

Face Recognition Techniques Using Artificial Neural Networks

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Abstract

The artificial neural network based technology is playing pivotal role in this highly challenging and unpredictable environment, transcending by nature than ever as far as inclusiveness and sustainability of intelligent and expert system to recognised & satisfy human need is concerned in this competitive arena. In present era Face recognition is widely used due to its numerous ability to cope up with various other techniques associated with it. The exploration in the upcoming opportunities and challenges which are associated with face recognition is inspired not only by the ground challenges face recognition shows but also by certain approaches & numerous practical applications where human identification is needed. Face recognition has several advantages over other technologies as it is more natural, nonintrusive, and easy to use. In this review paper various (Ica, Pca, and Neural Network) techniques has been used to extend their study.

Key Words – Face Recognition, Biometric, face recognition technique, artificial Neural Network.

Purpose – The purpose of this review based research paper is to investigate & associate the various techniques which are used in face recognition & the application based on face recognition under the inspiration of artificial neural network.

Originality – The study done on review bases and perusal study has been performed on contemporary ideas & over the techniques that are original in nature which is associated with face recognition techniques inspired by artificial neural network.

Findings – The findings that are associated & evolved with this work through the comparative analysis based approach of various technique has been shown towards the sustainability of face recognition based system.

Implications – the world of artificial neural based application is just evolved in recent decades and the sustainability and commercialisation of such technology is itself is a big challenge, as it has various implication associated with it such as funding for research work, setup of research laboratories, and providing practical environment & simulation of technologies for its sustainability.

Paper type – Research paper.

I. Introduction

Over the last ten years, face recognition has become a specialized applications area within the larger field of computer vision and other associated fields. Sophisticated commercial systems perform face detection, image registration, and image matching, all

in real time. Face recognition is a task that humans perform routinely and effortlessly in their daily lives. Face recognition, as one of the primary biometric technologies, became more and more important owing to rapid advances in technologies such as digital cameras, the Internet and mobile devices, and increased demands on security. Wide availability of powerful and low-cost desktop and embedded computing systems has created an enormous interest in automatic processing of digital images and videos in a number of applications, including biometric authentication, surveillance, human-computer interaction, and multimedia management. Research and development in automatic face recognition follows naturally. A face recognition system is expected to identify faces present in images and videos automatically. There are two predominant approaches to the face recognition problem: geometric (feature based) and photometric (view based). In order to organize the vast field of face recognition, several approaches are conceivable. For instance, algorithms treating the face and its environment as uncontrolled systems could be distinguished from systems that control the lighting or background of the scene, or the orientation of the face. Or systems that use one or more still images for the recognition task could be distinguished from others that base their efforts on video sequences.

II. Biometric Technique

Biometrics means life measurement but the term is usually associated with the use of unique physiological characteristics to identify an individual. Biometric recognition, or biometrics, refers to the automatic identification of a person based on his/her anatomical (e.g., fingerprint, iris) or behavioural (e.g., signature) characteristics or traits. This method of identification offers several advantages over traditional methods involving ID cards (tokens) or PIN numbers (passwords) for various reasons: (i) the person to be identified is required to be physically present at the point-of-identification; (ii) identification based on biometric techniques obviates the need to remember a password or carry a token.

2.1 . Biometric-Based On Two Technologies

Physiological - It depends upon the physical appearance of the human body or shape of the human like nose, chin, eyes, face and lips etc.

Behavioural - Behavioral biometrics is related to behaviour, nature and expression of human or person like heat of the body.



Fig.1 Types of biometric

III. Face Recognition

Face recognition is one of the most classical pattern recognition projects. Many techniques have been developed for face recognition based on facial images. Face recognition, as one of the primary biometric technologies, became more and more important owing to rapid advances in technologies such as various digital & computing systems, digital cameras, the Internet and mobile devices, and increased demands on security. Despite of the fact that many face recognition systems have been designed, new robust face recognition methods are still expected. Artificial neural networks are a popular tool in face recognition. They have been used in pattern recognition and classification. The applications of

neural networks are in many pattern recognition problems, like character recognition, object recognition, and autonomous robot driving. The main advantage of the neural network in the face recognition is the feasibility of training a system to capture the complex class of face patterns. To get the best performance by the neural network, it has to be extensively tuned (number of layers, number of nodes, learning rates, etc.). The neural network is widely used because it is non linear in the network.

How Does It Work?

