

Face Recognition Using Discriminant Face Features Extraction method

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Abstract

Face recognition has been one of the most interesting and important research fields in the past two decades. The reasons come from the need of automatic recognitions and surveillance systems, the interest in human visual system on face recognition, and the design of human-computer interface, etc. These researches involve knowledge and researchers from disciplines such as neuroscience, psychology, computer vision, pattern recognition, image processing, and machine learning, etc. A bunch of papers have been published to overcome difference factors (such as illumination, expression, scale, pose, etc) and achieve better recognition rate, while there is still no robust technique against uncontrolled practical cases which may involve kinds of factors simultaneously. Most of the current face recognition systems presume that faces are readily available for processing. However, in reality, we do not get images with just faces. We need a system, which will detect the face in image, so that this detected face can be given as input to face recognition systems. The goal of a face detection algorithm is to identify the location and scale of all the faces in image. The task of face detection is so trivial for the human brain, yet it still remains a challenging and difficult problem to enable a computer to do face detection. This is because the human face changes with respect to internal factors like facial expression, beard and mustache, glasses etc and it is also affected by external factors like scale, lightning conditions, contrast between face and background and orientation of the face.

Keywords: *Low resolution, face recognition, discriminate analysis, kernel face features*

1. Introduction

Face recognition is the process of automatically determining whether two faces are the same person. A number of factors make this a challenging problem for computers. Faces in images and video can be captured at various resolutions, quality, and lighting conditions. Different cameras have different imaging properties. Moreover, people's facial expressions as well as their pose with respect to the camera can vary widely, and facial characteristics can change dramatically as people age over time.

Digital images and video are becoming more and more important in the multimedia information era. The human face is one of the most important objects in an image or video. Detecting the location of human faces and then extracting the facial feature in an image is an important ability with wide range of applications, such as human face recognition,

surveillance systems, human computer interfacing, video-conferencing etc.

In this work, it is implemented a human face recognition method by Genetic algorithm [2]. Genetic algorithms are a stochastic search algorithm, which uses probability to guide the search. It can find the near global optimal solution in a large solution space quickly. It has been used extensively in many application areas, such as image processing, pattern recognition, face detection, feature selection, and machine learning. Its power comes from its ability to combine good pieces from different solutions and assemble them into a single super solution.

Our aim, which we believe we have reached, was to develop a method of face recognition that is fast, robust, reasonably simple and accurate with a relatively simple and easy to understand algorithms and techniques. Given an image, the goal of face

detection algorithm is to detect the face and extract the features from given image and to recognize the detected face with given database of face images which is trained by Artificial Neural Network using Genetic Algorithm [3,4,5].

2. LITERATURE REVIEW

There are various approaches proposed by various researchers for image based face recognition. In this chapter a brief description of these approaches and a comparison between them are given.

2.1. Support Vector Machine

2.1.1. Evolutionary Pursuit Approach

In 2000, Evolutionary Pursuit (EP), a novel adaptive representation method, and showed its feasibility for the face recognition problem. EP seeks to learn an optimal basis for the dual purpose of data compression and pattern classification. Face projections suitable for compact and efficient face encoding in terms of both present and future recognition ability. The prediction risk, included as a penalty, is a measure of generalization ability and is driven by scatter index. The scatter index is conceptually similar to the capacity of classifier and its use is to prevent over fitting. Overall, EP provides a new methodology for both functional approximation and pattern classification problems with some prediction risk [7].

2.1.2. Eigen face-based Recognition Approach

In 2001, Kwok-Wai Wong, Kin-Man Lam proposed a more reliable face detection approach based on the genetic algorithm and Eigen face technique [8]. Firstly, possible eye candidates are obtained by detecting the valley points. Based on a pair of eye candidates, possible face regions are generated by genetic algorithm. Each of the possible face candidates is normalized by approximating the shirring angle due to head movement. The lighting effect is reduced by transforming their histograms into the histogram of reference face image. The fitness value of face candidate is calculated by projecting it onto the eigen faces. Selected face candidates are then further verified by measuring their symmetries and determining the existence of different facial features. But limitation is that the threshold value for single-face detection is greater than that for multiple-faces detection. Detection rate for multiple faces is poor. Also there is other research on eigenspace-based face recognition [9].

2.1.3. Hausdorff Distance Approach

In 2001, a face detection system that works with edge features of grayscale images and the modified Hausdorff Distance. After detection of facial region, face position parameters are refined in a second phase. System performance has been examined on two large test sets by comparing eye positions estimated by the system against manually set ones with a relative error measure that is independent of both the dimension of input images and the scale of faces. The good localization results show that system is robust against different background conditions and changing illumination. But there are restrictions of detection of only frontal views and single faces, on automatic model creation and transformation parameter optimization [10].

