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Approach on Face Recognition & Detection Techniques

[a]Parveen kumar, [b]Doulat singh
[a] M. Tech Scholar, [b] Assistant Professor
[a, b]Department of Computer Science
JCDMCOE Sirsa (Haryana), 125055, India
parveenpannu@gmail.com

Abstract— Images are an important form of data and are used in almost every application. Some applications cannot use images directly due to the large amount of memory space needed to store these images. One of the most critical decision points in the design of a face recognition system is the choice of an appropriate face representation. Effective feature descriptors are expected to convey sufficient invariant and non-redundant facial information. Motion information is used to find the moving regions and probable eye region blobs are extracted by thresholding the image. These blobs reduce the search space for face verification which is done by template matching. Experimental results for face detection show good performance even across orientation and pose variation to a certain extent. The face recognition is carried out by cumulatively summing up the Euclidean distance between the test face images and the stored database, which shows good discrimination for true and false subjects. As human face is a dynamic object having high degree of variability in its appearance, that makes face detection a difficult problem in computer vision. In this field, accuracy and speed of identification is a main issue.
The goal of this paper is to evaluate various face detection and recognition methods, provide complete solution for image based face detection and recognition with higher accuracy, better response rate as an initial step for video surveillance. Solution is proposed based on performed tests on various face rich databases in terms of subjects, pose, emotions, race and light.

Keywords- Face Recognition, Face Recognition, Biometrics, Face Identification PCA, LDA.

1. INTRODUCTION

Over the last few decade lots of work is been done in face detection and recognition. A facial recognition system is a computer application capable of identifying or verifying a person from a digital image or a video frame from a video source. One of the ways to do this is by comparing selected facial features from the image and a facial database. Face detection is a computer technology being used in a variety of applications that identifies human faces in digital images. Face detection also refers to the psychological process by which humans locate and attend to faces in a visual scene. It is typically used in security systems and can be compared to other biometrics such as fingerprint or eye iris recognition systems. Recently, it has also become popular as a commercial identification and marketing tool. Face detection can be regarded as a specific case of object-class detection. In object-class detection, the task is to find the locations and sizes of all objects in an image that belong to a given class. Examples include upper torsos, pedestrians, and cars. Face-detection algorithms focus on the detection of frontal human faces. It is analogous to image detection in which the image of a person is matched bit by bit. Image matches with the image stores in database. Any facial feature changes in the database will invalidate the matching process. A reliable face-detection approach based on the genetic algorithm and the eigen-face technique.

2. RELATED WORK

Face Recognition, as the most successful applications of image analysis and understanding, has recently received significant attention. Recognition implies the tasks of identification or authentication. Identification involves a one-to-many comparison to fetch unknown identity from a set of known possibilities. Authentication involves a one-to-one comparison to verify a claimed identity. Furthermore, closely related to recognition is classification where the problem is to identify a group of individuals as sharing some common features. Their applications include security monitoring, automated surveillance systems, access control, mug shot identification, suspect versus perpetrator verification, facial reconstruction, victim and missing person identification, design of human computer interfaces, multimedia communication, medical diagnosis and treatment planning.

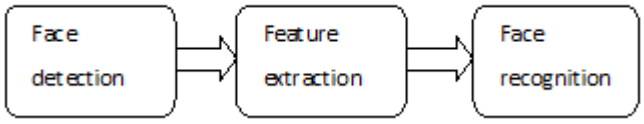

Fig 1- Configuration of a face recognition system [1]

In a face recognition system, 3 steps includes: Face detection, feature extraction & face recognition. In any system, challenges are race, age, gender, facial expression, or speech may be used in narrowing the search. In order to solve this problem, segmentation of faces (face detection) from cluttered scenes, feature extraction from the face regions, recognition, or verification is used. In identification, the input to the system is an unknown face, and the system reports back the determined identity from a database, whereas in verification problems, the system needs to confirm or reject the claimed identity. The first step in any automatic face recognition systems is the detection of faces in images. After a face has been detected, the task of feature extraction is to obtain features that are fed into a face classification system. Depending on the type of classification system, features can be local features such as lines or facial features such as eyes, nose, and mouth. Face detection may also employ features, in which case features are extracted simultaneously with face detection. Feature extraction is also a key to animation and recognition of facial expressions.

2. FACE DETECTION STRATEGIES

Face detection can be represented by Face detection techniques and algorithm deals with detection of face in clutter background with poses. True positives (detection rate) and false positives (detections of non face regions) would have to be very high and very low respectively for an ideal system.