1. The first step for a facial recognition system is to recognize a human face and extract it for the rest of the scene.
2. Next, the system measures nodal points on the face, (such as the distance between the eyes, the shape of the cheekbones and other distinguishable features.)
3. These nodal points are then compared to the nodal points computed from a database of pictures in order to find a match.

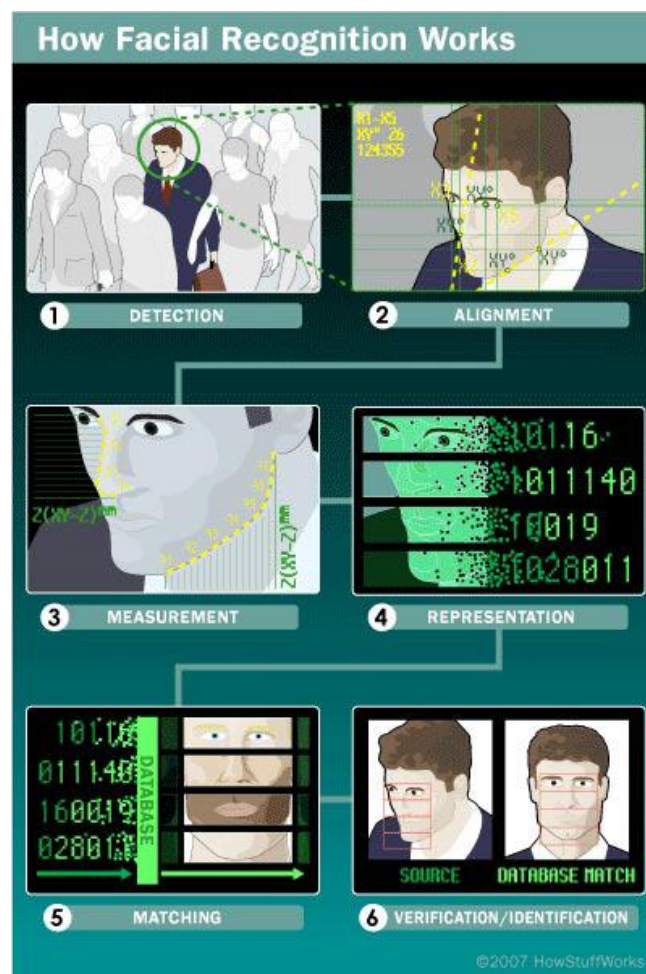


Fig.2

IV. Face Recognition Techniques

There are many different face recognition techniques that apply mostly to the frontal faces. This section gives an overview of all these techniques. The advantages and disadvantages of each technique are also discussed. The methods which are used for the face recognition are Eigen faces (Eigen features), neural networks, dynamic link architecture, hidden Markov model, geometrical feature matching, and template matching. The approaches are analyzed in terms of the facial representations they used.

1. Independent Component Analysis (ICA)
2. The Neural Networks.
3. Linear/Nonlinear Projection Methods.
4. Elastic Bunch Graph Matching (EBGM).
5. Linear Discriminate Analysis (LDA).
6. Principle Component Analysis (PCA).

Neural Network

The applications of neural networks are in many pattern recognition problems, like character recognition, object recognition, and autonomous robot driving. The main advantage of the neural network in the face recognition is the feasibility of training a system to capture the complex class of face patterns. To get the best performance by the neural network, it has to be extensively tuned (number of layers, number of nodes, learning rates, etc.). The neural network is widely used because it is non linear in the network. So, the feature extraction step may be more efficient than the linear Karhunen-Loève methods in a dimensionality reducing linear projection is selected which increase the scatter of all projected samples. The authors reported that there was 96.2% accuracy in the face recognition process when 400 images of 40 individuals are considered. The classification time is less than 0.5 second, but the training time is as long as 4 hours features in a hierarchical set of layers and provides partial invariance to translation, rotation, scale, and deformation. In general, neural network approaches encounter problems when the number of classes (i.e., individuals) increases.

They combined unsupervised methods for extracting features and supervised methods for finding features able to reduce classification error. They used feed-forward neural networks (FFNN) for classification. They also tested their algorithm using additional bias constraints, obtaining better results. They also demonstrated that they could decrease the error rate training several neural networks and averaging over their outputs, although it is more time-consuming than the simple method. Lawrence used

self-organizing map neural network and convolutional networks. Self-organizing maps (SOM) are used to project the data in a lower dimensional space and a convolutional neural network (CNN) for partial translation and deformation invariance. Self-organizing maps (SOM) as shown in figure 3.

