FACE RECOGNITION: NEURAL-NETWORK APPROACHES

Dr. Luis Fernando Herrera, Dr. Camila Rodriguez, Dr. Diego Alvarez
Department of Physics, Universidad Nacional de Colombia, Bogotá, Colombia
Faculty of Engineering, Pontificia Universidad Católica de Chile, Santiago, Chile
Department of Computer Science, Universidad de Buenos Aires, Buenos Aires, Argentina

ABSTRACT

There is a crucial need for high security, with data and information accumulating in abundance. More attention has now been given to biometrics. Face biometrics, useful for the authentication of a person, is a simple and non-intrusive method that recognizes face in a complex multidimensional visual model and develops for it a computational model.

Faces are complex, multidimensional, meaningful visual stimuli and it is difficult to develop a computational model for face recognition. We present a hybrid neural network solution that matches other methods favorably. The system combines local image sampling, a neural map network that is self-organizing, and a convolutional neural network. The self-organizing map provides a quantization of image samples into a topological space where nearby inputs in the original space are also nearby in the output space, thereby reducing the dimensionality and invariance of minor image sample changes, and the convolutionary neural network provides partial unchanged to translation, rotation, scale, and deformation.

First we present an overview of face recognition in this paper and discuss the methodology and how it works. Then we represent the latest techniques of face recognition listing their advantages and disadvantages.

Some techniques specified here also improve the effectiveness of face recognition underdifferent conditions of lighti ng and expression of face images.

We use a 400 image database of 40 people that contains quite a high degree of variability in expression, pose, and fa cial details. We analyze the complexity of computations and discuss howto add new classes to the trained recognizer

I. INTRODUCTION

The need for reliable personal identification in computerized access control led to increased interest in biometrics. Fingerprints, speech, signature dynamics and face recognition are included in the biometrics being investigated. Sales of products for identity verification exceed $100 million. Recognition of face has the advantage of being a passive, non-intrusive system.

Face Recognition system broadly classify into two categories.

- We want to find a person in a large faces database (e.g. in a database of police). Usually these systems retur n a list of the most likely people in the database. Often there is only one picture per person. Recognition is usually not required in real time.
- We want to identify individuals in real time (e.g. in a security monitoring system, location tracking system, etc.) or we want to allow access to a group of people and deny access to all others (e.g. building access, computer access, etc.). Training is often provided with multiple images per person, and real-time recognition is required.

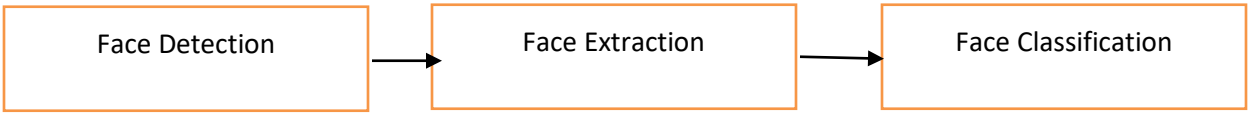

Fig 1 Block Diagram of a Face Recognition

II. DATA

We used the ORL database containing a set of faces taken at the Olivetti Research Laboratory in Cambridge between April 1992 and April 1994. There are 10 different pictures of 40 different subjects. The pictures were taken at different times for some of the subjects. The facial expression (open / closed eyes, smiling / non-smiling) and the facial details (glasses / no glasses) are different.

Basic of Face Recognition

A. Feature base approach

Local features such as nose are segmented in feature based approach and eyes can be used as input data in face detection to facilitate face recognition tasks.

B. Holistic approach

The whole face is taken as the input in the face detection system to perform face recognitionin a holistic approach.

C. Hybrid approach

Hybrid approach combines a feature based approach with a holistic one. Local and whole face are used as input to face detection system in this approach.

III. METHODOLOGY

In this work, efficient face recognition is built using the ML approach with Big Datato overcome the challenges related to large data sets. The proposed framework is designed not only to build an effective face recognition system, but also to solve the problems.