2.1 Knowledge Based Method-

It calculates parameters of human facial feature. Features of a face (like nose, mouth, eyes, lips) and their relationships (like relative distance, intensity) are comparatively simple to take into account. After detection of features, false detection is reduced for verification. This approach is good for face image taken from front and not in different poses.

2.2 Feature-Based Method-

Feature-based approach can be further divided into three areas.

2.2.1 Low-level Analysis-

In low-level analysis visual features are segmented using properties of the pixels. Operators like the Sobel operator, the Marr-Hildreth operator, and a variety of first and second derivatives of Gaussians are used to detect the presence of edge in image. Govindaraju et. al. [2] labeled edges as left side, hairline, and right side, developing a system capable of detecting 76% of faces in a set of 60 images with complex backgrounds, with an average of two false alarms per image.

Extraction algorithms can search for local minima to detect darker surrounding and local maxima can indicate bright facial spots such as nose tips.

2.2.2 Feature Analysis-

There are two approaches. First involves sequential feature searching which is based on the relative positioning of individual facial features. To hypothesized less prominent features, prominent facial features are determined. A facial feature extraction algorithm proposed by De silva et. al. [3] got 82% accuracy, however Jeng et al [4] reported an 86% detection rate. The second technique is constellation analysis, which is less rigid and is more capable of locating faces of various poses in complex backgrounds. Features detected from a multi-scale Gaussian derivative filter using statistical shape theory is capable of detecting 84% of faces. However Probabilistic face models based on multiple face appearance reported 92% detection rate.

2.2.3 Active Shape Model-

These are three types: snakes, deformable templates and smart snakes. Snakes used to create a head boundary. They lock on to nearby edges, assuming the shape of the head. To achieve it energy function are minimized, which consists of the sum of an internal energy function, defining its natural evolution and an external energy function, which counteracts the internal energy enabling the contours to deviate from the natural evolution. Deformable Templates is an extension to the snake models. Yuille et al [5] used global information of the eye to improve the extraction process. Once established near an eye feature, optimal feature boundaries are minimized using steepest gradient descent minimization. Its Limitations is that they are sensitive to initial placement and the processing time Smart Snakes or Point Distributed Models (PDMs) are compact parameterized descriptions of a shape based upon statistics. They use PCA to construct a linear flexible model from variations of the features in a training set. Face PDM has 95% detection rate.

2.3 Image-Based Method-

Image-based approaches are having three methods: Linear subspace methods, neural networks, and statistical approaches.

2.3.1 Linear Subspace methods-

Detection can be represented by methods having statistical analysis, including Principal Component Analysis (PCA), Linear Discriminate Analysis (LDA), and Factor Analysis (FA). In PCA, principal components of faces are found. Each face in the set can then be approximated by combination of the largest eigenvectors, referred as eigenfaces. Pentland et. al. [6] proposed a facial feature detector generated from eigenfeatures, obtained from various templates in a training set. It reported about 94% accuracy. Yang et al [7] proposed a method based on Factor Analysis (FA), which assumes that observed data samples come from a well defined model. Using a mixture of factor analyzers, training images is used to estimate the parameters in the mixture model. This model is then applied to sub windows in the input image, and the probability of a face being present is returned. Yang et al [7] also proposed a system using LDA which aims for discrimination, where the class of faces and non-faces is divided into subclasses.

2.3.2 Neural Networks-

Rowley et al [8] proposed the first advanced neural approach which reported performance statistics on a large and complex dataset. Their system incorporates face knowledge in the neural network architecture, with specialized window sizes designed to best capture facial information. Images are pre-processed before being classified by the network; the output is post-processed to remove overlapping detections, resulting in one detection per face, and a reduction in false positives. Multiple networks were trained independently and their outputs combined using various arbitration methods to further improve performance.

2.3.3 Statistical Approaches-

Statistical approach includes based on information theory, support vector machines and Bayes' Decision Rule. Huang et. al. [9] developed a system based on Kullback relative information. This divergence is a non-negative measure of the difference between two probability density functions. During training, for each pair of pixels in the training set, a joint-histogram is used to create probability functions for the classes of faces and non-faces using a large quantity of 11x11 pixel images and results in a set of look-up tables of likelihood ratios. Poor detection are completely removed from the look-up tables to reduce computational requirements. The system was further improved by incorporating a bootstrap training algorithm. A SVM with a 2nd degree polynomial as a kernel function is trained with a decomposition algorithm. Images are pre processed and trained with a bootstrap learning algorithm. Schneiderman et. al. [10] proposes two face detectors based on Bayes' decision rule.

2.4 Template Matching Method-

Template matching methods use the correlation between pattern in the input image and stored standard patterns of a whole face / face features to determine the presence of a face or face features. Predefined templates as well as deformable templates can be used.

