AI DEPLOYMENT IN FACE DETECTION AND FACE RECOGNITION MODEL BY IMPLEMENTING COMPUTER VISION

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AI DEPLOYMENT IN FACE DETECTION AND FACE RECOGNITION MODEL BY IMPLEMENTING COMPUTER VISION

By

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ABSTRACT

As we all know, many more computer technologies are becoming popular for discrete applications these days, but identity verification for biometrics and security purposes is critical in industrial systems, banking systems, educational systems, and mobile systems, among other places. On that scenario identifying and recognizing the facial features is a basic requirement for authentication to reduce the embezzlement in above mentioned systems. Face detection is one of the computer technology and psychological process implemented to examine the human faces in digital images, however in face recognition system information of human face captured by camera or video frames is compared with the datasets of images. For considered system, 15 different datasets are taken for this training model to recognize the faces of different individuals. Till now lot of researches has been done on facial detection but some limitations like accuracy, real time face detection exists. This algorithm has more speed and accuracy to identify images with respect to feature extraction like nose, eyes and mouth of human being that varies from person to person. The proposed algorithm uses AI to match above unique features of individuals with databases of faces and find the name of that individual. It is used to authenticate clients via ID verification systems for preventing crime, unlocking devices, providing blind assistance, biometric systems, and payments, etc.

Keywords: Face Detection, Recognition, AI, Feature Extraction, ID Verification.

INTRODUCTION

Biometrics is the measurement of a person's physical attributes for the purpose of verifying their identity. It encompasses physiological traits like thumb prints and eye retina, as well as facial recognition, security, and authentication. The proposed system works without any human support and hardware. The most important aspect of this concept is the use of computer vision to detect and identify visual frames. In image processing, an image is processed and a transformation is applied to it in order to obtain the final image. In contrast, computer vision is a branch of artificial intelligence that instructs computers to illuminate and assess visual studios using various image processing methods. The model presented here uses different classifiers, libraries to identify face from image databases. The model's procedure is to first initialise the computer or mobile phone's camera, read images, convert them to grey scale for ease detection, then transmit the frame to the algorithm, load it into the model, and finally identify the frame with its Id and accuracy. Face detection algorithm analyses the position of images, the size and shape of eyes, nose, and mouth of frontal face photographs, and extracts features. Categorization for face detection algorithms is described by Sun et al. (2014). The methods of face detection is shown in Figure 1.

Knowledge based method follows the set of rules and also human knowledge to discover the faces. Template Matching method uses pre-determined face layouts to locate or detect the faces by the relationship between the face layouts and input images. The feature-based method detects faces by extracting structural features of the face for which the classifier is trained initially. The appearance-

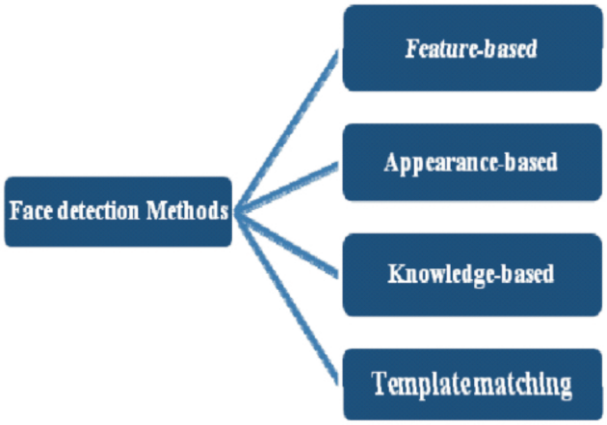

Figure 1. Methods for Face Detection

based method hang on a set of representative training facial images to search face models. This approach is effective than other methods. Statistical analysis and machine learning type techniques are implemented in appearance based method to observe appropriate attributes of images. Appearance based approach is further divided into Eigen face-Based, Distribution-Based, Neural-Networks, Support Vector, Machine Sparse Network of Winnows, Naive Bayes Classifiers, Hidden Markov Model and many more algorithms are used for face detection, emotion detection, object detection.

