Section A-Research paper
ISSN 2063-5346

BASELINE ANALYSIS OF DATA FOR FACIAL RECOGNITION

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DOI: 10.48047/ecb/2023.12.si4.1533

Abstract:

In computer vision and deep learning, face detection and recognition are developing and active research fields. A statistical method called PCA is used to lower the number of variables in face recognition. Each image in the training set is represented by a linear combination of eigenfaces, which are weighted eigenvectors, in PCA. These eigenvectors are derived from a training image set's covariance matrix. After choosing a group of the most pertinent eigenfaces, the weights are determined. The first step in recognition is to project a test picture onto the region of space covered by the eigenfaces, and the second step in classification is to calculate the minimum Euclidean distance. A number of experiments were done to evaluate the performance of the face recognition system. This study compares and analyses the accuracy reported by two independent datasets.

Keywords: Computer Vision, Face Detection, Face Recognition, Principal Component Analysis.

INTRODUCTION

One of the most exciting areas in computer vision is face recognition. Face recognition software automatically recognizes faces and verifies individuals from photos. In daily life, face recognition plays a significant role. Face recognition is frequently utilized to automatically and reliably authenticate a person for a variety of applications, including passport checking, ATM, credit card, voter verification, smart doors, criminal or terrorist investigations, and many more. The purpose of this research work is to investigate, create, and test an accurate MATLAB

ISSN 2063-5346

program for facial recognition using principal component analysis on two standard datasets. This method is recommended because it is easy to learn, quick, and effective. Security and surveillance involve several crucial factors, including the detection and recognition of human faces. Face recognition technology can evaluate human faces in an image against the database of faces that has been saved. The model takes the input image and extracts the facial traits. These strategies are used in both the public and private sectors, the applications are:

1) law enforcement 2) Healthcare 3) Retail and banking[1]. Facial biometrics is one of the main uses for face recognition. Due to its quickness, it is the most favored biometric benchmark. Without human interaction, deployment and implementation are similarly simple. It is a technique for validating and approving the extraction of a person's identity based on their extracted face features [2]. Using a person's face features as a starting point, it records, analyses, and matches patterns. The steps involved in the process are: 1) Detecting the face in the image 2) Extracting facial features 3) comparing the database with the face that was detected.

The human face is a complex, multidimensional structure that can communicate a lot of information about the person, including facial characteristics, expression, and feelings. Analyzing facial information characteristics effectively and efficiently. This study examines the accuracy of face identification [6]. The purpose of this study is to evaluate the accuracy of datasets. The algorithm is tested using two separate data sets in order to compare the test's dependability. We can identify the top data sets by comparing test results and ranking the data sets in accordance with those results [7]. Even though there have been many advances made in the design of face recognition algorithms and systems, some significant problems with these algorithms and systems need to be significantly reduced or addressed for facial recognition accuracy to match that of humans[8]. The key obstacles for effective face detection and recognition systems are lighting conditions, scale, occlusion, stance, background, expression etc [9].

The major goal of our research is to calculate the accuracy of facial recognition algorithm on two standard datasets. Face pictures from Datasets 1 and 2 will be used. Dataset 1 is AT & T face database. There are 400 photos in total of 40 individuals (10 images for each).Dataset2 is

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YALE face database.Dataset1 is a collection of face images from the AT & T database that have undergone image processing to identify individual faces, which will be fed into the face recognition system[4].PCA algorithm will then be used to compare the improved input photos with the improved training im- ages in order to recognize faces.

II. PROCESS OF FACE RECOGNITION

The so-called eigenface approach is one of the simplest and most efficient PCA methods used in face recognition systems. With this method, faces are reduced to a handful of fundamental traits called eigenfaces, which make up the majority of the first collection of training photos. The process of recognition begins by projecting a fresh image into the eigenface subspace. Next, the subject is categorized by contrasting the image's location in the eigenface space with that of known subjects. This method has an advantage over other facial recognition systems since it is straightforward, quick, and insensitive to subtle or gradual changes in the face. The issue only affects files that can be used to identify faces. In particular, human faces must be shown in vertical frontal views in the photographs. There are two steps in the recognition process overall: Initialization procedure, first Process of Recognition. The following operations are part of the initialization process: i. Obtain the initial training set, or collection, of face photographs. ii. Only keep the highest eigenvalues when calculating the Eigenfaces from the training set. The face space is defined by these M pictures. The eigenfaces may be revised or updated as new faces are encountered. iii. Calculate each known person's distribution in this M-dimensional space by superimposing the person's face pictures onto this face-space. One of the earliest functional facial recognition methods is the Eigenfaces method[10]. Principal Component Analysis (PCA) serves as its foundation [3]. Despite the Eigenfaces technique's ubiquity, simplicity, and capacity to deliver outstanding results under controlled circumstances, it has a number of drawbacks as detailed in references [11–12] due to differences in illumination, angle, occlusions, and distance. We choose to use the AT&T database (AT&T Labs Cambridge) for this study [13]. This database, which serves as a representation of the training database, is accessible and has 400 faces in it. There are ten images for each subject to be used in training .

