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Research paper

Face Recognition Model Using Back Propagation

[1]R. Aswini Priyanka, [2]C. Ashwitha, [3] R. Arun Chakravarthi, [4] R.Prakash

[1]Assistant Professor, [2,3,4]Student
Department of Computer Science and Engineering,
Vel Tech Multi Tech Dr. Rangarajan Dr. Sakunthala Engineering College, Chennai

Abstract

In scientific world, Face recognition becomes an important research topic. The face identification system is an application capable of verifying a human face from a live videos or digital images. One of the best methods is to compare the particular facial attributes of a person with the images and its database. It is widely used in biometrics and security systems. Back in old days, face identification was a challenging concept. Because of the variations in viewpoint and facial expression, the deep learning neural network came into the technology stack it's been very easy to detect and recognize the faces. The efficiency has increased dramatically. In this paper, ORL database is about the ten images of forty people helps to evaluate our methodology. We use the concept of Back Propagation Neural Network (BPNN) in deep learning model is to recognize the faces and increase the efficiency of the model compared to previously existing face recognition models.

Keywords*: Face Recognition, Deep learning, Convolutional Neural Network (CNN), Back Propagation Neural Network (BPNN).*

1. Introduction

One of the most important biometrics verification methods is Face Recognition System. It is an effective presentation of Pattern recognition and Image analysis. Human face recognition can be done with the features like fingerprint, signature, iris, palm print face, hand geometry, gaits and speech. It shows great recognition or authentication at the rate of 92% for massive face datasets with well-controlled position and brightness situations. The objective is to implement face identification in a novel way and used in Biometrics for security purposes. Face identification system is a biometric technique of verifying every individual person by evaluating digital images or live videos with the stored information of any human.

Face recognition systems are widely used for security reasons. For example, KINECT motion gaming console uses the facial identification to recognize players in the gaming field. The online mobile payment mode uses the facial identification to validate the users securely. The facial recognition systems are widely used and deployed in airport security. In recent times, the face identification methods are based on numeric codes called as face prints. The Face Identification tools verify 80 nodal points on a person face. These nodal points are called as end points used to evaluate the parameters of a human's face, such as the length or width of the nose, the depth of the eye sockets and the shape of the cheekbones.

This systems work by capturing the data of each nodal point on an image of a human face and stores the final output data as information of face print. It is used for evaluating the data captured from the human faces in a video or image. These systems are based on face prints that can able to identify the targeted individuals accurately. The technology is developing swiftly and some novel methods like 3D modeling that may solve all our issues with the systems. According to the National Institute of Standards and Technology (NIST), the event of fake outcomes in facial recognition systems has been halved every two years since 1993, at the end of 2011, the value is .003%. Recently, Smartphone applications use the face recognition application for development and safety reasons.

Smartphone face recognition application has features like tagging image, social networks, integration purposes and customized marketing. A research team at Carnegie Mellon has developed a proof of concept, an iPhone app that will take a picture of a person and provide details of the individual's name, date of birth and social security number. The most popular social network application named Facebook uses the face identification software to verify automatic user tagging in the pictures. When a person is tagged in a group picture, the identification software application records the information about that person's facial features.

The data gets stored to identify the person face easily and then the system uses that particular data to verify the same human face in different pictures and will automatically tag that person's name. Face identification software improves the customized marketing. The Billboards have developed integrated software that verifies the gender, nationality and age of passers-by for effective advertising. According to a report from CBS News, almost half of United States citizens are represented in a facial recognition database.

2. Literature Survey

Stoimen Stoimenov, Georgi T. Tsenov, Valeri M. Mladenov[1] proposes the concept of face identification system which is developed in Android for all the Smartphone face detection of users. The categorization of the standard neural network structures in Java are used as a classifier by implementing the classical Feed-forward Neural Network (NN) with back propagation algorithm.Image identification is the best method to understand objects in the surrounding atmosphere. It would be a useful

interface to communicate between the machines. The improvement in image recognition process on machines is been researched for a long duration. The facial identification systems consist of both the hardware and software parts. They are used for user identification process automatically.