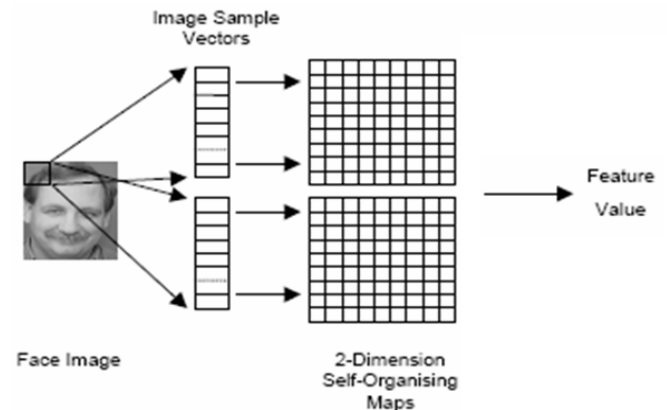


Fig.3 Self-Organizing

Their method is evaluated, by substituting the SOM with PCA and the CNN with a multi-layer perceptron (MLP) and comparing the results. They conclude that a convolution network is preferable over a MPL without previous knowledge incorporation. Multi-layer perceptron as shown in figure 4. The SOM seems to be computationally costly and can be substituted by a PCA without loss of accuracy.

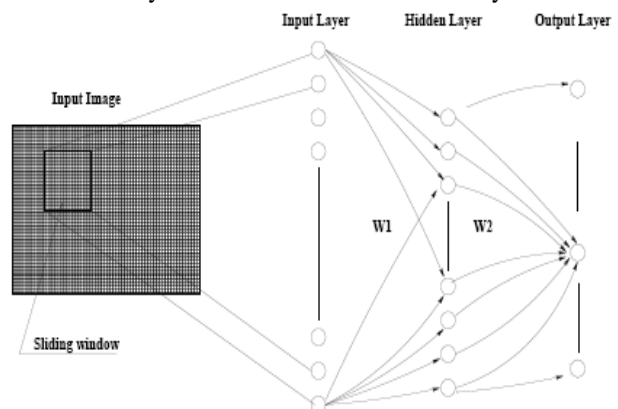


Fig. 4 Multi-layer perceptron (MLP)

Features from the entire face are extracted as visual contrast elements such as the eyes, side of the nose, mouth, eyebrows, cheek-line and others (Feature Extraction). The features are quantified, normalized and compressed into a template code.

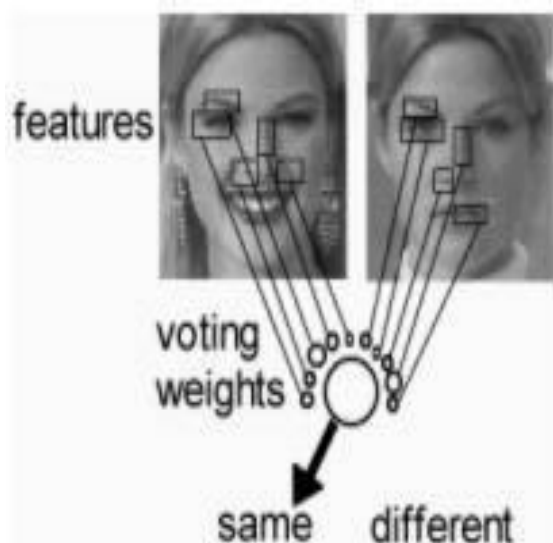


Fig.5 Template code

the space is, more the computation we need to find a match, a dimensional reduction technique is used to project the problem in a lower-dimensionality space.

V. Conclusion

The ability to recognize a face is an important part of being able to survive daily life. Humans have always had the innate ability to recognize and distinguish between faces, yet computers only recently have shown the same ability. Face recognition is an essential technological as well as social tool for humans. It allows us to identify members of particular groups, security of the system based on it and in doing so allows us to recognize those who we need to socialize with to aid our surviving in a more specific manner. Its application is very useful for personal verification and recognition. In face recognition, various techniques are used in the design and development of a system based on face recognition technology. It has already been stated that face recognition techniques have always been a very thinkable task for researchers because of all constraints and limitations imposed on various techniques which are used in face recognition. Face recognition is not a perfect process, errors can occur such as the inability for an individual to recognize themselves and misidentification.

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