1. Literature Review

Many researchers did the research on face detection by applying various techniques. Jones and Viola (2003), and Viola and Jones (2004) describes the system which utilized the Adaboost algorithm to achieve high detection rate for processing the images. Mita et al. (2005), and Talele et al. (2012) proposed the face detection system based on a new feature that is Joint Haar like feature by applying Adaboost algorithm to acquire efficiency and accuracy. Chi et al. (2019) used Selective Refinement Network (SRN) in face detection to obtain high performance. Pham and Cham (2007) suggested the fast training and Haar feature based system which employed statistics of input data to minimize the training time.

2. Proposed Work

The flow diagram or methodology is shown in Figure 2.

2.1 Haar Cascade Frontal Face Algorithm

Haar cascade classifier has the following classifiers like haarcascade_eye and haarcascade_frontalface_default as explained in Figure 3. For instructing the classifier, algorithm needs a number of image frames.

- This algorithm is Haar Wavelet technique based and used to examine pixels in the image frame into squares by the function.
- Machine learning techniques are applied for haar algorithm to achieve high degree accuracy from training database.
- "Integral image" is a concept to compute the characteristics detection.
- Haar uses the Adaboost learning algorithm that picks out a small number of important attributes from a huge set to get an effectual result of classifiers.
- The algorithm uses function like detect MultiScale used to identify the frame which have to be detected and returns the value by means of rectangle with its coordinates like x, y, height and width.