The inputs will be in the form of photos or frame captured from live videos. The government and private organizations utilize these systems for face identification of personnel verification from cameras or biometrics for user validation with the help of 3D scanners. The system must identify the human face from the given photo and extract the facial features from the photo for verification. There are so many ways for validation, but the best solution is to save the features of the person face in quantifiable form. The human will have 80 different pattern variables like nose width ratio, distance between eyes, height of the eye sockets, facial bone form, width of the jaw and can be used as classification parameters.

N.Revathy, T.Guhan[2] proposes the concept of face identification is the best way of biometric techniques, to verify the face image using salient features of human. It deals with a face identification method using Principal Component Analysis and Two-Layer Feed Forward Neural Network techniques are used to identify the frontal and poses variation images. The various dimensions of image face are reduced by the Principal Component Analysis and provide us the features of vector images. The testing and training are two processes done by the Two Layer Feed-Forward Neural Network. It highlights the performance of neural network. The Two layer feed forward NN applied on face 95 as a standard dataset and Local Images taken by the variations of poses.

The performance of neural network is satisfactory and the accuracy of recognition is 93%.It is observed that a lot of researchers give up working in the face recognition problem due to the inefficiencies of the technique used to represent faces. The performance analysis of Neural Network for face 95 database is 0.087516.The performance of Neural Network applied on local images is 0.029753. Entirely Performance is satisfactory. The execution time is in few seconds and the recognition accuracy is 93%.

3. Problems with the Existing System

Face recognition algorithm using scattering convolutional network is done. Scattering features are locally invariant and carry a great deal of high-frequency information. After feature extraction, PCA (Principle Component Analysis) is applied to reduce dimensionality. The multi-class SVM algorithm is used to perform recognition. This algorithm has been tested on three well-known databases such as EdgeMap, EigenFaces and SRC.

- It provides less accuracy rate of only about 93.1%
- It has less security.
- It has less efficiency

4. Proposed System

In this system, the concept of Neural Network (NN) is used. The ORL database is used to store ten images of forty people which can be used to test the software and method. The Deep learning Convolutional Neural Network (CNN) model is mainly used for identifying the human faces. The Back Propagation Neural Network (BPNN) will give better efficiency compared to the previously existing face recognition models. In this model, when the output is obtained it shows some errors. Then the errors are back propagated again as an input and the process is continued 'n' number of times using Back Propagation Neural Network (BPNN) to gain 98% accuracy in face recognition.

- This proposed system possess Deep learning Convolutional Neural Network model with Back propagation concept.
- It provides high rate of accuracy (98%)
- It has high security and efficiency.
- It can be used in Biometric support which requires greater efficiency.
- Important data can be stored in the system and this system can be used to gain access into the information stored by recognizing the faces.

The system model consists of two entities namely the user and the device. For each image updated in the database, the ORL database has totally four hundred images of 40 people's ten different faces. The system mainly consists of four phases: Pre-processing phase, Convolutional Neural Network (CNN) phase, Training phase and the Testing phase.

