Face Recognition Based on Artificial Neural Network

Artificial intelligence 's project.

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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's 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.

Introduction

Introduction

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.

Introduction

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.

Similar applications in the market

Similar applications in the market

1 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

2 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 Animoj

An initial literature review of Academic

Structure of Face Recognition System

The construction of any Biometrics Recognition system like face recognition consists of four main contemporary phases: face detection, preprocessing, feature extraction, and face recognition (Shaaban, 2021; Hassin & Abbood,2021).

It serves individuals' verification and identification purpose, as presented in Figure 1 (Khan et al., 2019). The image acquisition is made through a video camera or importing it from a database, and then this image goes further over different phases as shown in Figure 1.
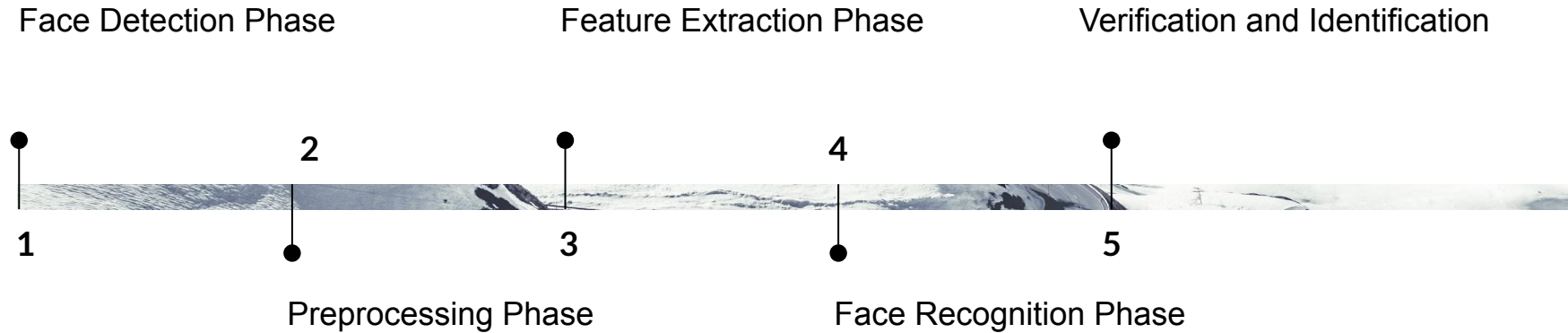
Structure of Face Recognition System

Face Detection Phase

Feature Extraction Phase

Verification and Identification

2

4

1

3

5

Preprocessing Phase

Face Recognition Phase

Figure 1: Structure of Face Recognition system (Khan et al., 2019)

Face Detection Phase

01

Detecting the target face image from a captured image or selected image from the DB is considered as the core function of this phase. Actually, the main purpose of the face detection process is to make sure and verify whether a given image has a face image region or not. When finish segmenting and detecting the target face area or region of concern, this output will be delivered into the preprocessing phase for further progressions

Preprocessing Phase

02

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 (Al-Hatmi & Yousif, 2017; Hasoon, 2011).

Preprocessing Phase

02

Through preprocessing 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 (Saudagare & Chaudhari, 2012) as shown in Figure 2.
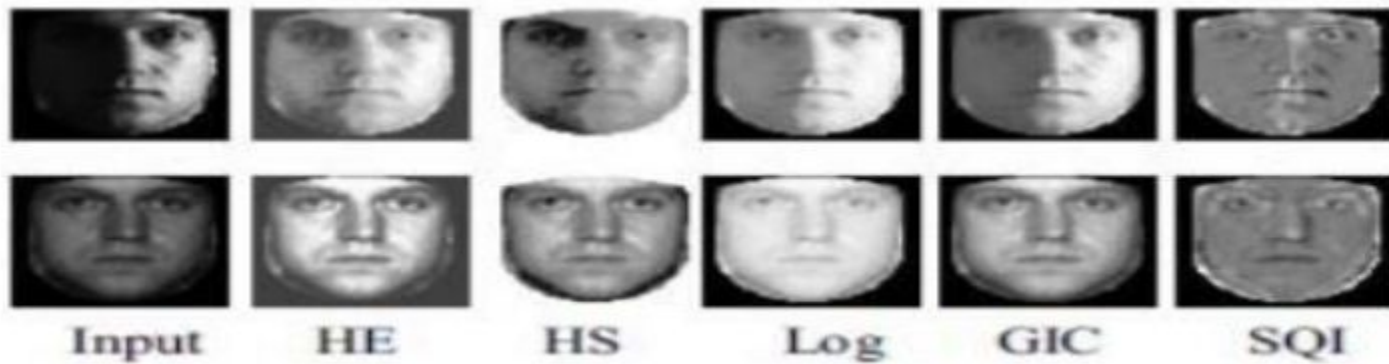
Preprocessing Phase

02

Figure 2: Typical Preprocessing Method (Zaho et al., 2003)

Feature Extraction Phase

03

This stage will receive the detected face image region as an input. Through using feature extraction algorithms,all face characteristics will be extracted effectively from the face region such as the distances among eye, lip, and no sefeatures (Saudagare & Chaudhari, 2012).

