

Face Detection and Recognition using Neural Network

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Abstract—Face detection and recognition have become one of the most popular biometric techniques over the past few years. It has a wide range of applications in the market and therefore is a need of today's world. A human brain can naturally detect and remember many faces but for computers, it is very difficult to do so hence different types of algorithms and training methodology are available.

Progress and innovations are done in this field regularly for getting higher accuracy and desired outputs. Face detection and recognition have high identification rates with a well-controlled pose and illumination conditions.

Keywords—database, facial detection, facial recognition, neural networks, Python.

I. INTRODUCTION

A facial recognition system is a technology capable of distinguishing or validating an individual from a digital image or a video frame from a video input. There are multiple methods in which facial recognition systems work, but in general, they work by comparing selected facial features from a given image with faces within a database.

This paper discusses a neural network based upright frontal face detection system. A visual neural network examines a small window of an image and decides whether it contains a face. Network or the machine is to be trained with a person database of facial images for training. The network also aims to recognize the trained face at an acceptable lighting and camera condition.

The password and ID card can easily be broken because the password can be disclosed to an unauthorized user and an impostor can steal the ID card. The emergence of biometrics has thus identified these problems associated with traditional methods of verification. A facial recognition system instantly matches the face of an individual with a photo database to establish identity. The facial recognition system has the advantage of being a passive, non-intrusive system for personal identity verification. The aim of this paper is therefore to discuss a system that uses face-to-face as a measure of security and identification and imitates the ability to recognize people.

II. BASICS

The face detection and recognition technique can be applied basically by taking pictures through a camera and then giving it as an input externally. But in this advanced world, we use the second way that is real-time processing. In this method, a webcam is used to take live inputs and provide desired outputs in real time.

The following tools and software are required to do so are as follows:

- Python
- Anaconda Navigator/Pycharm
- Open CV

III. NEURAL NETWORK VS CONVENTIONAL COMPUTERS

Neural networks adopt an alternate strategy to problem-tackling than that of traditional computers. Ordinary computers utilize an algorithmic methodology, for example, the computer adheres to a lot of directions so as to solve a problem. Except if the particular advances that the computer needs to pursue are realized the computer can't solve the problem. That limits the problem-fathoming ability of traditional computers to problems that we as of now comprehend and realize how to solve. In any case, computers would be quite a lot more valuable on the off chance that they could do things that we don't actually realize how to do.

Neural networks process data likewise the human mind does. The network is made out of countless interconnected preparing components (neurons) working in parallel to solve a particular problem. Neural networks learn by model. They can't be customized to play out a particular undertaking. Then again, traditional computers utilize an intellectual way to deal with problem-unraveling; the manner in which the problem is to solved must be known and expressed in little unambiguous guidelines. These directions are then changed over to an anomalous state lingo program and a short time later into machine code that the computer can get it. These machines are totally obvious; if anything turns out gravely is a direct result of an item or machine fault.

Neural networks and customary algorithmic computers are not in rivalry but rather supplement one another. There are assignments are progressively suited to an algorithmic methodology like number-crunching activities and undertakings that are increasingly suited to neural networks.

IV. DESIGN AND METHODOLOGY

4.1 General block of project consists of 4 major operations namely:

- Image acquisition and processing.
- Training process.
- Recognition.
- Verification.

Image acquisition and processing consist of an input side of the system. Here input is providing through a camera of the person. The face of the person is the input to image acquisition. Once input which is the face of the person is provided, face detection process begins. The face area is separated by non-face background the important features such as eyes nose face, etc. are located in the feature extraction process.

Next, training process where the face is being trained to the system by calculating multiple times .here different features of the face are being trained in the system by a specific algorithm. Different features such as contrast, shape are being trained in the database.

Next time when an input is given detected face system starts the process of recognition and verification face is being identified and recognized through the template database stored in the system. If users face is stored in the database then the system would recognize it then would verify with detail and accuracy. The accuracy of face detection depends on the computation of system and database stored in the system.