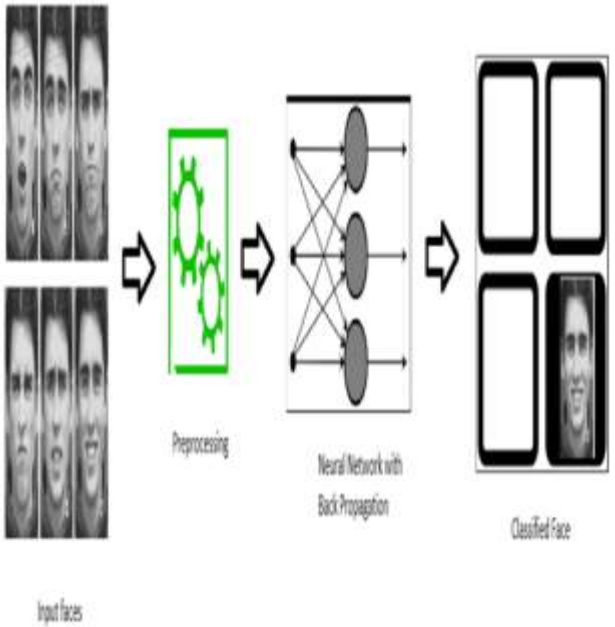

Fig 1.1: Convolutional Neural Network Model with Back Propagation

The pre-processing module involves converting image to our required numpy data format for neural networks. These images are given as input. Then the images are stored in buffer as bytes which are further used to find the values of header, width, height and maximum value. The maximum value for the images is 256.Now the bytes are converted into data for further process. It includes the calculation of dimension of image which is in the matrix form. Here each column is known as the Feature set. Converting 112 x 92 numpy mat into 1 x 10304 vector. Now the single row of the matrix known as the Feature Vector is further given as an input for the next Neural Network module.

The convolutional neural network module follows in which the feature vector is given as an input in which the scattering of images and assigning weights to the images takes place. In this module only some of the appropriate outputs from the inner layer are given as an input into the hidden layer. Then the next module is the Training module where 30 data sets from the ORL database are trained to the model. So that during the Testing module, the remaining 10 dataset images can be used for testing the Face recognition model to acquire maximum accuracy of about 98%.

5. Pre-Processing

The pre-processing module involves converting image to our required numpy data format for neural networks. These images are given as input. Then the image is stored in buffer as bytes which are further used to find the values of header, width, height and maximum value. The maximum value for the images is 256. Now the bytes are converted into data for further process. It includes the calculation of dimension of image which is in the matrix form.

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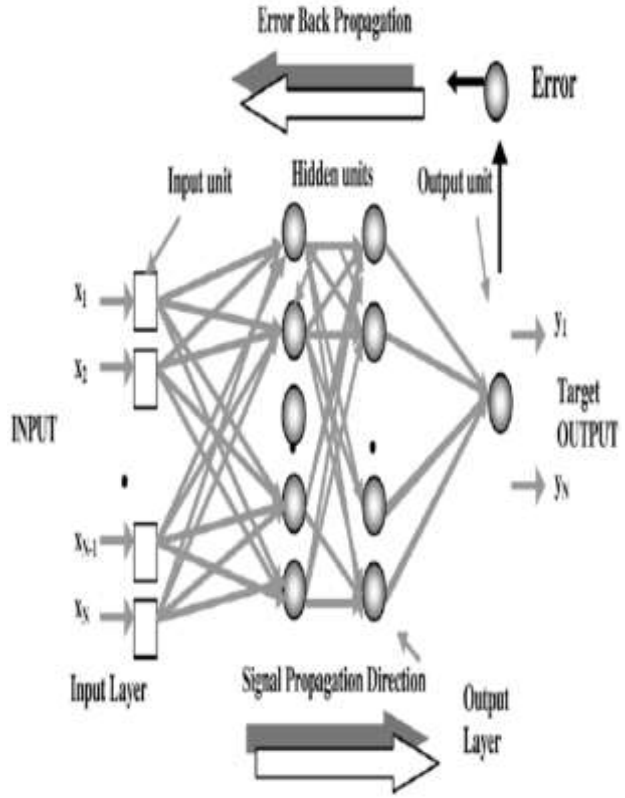

Fig 1.2: Back Propagation

The convolutional neural network module follows in which the vector is given as an input in which the scattering of images and assigning weights to the images takes place. In this module only some of the appropriate outputs from the inner layer are given as an input into the hidden layer. Then the next module is the Training module where 30 data sets from the ORL database are trained to the model. So that during the Testing module, the remaining 10 dataset images can be used for testing the Face recognition model to acquire maximum accuracy of about 98%.

6. Back Propagation Neural Network

It is a network which is consists of different interconnected layers. The term Back Propagation refers to the backward propagation of errors in conjunction with optimization method i.e steepest descent. It calculates the local minima with respect to the associated weights of the network. The weights are updated accordingly in order to reduce the local minima. Since this network relies on a known target output for every input fed into the network, it is thereby a supervised learning method.
This algorithm is best understood by categorizing under two main phases namely:
State 1: Propagation -

- Forward propagation: Input is given to the network to produce the propagation's outcomes.
- Backward propagation: The feedback network is developed by providing the output as input in order to evaluate a difference between the actual and target outputs.