Feature Extraction Phase

03

The main purposes of feature extraction process are to perform specific functionalities including packing of information, cleaning of noise, and do salience extractions. After that, the obtained information is transferred into a vector for the subsequent process and use like comparison of obtained feature with stored data (Bhele & Mankar, 2012).

Face Recognition Phase

04

 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 each individual several images should be taken and then extracted features stored in this dedicated DB (Bhele & Mankar, 2012).
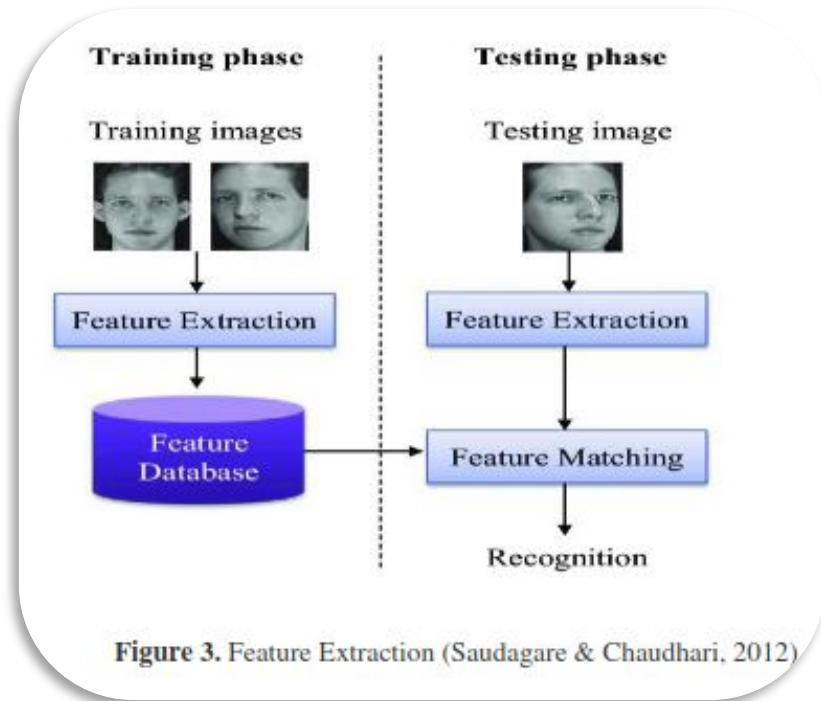
Face Recognition Phase

04

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 (Raheja & Kumar U, 2010).

Face Recognition Phase

04

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

Face Recognition Phase

04

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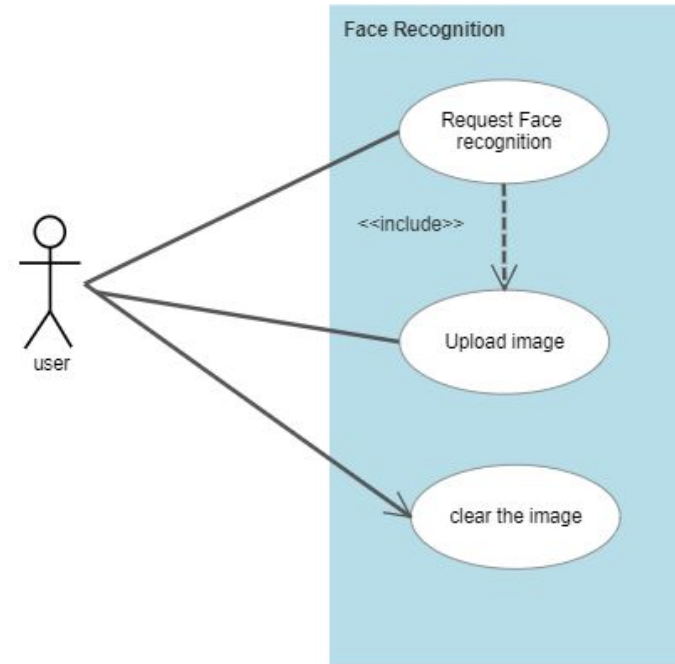
finally we got insights by plotting the confusion matrix of the model to see the performance of the model after applying all the testing images.
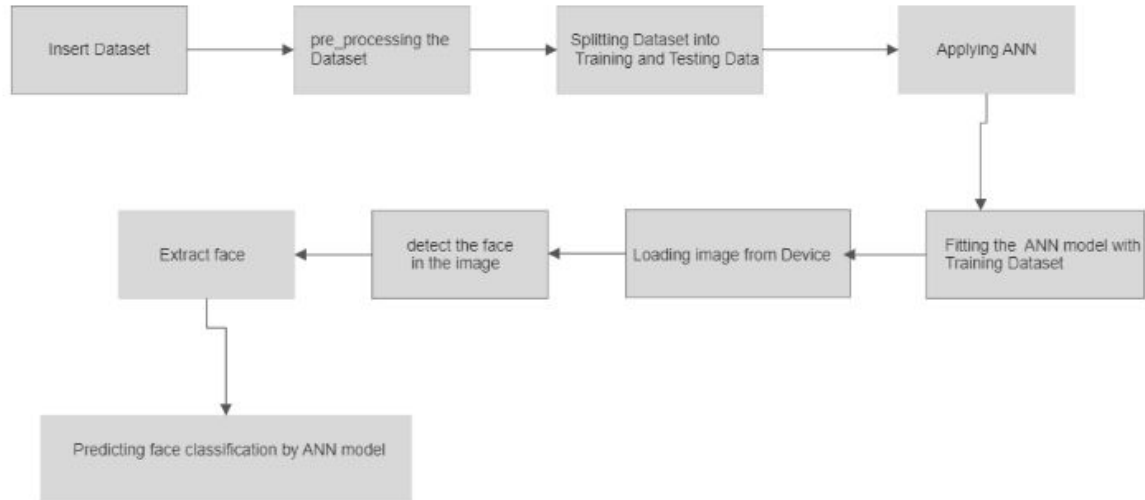
Main functionalities