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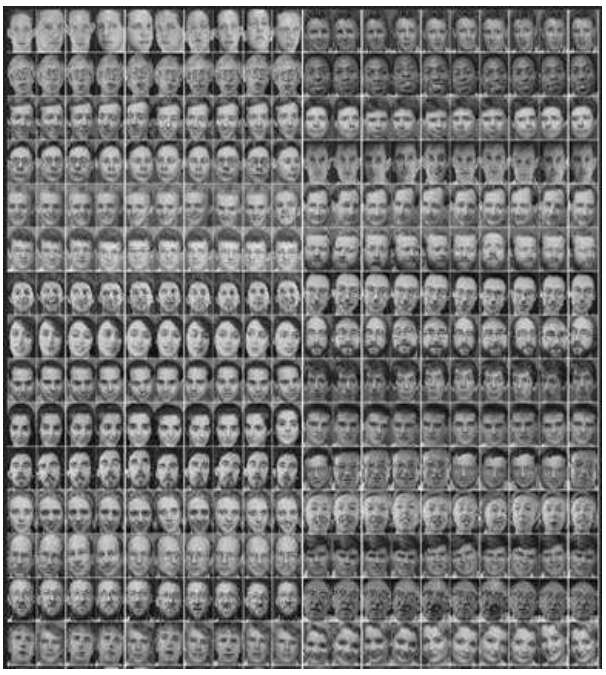

Figure 1. Sample pictures of dataset1

EIGENFACE ALGORITHM

Subsequently, the following algorithm is applied to the photos using the Eigenfaces method:
Step 1: Gather headshots (training images). The size N*N of the facial photos must match.
Step 2: Convert RGB color-space training images into grayscale.
Step 3: Create a set of vectors of $N^2$1 dimensions for each image of a face.
Step 4: Look for a typical face.
Step 5: Remove the typical face from each face in the practise pictures.
Step 6: Calculate the covariance matrix for C.
Step 7: Identify the covariance matrix C's eigenvalues and eigenvectors.
Step 8: Determine the K best eigenvectors and compute the eigenfaces.
Step 9: Calculate the "Weight Vectors."
Step10: Use a straightforward Euclidean distance calculation to compare any two weight vectors.

When the minimum distance falls below a specified threshold, a face is categorized as "known."

If not, the face is labeled as "unknown"[5] .

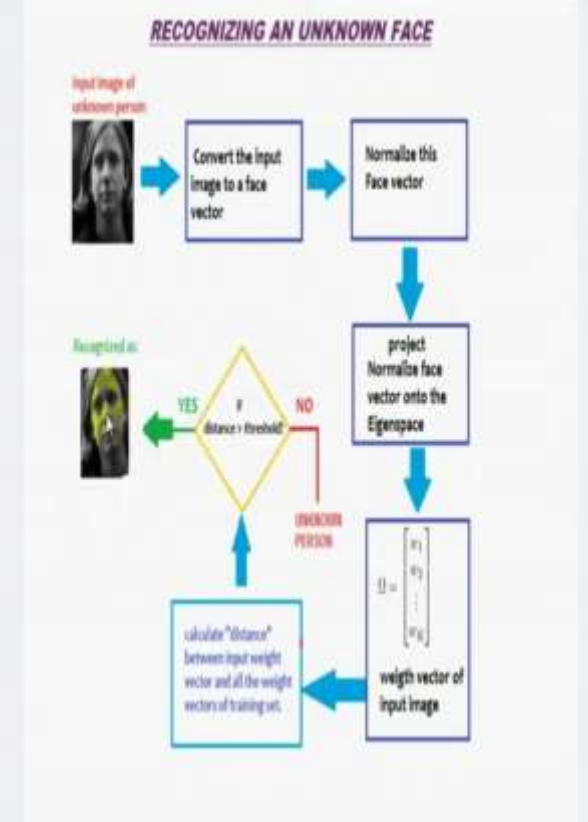

Figure 2. Face Recognition

TRAINING SAMPLE PROJECTION INTO EIGENFACE SPACE

The training sample must then be projected onto the Eigenface space. Using a common formula, the feature weight for the training photos is determined .