A. Neural Network

In many applications, neural networks are used such as pattern recognition issues, character recognition, object recognition, and autonomous robot driving. The neural network's main objective in face recognition is to train a system to capture the complex class of face patterns. To get the best performance from the neural network, the number of layers, number of nodes, learning rates, etc. needs to be extensively tuned. The neural networks in the network are non-linear, so facial recognition technique is widely used. Thus, the extraction step of the feature may be more efficient than the analysis of the main component.

With 400 images of 40 people, the authors achieved 96.2 percent accuracy in the face recognition process. The classification time is less than 0.5 seconds, but the training time in a hierarchical set of layers is as long as 4 hours features and provides partial invariance to translation, rotation, scale, and deformation. The disadvantage of the approach to the neural network is that the number of classes' increases then it cannot perform well.

B. Multi-layer perceptron (MLP)

For the proposed system, multi-layer perceptron (MLP) with feed forward learning algorithms was selected for its simplicity and supervised pattern matching capability. It has been applied successfully to many problems with pattern classification. Gabor wavelets & feed forward neural network presented a new approach to face detection. The method used to transform and feed Gabor wavelet into a neural network for finding feature points as well as extracting feature vectors.

The experimental results have shown that the method proposed achieves better results compared to other successful algorithms such as the methods of matching graphs and the methods of individual faces. A new class of convolutional neural network was proposed where inhibitory neurons are shunted by the processing cells. Previously shunting inhibitory neurons were used for classification and non-linear regression in conventional feed forward architecture and proved to be more powerful than MLPs, i.e. they can approximate complex decision surfaces much easier than MLPs.

C. Convolutional Neural Network

A hybrid neural network that combines local image sampling, a self-organizing neural map network, and a convolutional neural network has been presented. The SOM provides a quantization of image samples in a topological space where nearby inputs in the original space are also nearby in the output space, thus reducing dimensionality and making minor changes in the image sample invariably possible.

The CNN provides partial invariance to translation, rotation, scale, and deformation. PCA+CNN & SOM+CNN methods are both superior to the technique of their own faces, even if there is only one training image per person.SOM +CNN method consistently performs better than the PCA+CNN method.

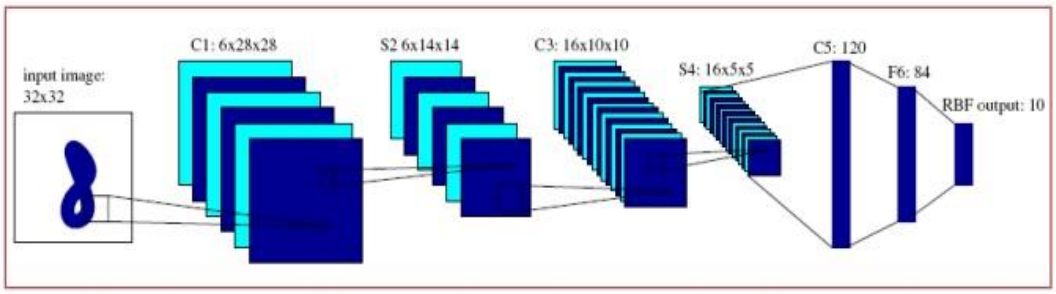

Fig 2 Convolutional Neural Network

D. Polynomial Neural Network

The PCA technique was used to reduce the PNN's image pattern dimensionality and extract features. The author had achieved relatively high detection rates and low false positive rates on images with complex backgrounds using a single network. The PNN performance is superior compared to a multilayer perceptron. Spectral Regression Kernel Discriminate Analysis (SRKDA) is based on regression and spectral graph analysis introduced in the proposed method to best reflect the 3D face manifold geometry and improve recognition. Effectively, when the sample vectors are non-linear, SRKDA can provide accurate solutions compared to ordinary approaches to subspace learning. Not only does it solve problems of high dimensional and small sample size, it also enhances the extraction of features from a non-linear facial structure. SRKDA only needs to solve a set of regularized regression issues and no eigenvector computing involved, which is a huge cost saving.

IV. CONCLUSION

In the field of image processing and computer vision, face recognition is a challenging issue. Great attention has been paid to face recognition due to a lot of application in different fields. Various face recognition algorithms with their advantages and disadvantages are mentioned in this paper. You can use any of them according to your application and requirement. You can also work on improving the efficiency and performance of the algorithms discussed.

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