State 2: Weight update -

- The Gradient of weight is an outcome of difference between the outputs and input activation.
- Subtract the percentage of the gradient from the weight.

7. Orl Database

It is applied ORL database for recognition of faces. This database has high acceptability in terms of face recognition system in the literature. As it's known, in the ORL database, there have been totally forty hundred images that belong to forty people's ten different pictures. With respect to this, database some specifications are come to the forefront which, the images were taken at different times, varying the lighting, facial expressions (open / closed eyes, smiling / not smiling) and facial details (glasses / no glasses). Beside these different points, all the images were taken against a dark homogeneous background with the subjects in an upright, frontal position (with tolerance for some side movement). Each file has the name of s1, s2,…, s40 and files have 10 different images of person. In the Fig.below, it is seen the first picture of s1 person.

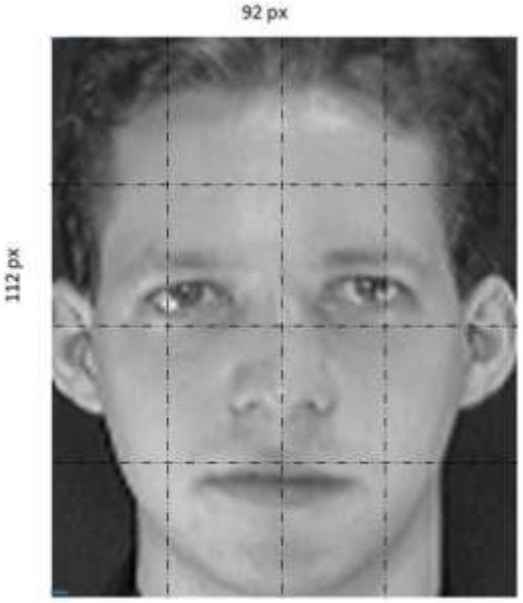

Fig 1.3: Human image of 1pgm

8. Convolutional Neural Network

In machine learning, a convolutional neural network (CNN, or ConvNet) is a type of feed-forward artificial neural network in which the connectivity pattern between its neurons is inspired by the organization of the animal visual cortex. Individual cortical neurons respond to stimuli in a restricted region of space known as the *receptive field*.
The receptive fields of different neurons partially overlap such that they tile the visual field. The response of an individual neuron to stimuli within its receptive field can be approximated mathematically by a convolution operation. They have wide applications in image and video recognition, recommender systems and natural language processing.

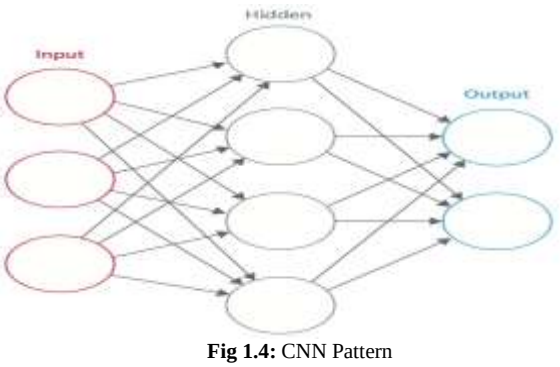

Fig 1.4: CNN Pattern

The convolutional neural network is also known as shift invariant or space invariant artificial neural network (SIANN), which is named based on its shared weights architecture and translation invariance characteristics.

9. Conclusion

Face recognition plays a vital role in many applications, which are crucial and integral part of life, and hence a high identification rate is desired. An efficient approach for face detection and recognition using Deep learning Convolutional Neural Network (CNN) with Back propagation is proposed in this paper. A total success rate of 98% is realized with the proposed method and hence can be considered in comparison with existing methods

10. Future Work

To secure client protection, different security safeguarding order methods have been proposed over the previous decade. The current methods are not pertinent to outsourced database conditions where the information dwells in encoded shape on an outsider server. We will propose a novel security safeguarding order convention over encoded information in the cloud. And also we will reduce the execution time of the encryption, decryption and classification.

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