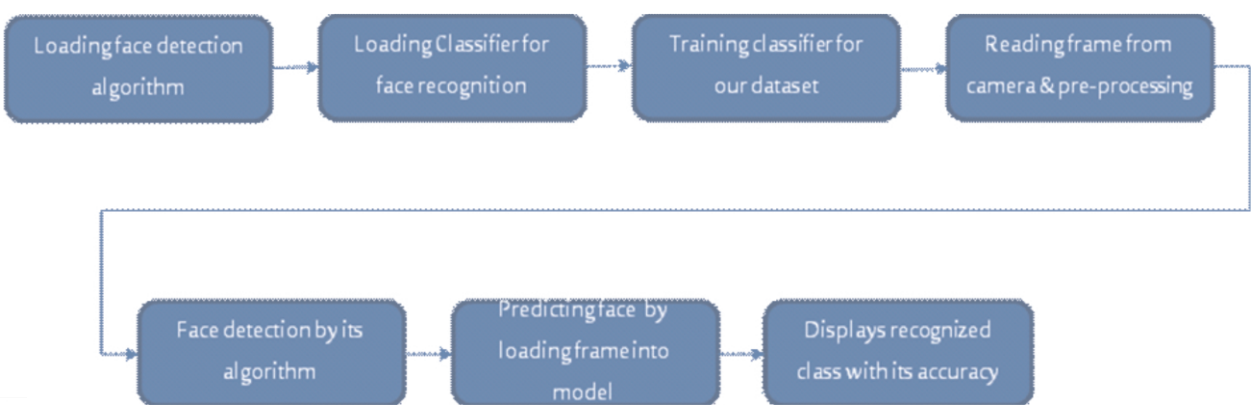

Figure 2. Workflow for Face Detection and Face Recognition Model

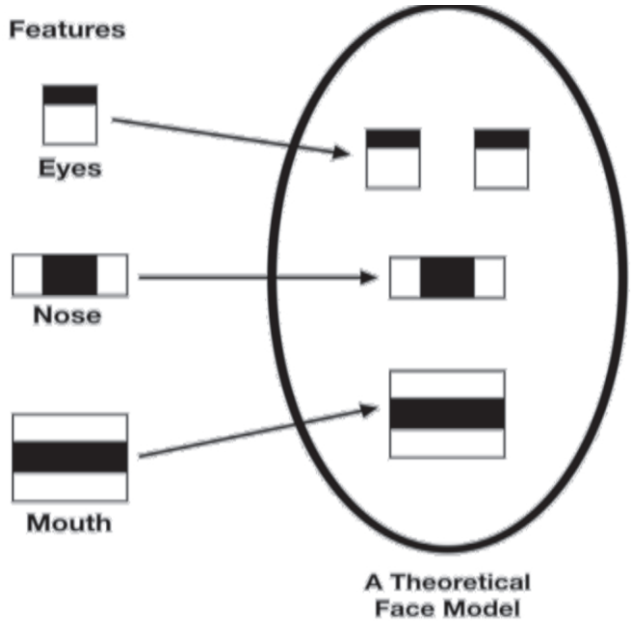

Figure 3. Face Model

- faces=face_cascade.detect MultiScale (src, scale factor, minNeighbors)
- faces = face_cascade.detect MultiScale (gray, 1.3, 4)
- scale Factor-reduces image size depending on requirement at each image scale.
- min Neighbors-number of neighborhood rectangles for each candidate should have to return.

2.2 Open CV

Open CV has been invented at Intel in 1999 by Gary Bradsky and supports wide varieties of programming languages such as C++, JAVA, Python, etc., accessible on various podiums as Windows, Linux, Android, etc. Open CV is a library of programming functions trained for real-time computer vision, machine learning and image processing. With this library images as well as videos are processed to detect objects, human faces. If it merged with different libraries like Numpy (Numerical Python) which is a library for the Python programming language and highly advanced library for numerical operations, multi-dimensional arrays and matrices including high-level mathematical functions performs the operation on these arrays. Besides that other libraries also imports to algorithm like scipy, imutils, mahotasetc for face identification and verification.

2.3 LBPH Face Recognizer

- Local Binary Pattern Histogram (LBPH) is an easy algorithm used for face detection task as in Figure 4. It is a very effective texture operator which tag the pixels of an image by thresholding the neighborhood of each picture element and the result becomes a binary number.
- To train the algorithm, large dataset with facial images are needed and set ID refers to any number or name for every image, after which the algorithm recognizes input image and output displays.
- LBPH consists of four parameters:
- Radius - to build the circular local binary pattern, defines the radius about the central pixel. It is set to 1.
- Neighbors - it is basically set to 8.
- X Grid - the cells in the horizontal direction.
- Y Grid - the cells in the vertical direction.

3. Methodology

Human brain identifies different faces everyday effortlessly and easily however for computer this is a very complex task as it has more variables. So in computer, recognition of individual is performed based on its digital image using various algorithms, libraries and identifies etc. Artificial intelligence and machine learning technologies are implemented to do such type of task, so AI plays a very significant role in face detection and recognition using image frames. Face detection and face recognition