TESTING SAMPLE CLASSIFICATIONS

a) Analyze the test image and remove the face .

b) Determine the test face's feature vector. The eigenface components of the test image are broken down. First, we multiply the difference between the line in our input image and themean image with each of the eigenvectors [14]. Each value on the vector would stand in for a weight. Where K is the ith Eigenface and i=1, 2, 3, etc .

c) Determine the average (Euclidean) distance between each training feature vector and the test feature vector. Finding the smallest Euclidean distance between a testing location and a training point given in the following equation is the mathematical definition of recognition. In this case, i = 1, 2, 3,..... K. Thus, the similarity between the matching images can be gauged by the Euclidean distance between two weight vectors.

d) The face class that has the shortest Euclidian distance resembles the test image .

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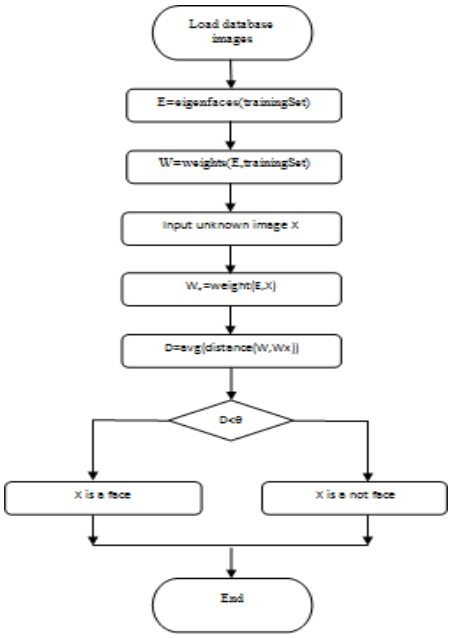

Figure 3. Flowchart of Eigenfaces method

VI. Experiments and Analysis

The proposed method is tested on most popular dataset of faces AT & T dataset and another set of images is YALE face images. In this section, we analyzed and validated our methodology, which is based on Eigenfaces facial recognition method, using face images from two datasets. We tested and validated the proposed approach. The results obtained are quite encouraging and support the efficacy and effectiveness of our approach. Take Test image apply preprocessing techniques mentioned above and then its eigen vector and compare eigonvalues with all images from training dataset eigen values array face will be recognized if maximum of eigen values are similar to eigen values of training dataset. In this project, we have total 400 images of 40 people (10 of each person) so that are already preprocessed. So, 8 images out of 10 of each person are used to train and calculate the eigenfaces. And remaining 2 images are used for test purpose. Experiment gives false results if test subject is not included in training data or face is blur or not clear in given picture as it calculates maximum similar eigon values. The dataset2 is YALE dataset face images .

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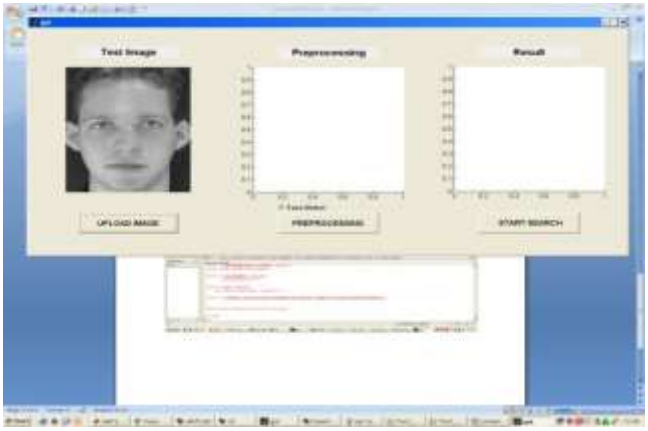

Figure 4: Load test image

Figure 5: Image Preprocessing

Figure 6: Face recognition

VII. CONCLUSIONS

In this paper, average recognition rates given by different datasets are compared and analyzed. Experiment compares the recognition rates of Datasets 1 and 2. In this paper, we have proposed an approach allowing us to continue to use some facial recognition

techniques. Our method entails doing preliminary processing on an image. The suggested technique involves first testing on images of faces from the dataset1 and dataset2 after that comparing the accuracy of both datasets. Accuracy of dataset1, will be compared to dataset2 after calculating the accuracy, the dataset utilized for the tests, which provides about 90%.

Face database	No. of subjects	No. of images	No. of images used for testing	Accuracy rate
AT & T	40	400	80	90%

Figure 6: Result of face recognition

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