Real Time Face Recognition using Effective Supervised Machine Learning Algorithms

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Abstract: In security authentication systems, face recognition has become an emerging new trend. Modern FR processes can detect whether the individual is real (live) or not through face recognition, thus preventing the systems from being compromised by displaying an actual person's image. These new systems of face recognition are the result of recent advances in the field of computer vision and efficient algorithms for machine learning. This thesis describes in depth how the identification of a real time face can be order to create a safety alert framework for the workplace, the machine learning algorithm Haar cascade classifier was used to build four distinct classes for identification of security equipment and eventually identify the faces in both images and video using python open CV. Initially, face detection technique is performed to scan the face identity marks through.

Keywords: Algorithm for Supervised Machine Learning, Haar-cascade, python.

1. Introduction

Face detection is the initial and important of face recognition. In face recognition process, after detection of face or image, the basic question that arises is to “whom this face or image belong”. The facial recognition process solves this question by evaluating through four stages like 1.detection 2.feature extraction 3.tracking and 4.recognition. Face detection of pictures is usually complicated because of the features present in human faces like position, orientation, expression and skin color etc [10][11]. The reconstruction of original data to a set of data with less number of variables and consists much preferable information is known as feature extraction. [12]. Face tracking technology tracks and detects the presence of human face in a digital image and video frame. This technology can also be incorporated into visualized communication devices and robotics [13].

2. Literature survey

As a rule, a great deal of consideration for specialists has increased in the field of face recognition. The legal observation is required to establish a facial quality, a visual resemblance of the face of a casualty, as the wrongdoing expands step by step. Numerous experts use various techniques. Continuous face exploration is still a boring undertaking and a respectable framework show is achieved. We are speaking about two models of facial recognition.

The continuous face district was identified by recommending the rectangular element based classifier and the hearty identification calculation that fulfilled the effectiveness of calculation and location execution was proposed. By utilizing the recognized face area as an acknowledgment input picture, in this paper the face acknowledgment strategy joined with PCA and the multi-layer network which is one of the
shrewd grouping was proposed and its exhibition was assessed. As a preprocessing calculation of info face picture, this technique registers the eigen face through PCA and communicates the preparation pictures with it as a basic vector. Each picture takes the arrangement of loads for the principal vector as an element vector and it diminishes the element of picture simultaneously, and afterward the face acknowledgment is performed by contributing the multi-layer neural organization.

[9] First, customary strategy and second, customary strategy Execution and location were suggested. In this paper, the face recognition strategy combined with PCA and the multilayer network, which is one of the shrewd groupings, was proposed by using the recognized face area as an acknowledgement input image and its exhibition was evaluated. This technique registers the own face via PCA as a preprocessing measurement of the info face image, and communicates the preparation images with it as a simple vector. The arrangement of the load is taken in each image.

3. Face Recognition Process:
To identify an individual’s face from a still image with a given image database of face images or from video frames. Face discloses a lot of information about the user and is often more sensitive to changes in the environment. Many experiments have been wiped out of the field of face recognition, but the accuracy rate is smaller compared to other person biometric details such as fingerprints, expression, eyes, palm geometry, retina etc.

![Figure 1: Face Recognition Process](image)

4. K-Nearest Neighbors

One of the basic classification algorithms in machine learning is known to be the k-NN algorithm. In machine learning, the k-NN algorithm is considered a well monitored type of learning. It is commonly used in the sorting of related elements in searching apps. By constructing a vector representation of objects and then measuring them using appropriate distance metrics, the similarities between the items are determined.

4.1 How KNN Algorithm works

It is a very simple algorithm and requires N training vectors. kNN indicates the nearest neighbours of k. The kNN algorithm recognises the nearest k neighbours of 'c' if a bidimensional space is selected and all 'a' and 'o' letters are placed as training vectors. Here 'c' is one more vector of characteristics for which the class is calculated. In this case, the closest neighbours that are oblivious to the marks are remembered here. If we have a sample in which k is equal to 3, for instance, and there are two groups.
4.2. kNN Algorithm

1. Loading the Data
2. Make K initialize
3. In the training data for each sample
   3.1. Calculate the distance between the point of the question and the present point.
   3.2. Add the example distance and index to the ordered set.
4. Sort -> ordered distance set and indexes from small to large
5. Select the first K entries from the classified list
6. Obtain the labels of the K entries picked
7. If regression returns --> mean of K labels
8. If classification --> mode of return of K labels

5. How Face Recognition Works

The machine learning algorithm requires a dataset as an input and learns from it. The algorithm transfers the information and recognises patterns of data. For instance, we can look at several things as a pattern if we want to recognise whose face is in the picture.