2.1.4. Radial Basis Function Approach

In 2002, Meng, Shiqian Wu, and Juwei Lu proposed a technique Radial Basis Function of Neural Network. a general design approach using an RBF neural classifier for face recognition to cope with small training sets of high-dimensional problem is presented. Firstly, face features are first extracted by the PCA, then the resulting features are further projected into the Fisher's optimal subspace in which ratio of the between-class scatter and within-class scatter is maximized. Training data information is used in the choice of structure and parameters of RBF neural networks before learning takes place, is presented. Finally, hybrid learning algorithm is proposed to train the RBF neural networks. Simulation results show that the system achieves excellent performance both in terms of error rates of classification and learning efficiency. This experiments show that if the variance of noise is small, there is no effect on generalization, whereas large variance of noise will deteriorate the performance [11].

2.1.5. Independent Component Analysis Approach

In 2003, Chengjun Liu and Harry Wechsler introduced an Independent Gabor Features (IGF) method for face recognition. The IGF method derives first a Gabor feature vector based upon a set of down sampled Gabor wavelet representations of face images by incorporating different orientation and scale local features. Independent component analysis operates then on the Gabor feature vector, whose dimensionality has been reduced by PCA, and derives independent Gabor features. Finally, the independence property of independent Gabor features leads to an application of the PRM method for classification. On one hand, Gabor transformed

face images exhibit strong characteristics of spatial locality, scale and orientation selectivity, similar to those displayed by Gabor wavelets. It produces salient local features in neighborhood of the eyes, nose and mouth that are most suitable for face recognition. On the other hand, ICA would further detect redundant features. The IGF method facilitates automatic implementation because it does not involve non-trivial manual annotation of shape points [12].

2.1.6. 2D Gabor wavelets Approach

In 2006, LinlinShen and Li Bai introduced a review on Gabor wavelets for face recognition [13]. 2D Gabor wavelets introduced that how to use them for local feature extraction. In face recognition, Face image could be represented by the Gabor jets extracted at some pre-defined feature points. Analytical methods utilize the Gabor jets extracted from pre-defined feature points on the face images for recognition. Different approaches to locate feature points for Gabor jets extraction, classified into two categories: For elastic graph based analytic methods, a graph is first placed at an initial location and deformed using jets to optimize its similarity with a model graph. Non-graph based methods locate feature points manually or by color or edge etc. after that recognition can then be performed using Gabor jets extracted from those feature points. But more research work is required in the following areas: 1) How to choose the optimal Gabor wavelet basis. While most of the works are following the framework of five scales/eight orientations, a large number of works also proposed their own design strategies. However, most of the strategies are presented without justification and it remains unclear which one is the best. 2) With no assumptions on locations and parameters of Gabor wavelet basis, an optimization algorithm able to select both the Gabor wavelet basis and jet locations for face representation is required. 3) The graph structures available for representation of faces are relatively limited, new structure and graph matching algorithms are encouraged. 4) The attention on Gabor wavelet networks is actually quite limited. [13].

2.1.7. Pseudo Zernike Moments Approach

In 2010, Rongbing, Changming and XiangRong proposed a technique Boosting Fisher-weighted PZM for Face Recognition [14,15]. This approach utilizes a Fisher-weighted function to emphasize the different facial parts. To reduce CPU computation time of

FWPZM, Adaboost is used to select the optimal feature set which contains optimal FWPZM orders and corresponding repetitions. FERET face database which contains face images at different orientations, scale, facial expression, different illuminations are selected to evaluate the proposed approach. But problem about pseudo-Zernike moments approach i.e. it often suffer heavy computational load.

2.2. Motivation

Although humans possess well-developed face processing expertise, face processing is nevertheless subject to a variety of biases. Perhaps the best known of these biases is the Cross-Race Effect--the tendency to have more accurate recognition for same-race than cross-race faces. The current work reviews the evidence for and provides a critical review of theories of the Cross-Race Effect, including perceptual expertise and social cognitive accounts of the bias. The authors conclude that recent hybrid models of the Cross-Race Effect, which combine elements of both perceptual expertise and social cognitive frameworks, provide an opportunity for theoretical synthesis and advancement not afforded by independent expertise or social cognitive models. Finally, the authors suggest future research directions intended to further develop a comprehensive and integrative understanding of biases in face recognition.

