PROJECT

BIOMETRICS: AUTOMATED FACE RECOGNITION USING ARTIFICIAL NEURAL NETWORK

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Content

Project Mean idea

Face Recognition is the process of identifying or verifying the identity of a person using their face. It captures, analyses, and compares patterns based on the person's facial details. The face detection process is an essential step in detecting and locating human faces in images and videos, BUT in general, they compare chosen facial traits from a given image with faces in a database. It is also known as a Biometric Artificial Intelligence-based application that analyses patterns based on a person's facial features and form to uniquely identify them.

Similar applications in the market

*Facebook which uses face recognition technology to automatically recognize when Facebook members appear in photos. This makes it easier for people to find photos they are in and can suggest when particular people should be tagged in photos.

* Face ID which is a facial recognition system designed and developed by Apple Inc. for the iPhone and iPad Pro. The system allows biometric authentication for unlocking a device, making payments, accessing sensitive data, providing detailed facial expression tracking for Animoji.

A Literature Review of Academic publications relevant to the problem

Abstract

Face recognition process is considered one of the most popular applications in image processing and biometric pattern recognition systems. Although the face recognition approach improves the authentication procedure, many challenges still appear due to diversities in human facial expression, colossal image size, background complexity, variation in illumination, poses, blurry, etc. Therefore, the face detection procedure is classified as one of the most challenging tasks in computer vision. This research paper reviews the implementation of image processing based on the Artificial Neural Network approaches.

ANNs represent it as a potential capability to enhance the method of extracting face patterns through an adaption of various ANN topologies. Furthermore, it means fundamental phases associated with the construction of any facial recognition system. Finally, it provides a comparison of different literature studies related to face recognition based on varying **ANN** approaches and critically analysed them.

Introduction

Many organizations draw their attention to maintain high information security level and control the grant access to the system by authenticating the individual's identity to evade cybercrime issues. On the other hand, standard authentication techniques such as PIN, password, username, ID card number, etc., become inefficient techniques. With the excessive advances in software computing and image processing, many emerging methodologies appeared to improve the authentication procedure (Bhattacharyya et al., 2009). The "Biometric" word is constructed through combing "Bio" and "metrics" words which refer to useful sciences that concern is analysing and measuring biological information through adapting intelligence machine learning and various mathematical algorithms. Nowadays, Biometrics Pattern Recognitions (BPR) methodologies are widely useable systems. It was defined as an efficient information system that is employed to detect, verify, and authenticating individuals' identity based on some of its behavioural characteristics like body movement, keystroke writing style, and unique physiological factors such as fingerprint, eye retina, or eye iris, voice pattern, DNA, facial pattern and handshape (Bhattacharyya et al., 2009). The recent development in machine learnings and technologies; makes it possible

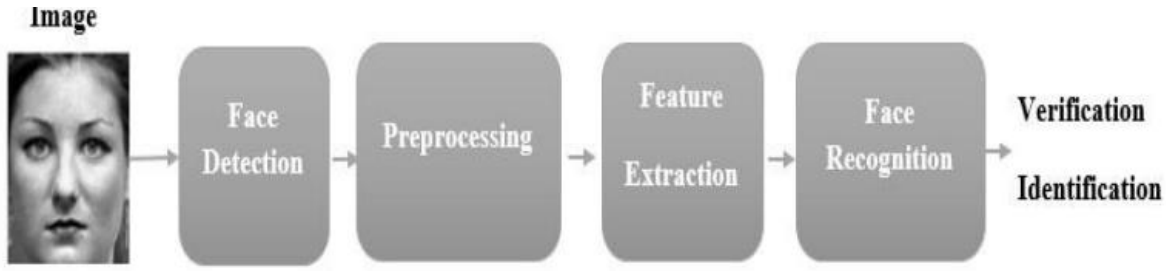
to generate an intelligence system based on statistical learning methodologies as a Facial Recognition (FR). Although, the FR system is considered one of the significant applications in image processing. However, this form of recognition may deliver great challenges in computer vision and pattern recognition due to many reasons such as diversities in facial expressions, orientation problems, illumination effects, and image size and background complexity (Khan et al., 2019). Although many researchers place considerable efforts in this area to overcome the limitations of FR using the Artificial Neural Network approach, many issues are still required to be solved. In general, the FR system analyses the individual's facial characteristics from an image that is entered as input into the system. This image will go through a reprocess phase to extract all essential information based on using specific algorithms like the Deep Learning Algorithm (DLA) to recognize the target individual at the end (Khan et al.,2019).