3. FACE RECOGNITION APPROACH

A face recognition system is a computer application for automatically identifying or verifying a person from a digital image or a video frame from a video. One way to do this is by comparing selected facial features of an image from a facial database. It is typically used in security systems and can be compared to other biometrics such as fingerprint or eye iris recognition system. Some face recognition algorithms identify facial features by extracting features or landmarks from an image of the particular face. For example, an algorithm may

examine the relative position, size, And shape of the eyes, nose, jaw and cheekbones [11].

Categorization of face recognition can be made on three methods.

3.1 Holistic matching methods-

These methods use the whole face region as the raw input to a recognition system. One of the most widely used representations of the face region is eigenpictures, which are based on principal component analysis.

3.1.1 Eigen faces Direct application of PCA

3.1.2 Probabilistic eigenfaces Two-class problem with prob. Measure

3.1.3 Evolution pursuit Enhanced GA learning

3.1.4 ICA-based feature analysis

3.1.5 PDBNN Probabilistic decision based NN

3.2 Feature-based (structural) matching methods

In these methods, local features such as the eyes, nose, and mouth are first extracted and their locations and local statistics (geometric and/or appearance) are fed into a structural classifier.

3.2.1 Dynamic link architecture Graph matching methods

3.2.2 Hidden Markov model, HMM methods-

3.3 Hybrid methods-

This method is best among above two methods. It uses both local features and the whole face region to recognize a face.

3.3.1 Modular eigenfaces, Eigenfaces and eigenmodules-

3.3.2 Hybrid LFA (Local feature Analysis)

3.3.3 Component-based Face region and components

3. CONCLUSION

In current work we developed the system to evaluate the face detection and recognition methods which are considered to be a bench mark. After study of various methods and steps of a face recognition system, it is concluded that image-based approaches is best among others because face images belong to face class. Geometric changes can be overcome by local appearance based approaches, 3D enhanced approaches, and hybrid approaches. By holistic matching methods, accurate location of key facial features such as eyes is obtained to normalize the detected face. Also it is concluded that, when the number of training samples per class is large, LDA is the better than PCA. The work can be extended to get more accurate, fast and efficient results. Further improvement is possible in future as an improved edge detection method can detect edges in color images.

REFERENCES

[1]. Patil A.M., Kolhe S.R.and Patil P.M, 2D Face Recognition Techniques: A Survey, International Journal of Machine Intelligence, ISSN: 0975–2927, Volume 2, Issue 1, 2010, pp-74-8

[2]. V. Govindaraju, Locating human faces in photographs, Int. J. Comput. Vision 19, 1996.

[3]. L. C. De Silva, K. Aizawa, and M. Hatori, Detection and tracking of facial features by using a facial feature model and deformable circular template, IEICE Trans. Inform. Systems E78–D(9), 1995, 1195–1207.

[4]. S. H. Jeng, H. Y. M. Liao, C. C. Han, M. Y. Chern, and Y. T. Liu, Facial feature detection using geometrical face model: An efficient approach, Pattern Recog. 31, 1998

[5]. A. L. Yuille, P. W. Hallinan, and D. S. Cohen, Feature extraction from faces using deformable templates, Int. J. Comput. Vision 8, 1992, 99–111

[6]. A Pentland, B. Moghaddam, and T. Strarner, View-based and modular eigenspaces for face recognition, in IEEE Proc. of Int. Conf. on Computer Vision and Pattern Recognition, 1994.

[7]. 7. M.-H. Yang, N. Ahuja, and D. Kriegman, 2000, Face detection using mixtures of linear subspaces, in Proceedings Fourth IEEE International Conference on Automatic Face and Gesture Recognition, H. A. Rowley, S. Baluja, and T. Kanade,1998 Neural network-based face detection, IEEE Trans. Pattern Anal. Mach. Intell. 20, January 1998, 23–38.

[8]. A. J. Colmenarez and T. S. Huang, 1997, Face detection with information-based maximum discrimination, in IEEE Proc. of Int. Conf. on Computer Vision and Pattern Recognition, 6

[9]. H. Schneiderman and T. Kanade, 1998, Probabilistic modeling of local appearance and spatial relationships for object recognition, in IEEE Conference on Computer Vision and Pattern Recognition, 6, .

[10]. TURK, M. AND PENTLAND, A. 1991. Eigenfaces for recognition. J. Cogn. Neurosci. 3, 72–86

[11]. Renu Bhatia,"Biometrics and Face Recognition Techniques", International Journal of Advanced Research in Computer Science and Software Engineering, Vol. 3, Issue 5, May 2013, pp. 97-98