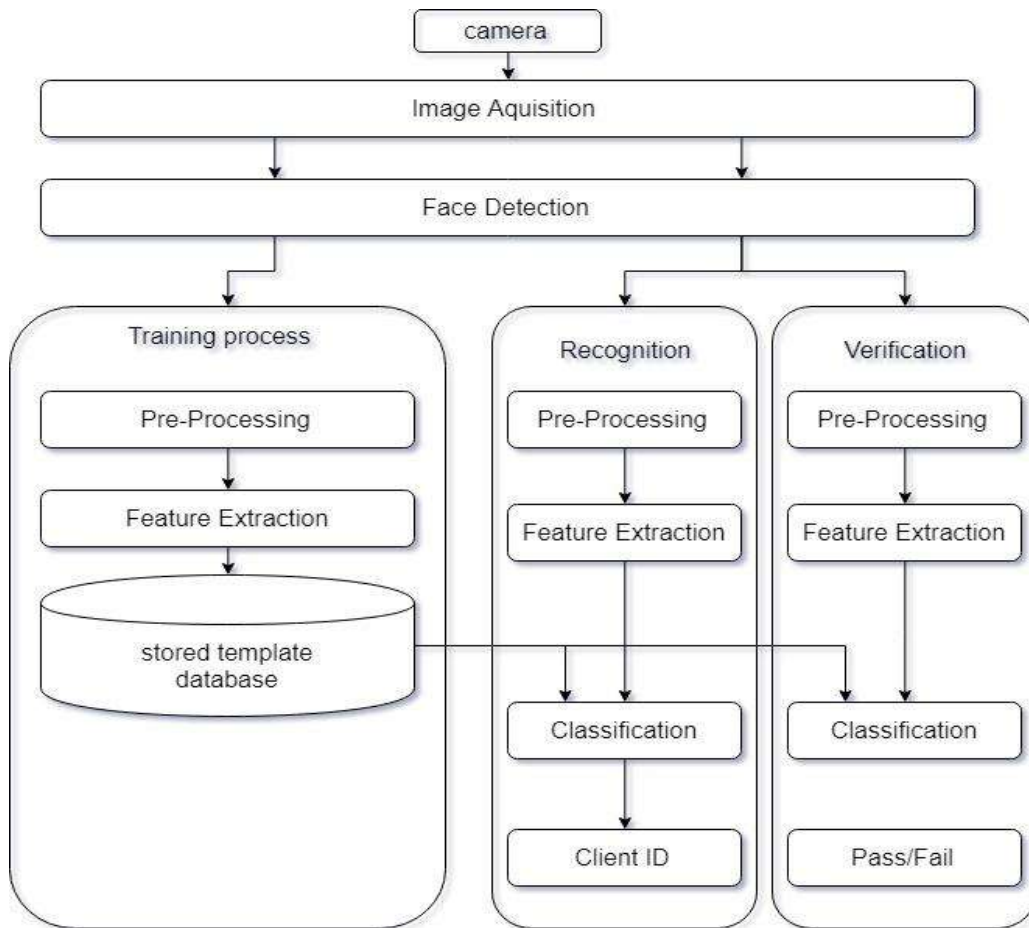


Fig 1. General flowchart of a neural network based system

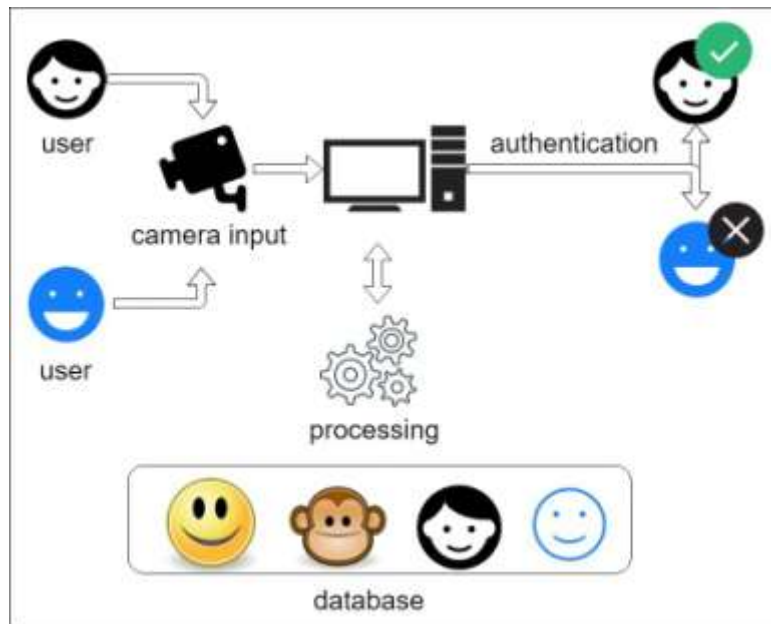


Fig 2. Implementation of the system

4.2 Different Neural networks and its advantages:

An Artificial Neural Network (ANN) is an information processing unit that is inspired by the way biological nervous systems exist, such as the brain, process information. The key element of this technique is its algorithm. It is composed of a large number of highly interconnected processing elements which work to implement a particular task. There are various algorithms available in the market such as.

4.2.1 Eigenface:

Eigenface divides the face into a feature vector. These eigenvectors are used to quantify variation between multiple faces. Each face can be considered as a linear combination of eigenvectors. An advantage of this method is practical, efficient and also has an easy algorithm. Drawbacks include finding Eigenvectors and Eigenvalues are time-consuming and are sensitive for lighting conditions.

4.2.2 Convolutional neural networks

Method and description of CNN consist of multiple layers. Each layer has multidimensional inputs as well as outputs. Every layer has a volume of activation through various functions. Different layers are as follows.

INPUT: It holds the raw pixels.

CONV: Computes the output that is connected to the local region

RELU: Apply activation function.

POOL: Perform down sampling operation.

Advantages of CNN (convolutional neural network) give the best results and can provide up to 98% efficiency. Drawbacks of CNN are that it has very huge training sets leads to high load and large storage requirements it also requires high processing power.

4.2.3 Viola jones algorithm

Method and description of The Viola-Jones algorithm have four stages.

- Haar feature selection: Haar feature takes into consideration properties common to human faces like eye region is darker than upper cheek and nose bridge region is darker than eyes
- Creating an integral structure: Regions are divided according to similarities.
- Ada boost Training:

Advantages are it gives better efficiency than most of the other algorithms. Drawbacks are Complex implementation. Thus, there are various algorithms available in the market which can be used according to applications. Each and every algorithm has its own domain and provides us with different accuracy accordingly.

V. CONCLUSION

In summary, artificial Neural Networks and especially mlps are one of the promises for the future in pattern recognition. They offer an ability to perform tasks outside the scope of traditional processors. They can recognize patterns within large datasets and then generalize those patterns into recommended courses of action.

Face recognition is a challenging problem in field of image processing and computer vision. Because of lots of application in different fields the face recognition has received great attention. Various applications where human interaction is required can be helped with introduction of computation power with help of machine learning programs and artificial intelligence.

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