Structure of Face Recognition System

The construction of any Biometrics Recognition system like face recognition consists of four main contemporary phases: face detection, pre-processing, feature extraction, and face recognition
It serves individuals' verification and

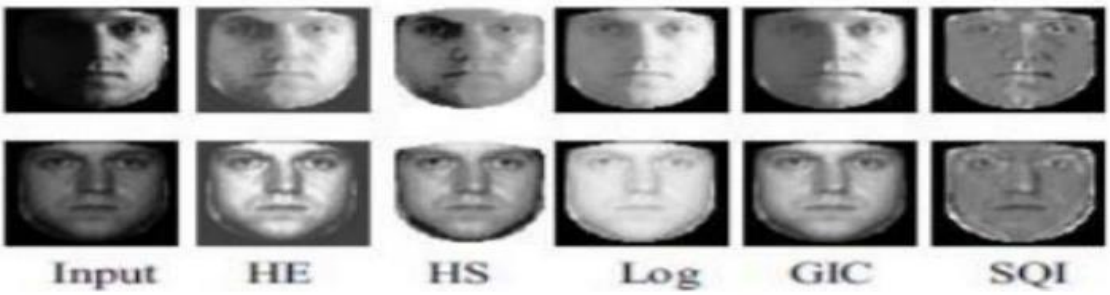
identification purpose, as presented in Figure 1

The image acquisition is made through a video camera or importing it from a database, and then this image goes further over distinct phases as



Pre-processing Phase

The image pre-processing steps usually forms as a combination of three important modules which are: histogram equalization, detection of edge, and matching of token that applied to enhance image quality, identify the edge point in the digital image, and finally perform removal and normalization based on specific algorithms, Through pre-processing technique, all undesirable image effects can be removed such as image noise, distortion, blur, shadow, or filters and it will make normalization for the image to generate smooth face image as an output which then will be utilized in extraction phase



Feature Recognition Phase

This is the last phase, and it is utilized to achieve automatic authentication and identification of the individuals. To achieve this goal, each face recognition system should maintain a face DB that stores information about all extracted faces features in which for everyone several images should be taken and then extracted features stored in this dedicated DB Consequently, Figure 3 shows the extracted features information that is received from the previous phase will be compared to each face class that stored in DB to perform authentication and recognize the person and the algorithm return the identity

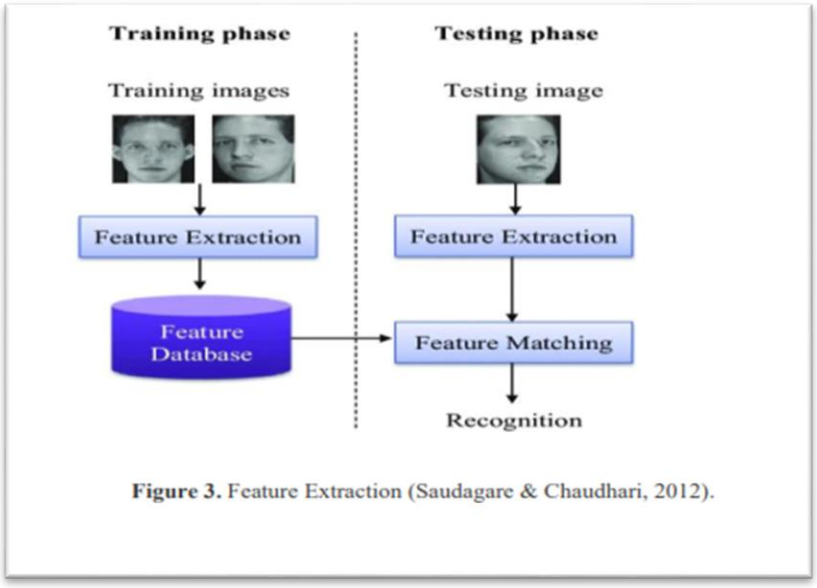


Figure 3. Feature Extraction (Saudagare & Chaudhari, 2012).

Solution tested on the testing images by uploading it and detecting the face on the image then extracting the features of the face and pre-processing it then applying the pre-processed features of the face to the model to classify it, finally we got insights by plotting the confusion matrix of the model to see the performance of the model after applying all the testing images.

Artificial Neural Networks Advantages and Disadvantage

ANNs can learn and model non-linear and complex relationships, which is important because in real-life, many of the relationships between inputs and outputs are non-linear as well as complex.

Artificial Neural Networks require lots of computational power. ...**Neural network models are hard to explain. ...**

Neural network training requires lots of data.

Data preparation for neural network models needs careful attention.

Resources

1. GUO Jin-xin, CHEN Wei, School of Optical-Electrical and Computer Engineering, University of Shanghai for Science and Technology.

2. AEU - International Journal of Electronics and Communications.

3. Brian O'Connor, and Kaushik Roy Department of Computer Science, North Carolina A&T State University, Greensboro, NC 27411.