2.3. Problem definition

Human face detection and recognition has attracted much attention, it is an active area of research spanning several disciplines such as computer vision and automatic access control system. To detect the face before trying to recognize it saves a lot of work, as only a restricted region of the image is analyzed, opposite to many algorithms which work considering the whole image. In fact, detecting human faces and extracting the facial features in an image is a challenging process. It is very difficult to locate the positions of faces in an image accurately. There are several variables that alert the detection performance, including wearing of glasses, deferent skin coloring, gender, facial hair, and facial expressions.

3. Proposed work

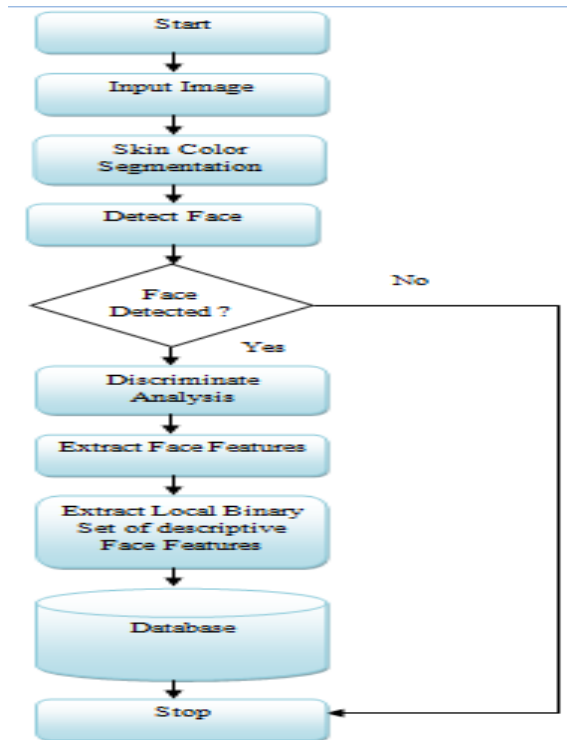


Figure 3: 1 Data Flow Diagram(Adding Faces to Database)

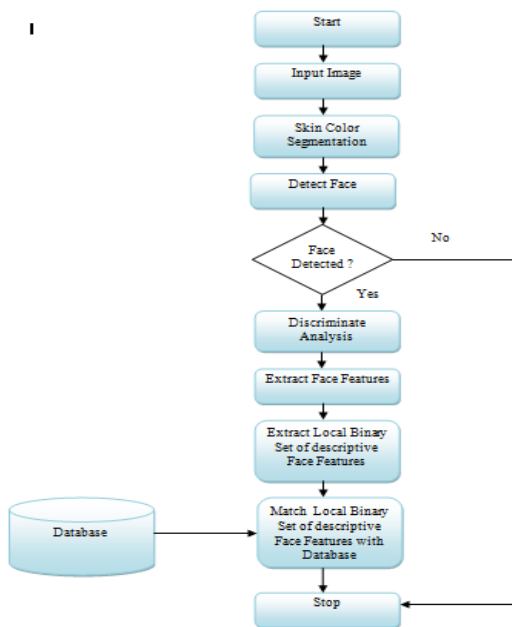


Figure 3.2: Data Flow Diagram(Face Recognition)

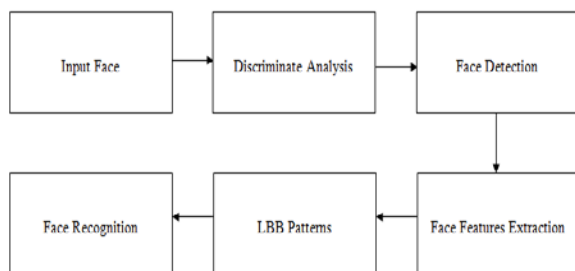


Figure 3.3: Architecture Diagram

3.1. Algorithm Step

1. Input Face
2. Detect Skin Color from input Face
3. If Skin Color Present then algorithm will go for face detection else discard input image.
4. Face Detection where features are detected with reference distance .
5. if face present , face features like (eyes,nose,mouth) will be extracted else input image discarded.
6. Selected Face Features play an important role in face recognition. Algorithm will calculate Local Binary Descriptive Patterns of Extracted features.
7. Once LBP calculated, are matched with database patterns values and maximum matched images will be declared as recognize image.

4. Result Analysis

Face Recognition Result Analysis							
Test	Total Number of Relevant Images	Number of Relevant Images Retrieved	Total Number of Retrieved Images	Recall	Precision	K. Saundep and A.N. Rajagopalan	
						Recall	Precision
1	46	42	45	91.30	93.33	63.04	64.44
2	47	42	46	89.36	91.34	78.94	68.00
3	45	38	42	84.44	90.37	66.66	80.00
4	42	35	41	83.33	85.36	83.33	69.44
5	40	25	35	59.52	71.42	71.80	65.70

Figure 4.1 Result Analysis

5. Conclusions

Face recognition is a complex and mutable subject. In addition to algorithms, there are more things to think about. The study of face recognition reveals many conclusions, issues and thoughts. This chapter aims to explain and sort them; hopefully to be useful is future research.