- Head height and width
- Height and width might not be correct as it is possible to resize the image to a closer face.
- The face height to width ratio will not change even after resizing, however.
- Colour of skin
- Other facial features, such as lips, nose etc.

6. OpenCV with Face Recognition

OpenCV coding is now simpler than ever for facial recognition. It requires only three basic steps that are close to the steps that our brain uses for the process of face recognition.

The three measures are comprised of:

**Gathering of data:** The face data (face image) of the individuals to be identified should initially be obtained.

**Recognizer training:** In the second step, the respective names of every face and the face data are fed to the recognizer.

**Recognition:** In the third stage the new faces of these individuals are fed and observed whether or not the trained face recognizer recognizes them.
6.1. Elbow for classifier:
The Elbow curve is created to train the Knn module for different N-neighbor values and finally pick a value that gives us an error. In order to define the function to construct the Elbow curve, an empty list of all test errors is created. Which saves the error value for each k value that is needed.

6.2. KNN Regression:
In order to import the minimum and maximum scales, we first import the data and segregate variables such as independent and dependent variables. All the values between the 0 and 1 range are in this Scales. We then import the split train test and get random state values. The implementation of Knn regresses and measurements generates default neighbour values.
7. KNN Results

Figure 6: KNN Results of without and with scale data

8. Haar Cascade classifier:
This is a technique focused on machine learning, during which a course work is prepared from a broad measure of positive and negative images. It's normal to identify issues in various images. It's a pretrained facial data model and it's popular to identify faces. It was Rainer Leinhart who built it. To detect whether or not a given object might be a face, it uses adaboost. It focuses primarily on the most important characteristics, such as skin, eyes, nose and lips, etc.

i) Line Features
ii) Edge Features
iii) Four Rectangular Features

Figure 7: Haar features

8.1. Face identification: Initially, to coordinate the classifier, the measurement includes a significant measure of positives (images of appearances) and negatives (images without faces). Later on the highlights are far from here. For this, hair highlights that appear in the image below are used. They're a lot like the Convolution piece. By subtracting total pixels under the white square shape from total pixels under the dark square shape, each part can be a single estimate acquired. The Small Squares and the R.

Figure 8: Finding features in face and eyes
8.2. HaarCascade working in Opencv:
In addition to detection, OpenCV comes with a teacher. OpenCV is also used only in case we want to teach our own classifier for any object such as vehicles, planes, etc. In Cascade Classifier coaching, all the necessary details are given. Detection here is well done. There are many pre-trained classifiers for face, eyes, smiles, etc. in OpenCV. In the opencv/data/haarcascades/ folder, XML files are kept. In order to carry out an OpenCV face and eye detector, we first have to load the XML classifiers.

9. Conclusion
Different face recognition procedures are getting used in security authentication systems to detect faces of persons. Most of the face recognition procedures work by concentrating on the various nodal focuses on a person's face. Using these procedures and by applying various algorithms like KNN algorithm and openCV, we will use the knowledge obtained from appearances and can rapidly recognize target person. face recognition procedures are rapidly advancing using new methodologies like 3-D displaying surpassing existing procedures.

9.1. Advantages and limitation
Facial recognition has numerous advantages in the public arena, including expanding wellbeing and security, forestalling wrongdoings, and diminishing human cooperation. It can even assistance support clinical endeavors, now and again. Entrepreneurs utilize facial recognition programming and surveillance cameras to distinguish referred to or suspected cheats as they enter their stores. Facial recognition has been an ordinary piece of Airport security evaluating for a long time, recognizing crooks and possible dangers to carriers and travelers. Facial acknowledgment can likewise tag photographs in your distributed storage through Apple or Google. This makes it simpler to sort out, find and offer your photographs. One astounding utilization of facial recognition innovation is the identification of hereditary problems.

Similarly as with any innovation, there are possible downsides to utilizing FR, like dangers to protection, infringement of rights and individual flexibilities, potential information robbery and different violations. There's additionally the danger of blunders because of imperfections in the innovation.

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