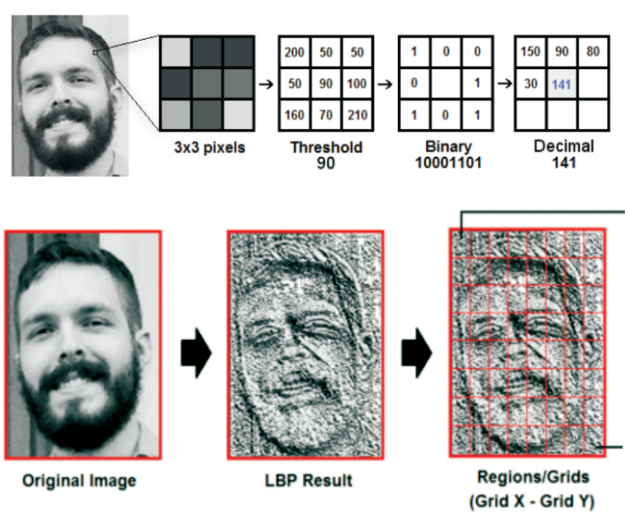

Figure 4. LBPH Algorithm

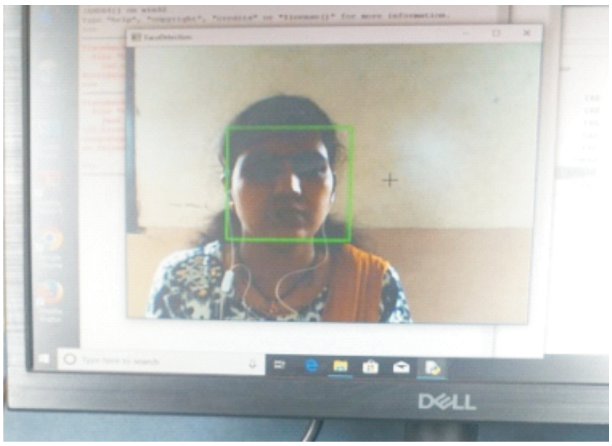

Figure 5. Face Detection

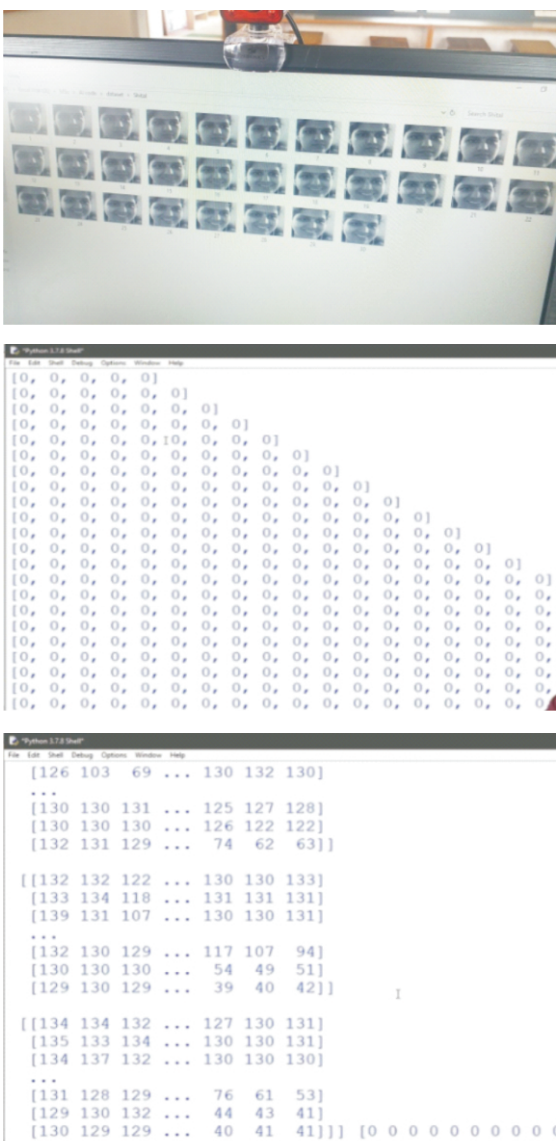

Figure 6. Data Bases

differs from each other. Face detection is to find human face in the images and extract them as in Figure 5, and face recognition means images are cropped, resized and converted into grayscale images, and algorithms are used to find features describing images. In this model, first initialize the camera used for getting images, images are then resized and and converted into grayscale. Aside from that, a face detection technique such as the Haar algorithm, as well as a face recognition classifier, are to be loaded as the database in Figure 6. The grey scale image is split into 3 x 3 pixels and described as a 3 x 3 matrix using the LBPH algorithm. The centre value of the matrix is utilised as a threshold and is used to transform into its binary value for neighbours. Concatenate each binary value into a decimal number and use it as the matrix's central value. Finally, a new image is created that displays the features of the original image, which is then divided into several grid lines, resulting in a histogram with 0 to 255 positions. After comparing input image to the training dataset or histogram the algorithm returns the image with closest histogram and we find final match.

Conclusion

The proposed model is efficient and is able to detect and recognize the human face as well as blurr image in real time using computer vision based on unique features like eyes, nose, mouth which are different from person to person with 90% to 95% accuracy. It requires large dataset of facial images and detects frontal face. The accuracy of model depends upon the as the number of images increases, the accuracy also increases. This model is deployed where biometrics are needed such as security system, attendance systems, ID verification systems etc.

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