This thesis has demonstrated the effectiveness of detecting faces using a view based approach implemented with neural networks. The neural networks are powerful tool to solve pattern recognition problems, and can potentially be applied at each stage of a face recognition system. Firstly the preprocessing of face image is gone through the various steps like enhancement of image, segmenting the image, then these preprocessed images are fed to the trained neural network. After that the initial network connection weights are optimized by the genetic algorithm, lastly BP algorithm is used to train the network. In testing

process, this neural network tests the input images with the given or template images which are trained by genetic algorithm. If it is matched then show the accurate face and display their characters, otherwise test will continue. If all images are scanned, then end otherwise scanning will be continue. It gives the correct recognition rate. Also by choosing any one strong feature of an image, our technique recognized whole face of that selected feature.

REFERENCES

1. K. Sandeep and A.N. Rajagopalan "Human Face Detection in Cluttered Color Images Using Skin Color and Edge Information", ICVGIP Proceeding, 2002.
2. Huang Chen-rong, Tang Jia-li, Liu Yi-jun, "A New Face Detection Method with GA-BP Neural Network", 978-1-4244-6252-0/11/\$26.00 ©2011 IEEE.
3. S.Arun, G.Harish, K.Salomon, et al., "Neural Networks And Genetic Algorithm Based Intelligent Robot For Face Recognition And Obstacle Avoidance", International Conference on Current Trends in Engineering and Technology, ICCTET'13.
4. Amin Niknam, PouryaHoseini, et al, "A Novel Evolutionary Algorithm For Block-Based Neural Network Training", 978-1-4673-6206-1/13/\$31.00 ©2013 IEEE.
5. N. Belghini, A. Zarghili et al, "P. Color Facial Authentication System Based on Neural Network", 978-1-4673-0115-2/11/\$26.00 ©2011 IEEE.
6. Edgar, Robert, et al, "Training Support Vector Machines: an application to face Detection", Preceeding of CVPR'97, june 17-19, 1997.
7. Chengjun Liu, Harry Wechsler, "Evolutionary Pursuit and Its Application to Face Recognition", IEEE Trans. Pattern Analysis and Machine Intelligence, vol. 22, no. 6, pp. 570-582, 2000.
8. Kwok-Wai Wong, Kin-Man Lam, Wan-Chi Siu, "An efficient algorithm for human face detection and facial feature extraction under different conditions", Pattern Recognition 34 (2001) 1993}2004.
9. Javier, Pablo Navarrete, "Eigenspace-Based Face Recognition: A Comparative Study of Different Approaches", IEEE Transactions on Systems, Man, And Cybernetics—Part C: Applications And Reviews, Vol. 35, No. 3, August 2005.
10. Oliver Jesorsky, Klaus, "Robust Face Detection Using the Hausdorff Distance", In Proc. Third International Conference on Audio- and Video-based Biometric Person Authentication, Springer, pp. 90–95, 6–8 June 2001.
11. MengJoo, Shiqian Wu, "Face Recognition with Radial Basis Function (RBF) Neural Networks" IEEE Transactions on Neural Networks, Vol. 13, No. 3, May 2002.
12. Chengjun Liu and Harry Wechsler, "Independent Component Analysis of Gabor Features for Face Recognition", IEEE Trans. Neural Networks, vol. 14, no. 4, pp. 919-928, 2003.
13. LinlinShen, Li Bai, "A review on Gabor wavelets for face recognition", Pattern Anal Applic, 9:273–292, Springer-Verlag London Limited 2006.
14. Rongbing HUANG, Changming, "Boosting Fisher-weighted PZM for Face Recognition", Journal of Computational Information Systems, 3439-3447, 2010.
15. Javed, karimfaez, "Neural Network Based Fcae Recognition with Moment Invariants", 0-7803-6725, IEEE, 2001.
16. S.Venkatesan and Dr.S.SrinivasaRaoMadane, "Face Recognition System with Genetic Algorithm and ANT Colony Optimization", International Journal of Innovation, Management and Technology, Vol. 1, No. 5, December 2010.
17. Gang Hua , Ming-HsuanYang, "Introduction to the Special Section on Real-World Face Recognition", IEEE Transactions On Pattern Analysis And Machine Intelligence, Vol. 33, No. 10, October 2011.