4. LGS, National School of Applied Sciences, Ibn to fail University, B.P. 241, university campus, Kenitra, Morocco.

5. Computer Vision – ACCV 2010, Daniel Maturana, Domingo Mery, Álvaro Soto.

Dataset

The dataset consists of 4 classes: Adriana Lima

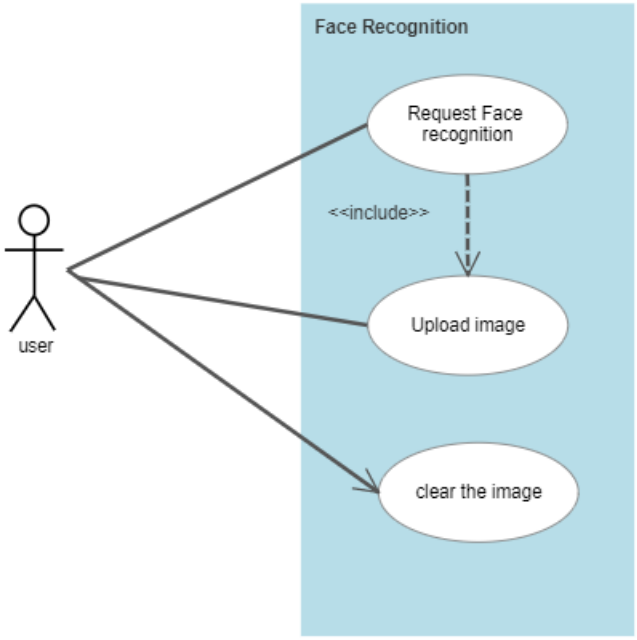
Alex Lawther

Bill Gates

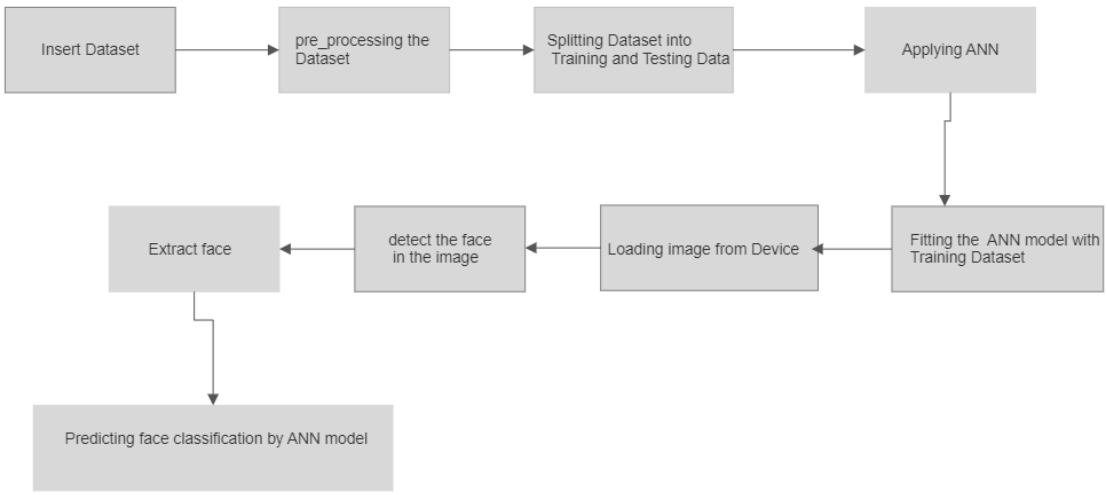
Rihanna

The link:
https://drive.google.com/drive/folders/1ZTQiK9EQNKn_6qPH3wTL67dLPBMyTi_N?usp=share_link

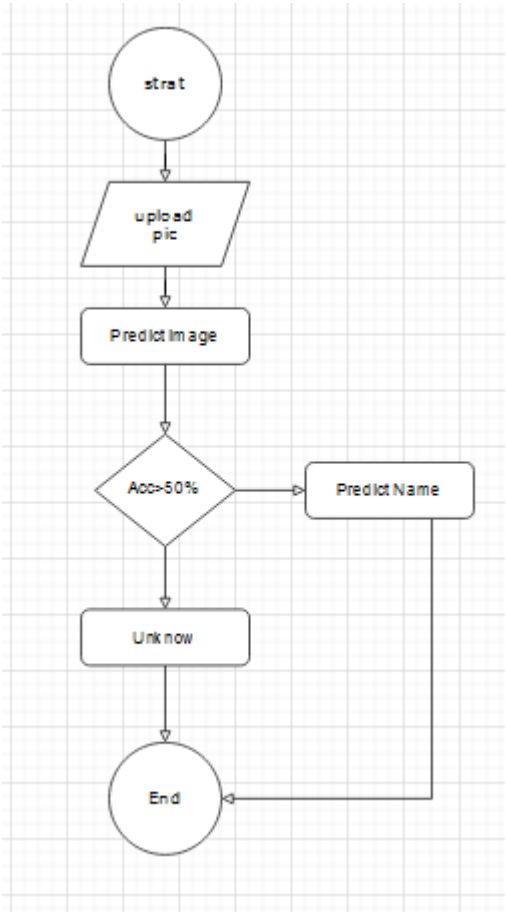
Main functionalities/features *(from the users' perspective)*



Applied Algorithms by block diagram



Flowchart


strat
upload pic
Predict Image
Acc>50%
Predict Name
Unknow
End

Development platform

Tools: Anaconda, Jupiter Notebook.

Programming Languages: Python.

Python Libraries:

pyodbc , matplotlib, io, os , PIL, NumPy, cv2, mtcnn , sklearn , tkinter , imageio , playsound .