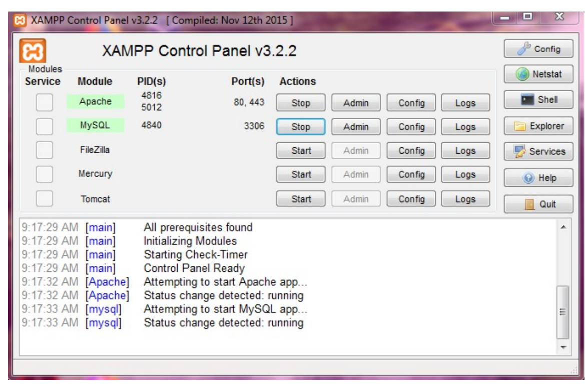
In automatic face recognition system the main complicated task is that it involves detection of faces from a cluttered background, facial feature extraction, and face recognition. A complete face recognition system has to solve all sub-problems, where each one is a separate research problem. Image template based and geometry feature-based are the two classes of face recognition system algorithms. In template based method it (Robert J) compute the correlation between a face image and one or more model of face image templates to estimate the face image identity from the database. Brunelli and Poggio (R. Brunelli) suggest the optimal strategy for face recognition system which is holistic and corresponds to template matching. The statistical tools such as Support Vector machines (SVM) (E. Osuna), (Vladimir N) Independent component Analysis, Principal Component Analysis (PCA) (L. Sirovich), (Matthew Turk), Linear Discriminant Analysis (LDA) (Peter N.Belhumeur et.al), kernel methods (Bernhard Scholkopf et.al), (M. H. Yang), and neural networks (A. Jonathan), (Steve Lawrence), (T. Poggio) used to construct a suitable database of face image templates.

III. Face Detection

AdaBoost classifier is used with Haar and Local Binary Pattern (LBP) features whereas Support Vector Machine (SVM) classifier is used with Histogram of Oriented Gradients (HOG) features for face detection evaluation.

Haar-like features are evaluated through the use of a new image representation that generates a large set of features and uses the boosting algorithm AdaBoost to reduce degenerative tree of the boosted classifiers for robust and fast interferences only simple rectangular Haar-like features are used that provides a number of benefits like sort of ad-hoc domain knowledge is implied as well as a speed increase over pixel based systems, suggestive to Haar basis functions equivalent to intensity difference readings are quite easy to compute. Implementation of a system that used such features would provide a feature set that was far too large, hence the feature set must be only restricted to a small number of critical features which is achieved by boosting algorithm, Adaboost. The original LBP operator labels the pixels of an image by thresholding the 3-by-3 neighborhood of each pixel with the center pixel value and considering the result as a binary number. Each face image can be considered as a composition of micro-patterns which can be effectively detected by the LBP operator.

To consider the shape information of faces, they divided face images into N small non-overlapping regions T0, T1... TN. The LBP histograms extractedfrom each sub-region are then concatenated into a single, spatially enhanced feature histogram defined as: Hi, j= Σx ,yI(fl(x,y)=i)I((x,y)϶Tj) where i = 0, ... , L-1; j = 0, ..., N-1. The extracted feature histogram describes the local texture and global shape of face images. Fig. 2 LBP calculation. SVM classifier is been used with HOG features for face detection. HOG greatly outperforms wavelets and degree of smoothing before calculating gradients damages, results emphasizes much of the available information is from sudden edges at fine scales that blurring this for reducing the sensitivity to spatial position is a mistake. Gradients should be calculated at the finest available scale in the current pyramid layer and strong local contrast normalization is essential for good results. Whereas SVM are formulated to solve a classical two class problem which returns a binary value, the class of the object. To train our SVM algorithm, we formulate the problem in a difference space that explicitly captures the dissimilarity between two facial images



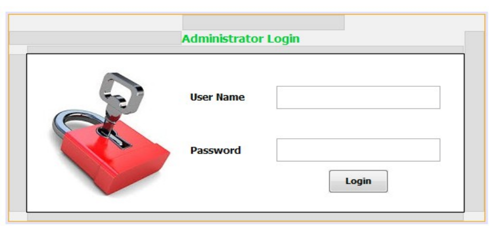
IV. Face Recognition

Eigen faces considered as 2-D face recognition problem, faces will be mostly upright and frontal. That's why 3-D information about the face is not required that reduces complexity by a significant bit. It convert the face images into a set of basic functions which essentially are the principal components of the face images seeks directions in which it is more efficient to represent the data. This is mainly useful for decrease the computational effort. Linear discriminant analysis is primarily used here to reduce the number of features to a more manageable number before recognition because face is represented by a large number of pixel values. Each of the new dimensions is a linear combination of pixel values, which form a template. The linear combinationsobtained using Fisher's linear discriminant are called Fisher faces. LBP is an order set of binary comparisons of pixel intensities between the center pixel and its eight surrounding pixels. $LBP (x_a ,y_a) = \sum_{n=0}^{7} s(i_m - i_a) 2^n$ Where i_a corresponds to the value of the center pixel (x_a ,y_a), i_m to the value of eight surrounding pixels, function f(x) is defined as: f(x) = Gabor [11] filters can exploit salient visual properties such as spatial localization, orientation selectivity, and spatial frequency characteristics. Considering these devastating capacities and its great success in face recognition Gabor [11] features are insensitive to transformations asillumination, pose and expressions although Gabor [11] transform is not specially designed for face recognition. Its transformation formula is predefined instead of learned from the face training data.

V. Dataset

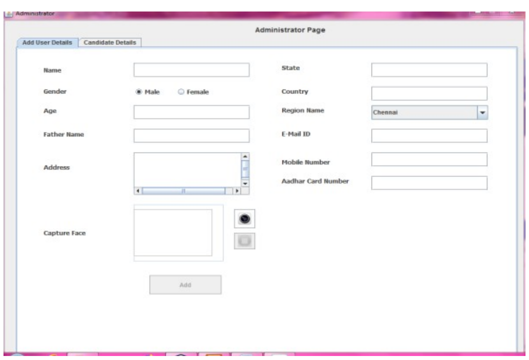
Five datasets been used for above experiments. In dataset, face collection with plain green background; no head scale and light variation but

having minor changes in head turn, tilt, slant, position of face and considerable change in expressions. In dataset, face collection with red curtain background, variation is caused by shadows as subject moves forward, having minor changes in head turn, tilt and slant; large head scale variation; some expression variation, translation in position of face and image lighting variation as subject moves forward, significant lighting changes occur on faces moment due to the artificial lighting arrangement. In dataset face collection with complex background; large head scale variation; minor variations in head turn, tilt, slant and expression; some translation in face position and significant light variation because of object moment in artificial light. In dataset, face collection with plain background; small head scalevariation; considerable variation in head turn, tilt, slant and major variation in expression; minor translation in face position and light variation. In dataset, face collection with constant background having minor head scale variation and light variation; huge variation in turn, tilt, slant, expression and face



VI. Conclusion

In current work we developed the system to evaluate the face detection and recognition methods which areconsidered to be a bench mark. Some methods performed consistently over different datasets whereas other methods behave very randomly however based on average experimental results performance is evaluated, five datasets been used for this purpose. In current system Haar-like features reported relatively well but it has much false detection than LBP which could be consider being a future work in surveillance to reduce false detection in Haar-like features and for the recognition part Gabor is reported well as it's qualities overcomes datasets



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