Use case

Face Recognition

Request Face recognition

<<include>>

Upload image

clear the image

user

Applied Algorithms by block diagram
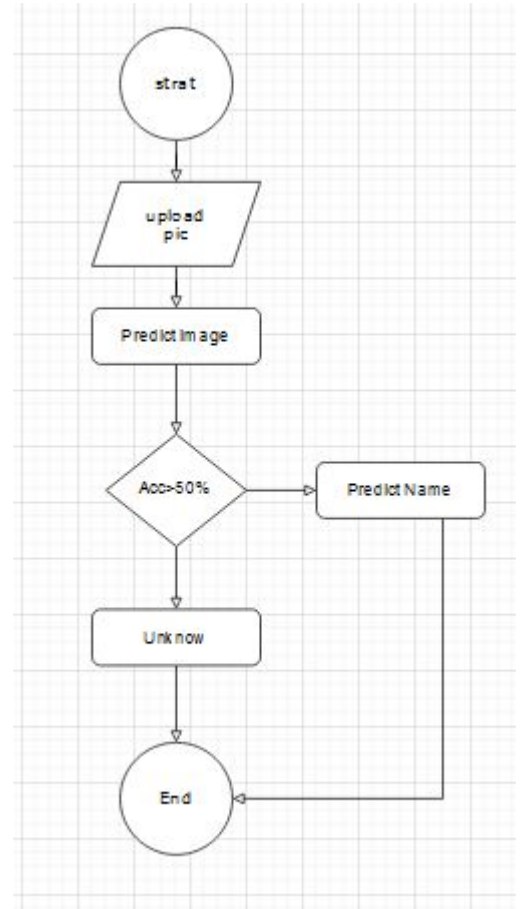
Flowchart

The Dataset employed

The Dataset employed

The dataset consists of 4 classes :Adriana Lima
                                     Alex Lawther
                                     Bill Gates
                                     Rihanna

The link:
https://drive.google.com/drive/folders/1ZTQiK9E
QNKn_6qPH3wTL67dLPBMyTi_N?usp=share_link

ANN   90%

Details of the algorithm

Artificial Neural Network

Artificial Neural Network (ANN) is an information processing paradigm that behaves like biological nervous systems. ANN is a powerful mathematical tool that processes input information to efficiently simulate or predicate the desired output data (Yousif & Sembokb2006a; Yousif & Sembokb2006b).

Many ANN models are adapted in the development of different multi-view face recognition systems because these models have great ability and essential roles to efficiently simulate the methodology of neurons work and structure like in the human brain (Boughrara et al., 2012).

Neural Network

a Neural network (NN) is considered a robust classification methodology that works correctly in non-linear or linear datasets. It had been employed not only for face recognition applications but also in diverse areas such as fingerprint recognition, voice recognition, iris recognition, Natural Language processing, etc. (Yousif & Sembokb2005; Yousif & Fekihal 2012).

he effectiveness of NN and its increased use could be due to its ability to work in a non-linear network (Boughrara et al., 2012).

Therefore, the feature extraction phase of face characteristics through using NN is more effective and efficient than using the linear karhun nen-loeve technique (Lawrence et al., 1997).

Neural Network

The first ANN technique utilized for face recognition is a single-layer adaptive network known as "WISARD" (Stonham et al., 1986).

The WISARD comprises a distinct network for each stored person. Constructing the NN structure is critical for making a successful face recognition system, and the model that should be applied depends on the intended application objectives (Stonham et al., 1986).

Commonly, Convolutional Neural Network (CNN), as well as Multi-layers Perception (MLP) structure, have been employed for the aim of face detection (Sung & Poggio,1995).

On the other hand, the Multi-Resolution Pyramid structure has been applied efficiently for face verification purposes.

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Development platform

Tools: Anaconda, Jupiter Notebook.

Programming Languages: Python.

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

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Thank you.