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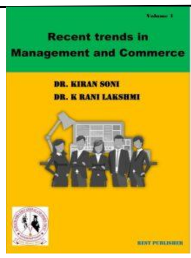

Eigen face Detection and Criminal Identification System Using Artificial Neural Network

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Abstract: Identifying and authenticating a criminal is a time-consuming and challenging task. According to a survey by the National Crime Archives, 80% of repeat offenders commit the same crimes over and over again. Criminals are becoming smarter than leaving any biological evidence or fingerprints at crime scenes. A face is a complex Multidimensional scene modeling and face recognition creating a computational model is difficult. Face image coding and of an information theory approach to coding the paper basically provides a face recognition algorithm. The face is a unique and important feature of the structure of the human body that identifies a person. This facial recognition can be used to identify criminals from a picture or video frame by cameras mounted in many areas. As a result, it can be used to trace the identity of a criminal. Face recognition uses biometrics to map a person's facial features statistically and save the information as a face print. Every face is given a distinctive shape, which It compares to other photos in the collection. If a match is found with the input face, Information related to the corresponding image will be shown. This strategy will lessen crime and safeguard public safety. For the test batch, nearly all recognition scores were calculated taking feature extraction into account. The model's overall Cronbach's Alpha rating is 0.616, which denotes a 61% reliability level.

Keywords: SPSS, Frequency for Recognition Rate Result 1 to Recognition Rate Result3

Introduction

Human identity depends on the face. It is the trait that most clearly identifies a person. Face detection has a substantial impact on numerous industries, including identity verification for banking and security system access, law enforcement identification, and personal identity, among others. It is an intriguing and difficult topic. Humans find face detection to be a simple process, while computers have a quite different challenge. Very little is known about how the brain processes images in humans, how we analyse them, and whether internal features like eyes, noses, and mouths or external ones like head shapes and hair are more effective for face recognition. Two neurophysiologists, David Hubel and Torsten Wiesel, have shown that our brains have specialized nerve cells that respond to specific local elements of a scene, such as lines, edges, angles, or motion. Our visual cortex must figure out a way to combine multiple sources of information into usable patterns because we don't view the world in isolated parts. Automatic face recognition entails taking those important elements out of an image, representing them in a useful way, and classifying them. The most organic method of identifying people may be facial recognition based on the geometric aspects of the face. The entire procedure may be broken down into three primary parts, with the first step being the discovery of a reliable database of faces that includes numerous photos for each individual. The following step is to find the faces in the database photos and use them to train the face recognizer. The last step is to test the face recognition to see if it can find the faces that have been taught. The following step is to find the faces in the database photos and use them to train the face recognizer. The last step is to test the face recognition to see if it can find the faces that have been taught. Face detection is used widely today, particularly on image-sharing platforms like Face book, Picasa, and Photo bucket. The auto-tagging tool provides sharing photos between those in the photo a new level and also helps others identify the person in the photo. In our project, we researched and put into practise a face detection algorithm that takes into consideration the hue of human skin. Our goal, which we feel we have accomplished, was to create a system that the police or the intelligence division could use to recognise criminals from their faces. The used facial recognition method uses relatively straightforward and simple methods and approaches that are quick, reliable, and accurate. Our goal, which we feel we have accomplished, was to create a system that the police or the intelligence division could use to recognise criminals from their faces. The used facial recognition method uses relatively straightforward and simple methods and approaches that are quick, reliable, and accurate. The primary goal of LBPH is to extract local features from photos. Instead of seeing the entire image as a high-dimensional vector, the concept is to simply express the local features of an object. By comparing each pixel to its surroundings, local binary patterns' fundamental notion is to condense the local structure in a picture. The LBP operator can withstand monotonic changes in grayscale.

Face Detection

To determine a face's precise location or coordinates, the initial stage in face recognition is to identify faces in an image. The cropped face of the image can be used to extract features using depth metric features. Here, we extract facial features using face embeddings. When given a facial image as input, a neural network produces an output vector comprising the face's most noticeable traits. This vector is referred to as a phase embedding in machine learning. A deep neural network produces an output that resembles a face-like vector when it is being trained. After neural network training, the network returns output vectors that are close to each other with similar faces. After facial feature extraction using face embedding, the next step is to identify a new crime face that is not present in our previous crime data. It first calculates an embedding for the image and then compares this embedding with the rest of the image data. If the generated embedding is close or similar to any other embedding, it recognizes the face of the image. Computer technology has made face detection a close and effective system for in-the-moment alterations. evaluates and puts into practise the settings algorithm. The method entails weighing the variance between the mean pictures that are produced by averaging the predetermined faces and the supplied face image. A collection of face photos used to calculate the average face is called a training set. For weighted face detection, the weight difference between the set of eigenvectors and the linear projection of the picture in the low-dimensional image space is calculated. Criminal facial identification uses face recognition technology to extract a face from a video or image. To learn more about the criminal, the database is searched using the face. The initial stage in face detection is to register a new offender because the ID, name, age, state, and offence committed are all stored in the database. processing features to be extracted and pre-processing photos to increase face recognition rate. The facial image has been reduced in size and cropped. The histogram produced by images containing disruptions is incorrect, which makes it challenging to train the model. Extraction of Features This process determines how well the overall system functions. Different MTCNN classifiers are used to extract various facial features. This step's grayscale images are utilised to train the model and find the offender. Compare the generated image to the images already present in the corresponding data base. Return the database information related to the image if a match is discovered; else, the authorised person is not at fault.There are two fundamental approaches to facial recognition. The first approach uses deformable templates and intricate math to extract feature vectors from the basic facial features, including the eyes, nose, mouth, and chin. The crucial data from the fundamental components of the face is then gathered and transformed into a feature vector. In order to extract the edges of face photos, Yulli and Cohen used decomposable templates. A different approach is based on ideas from information theory. Method of principal components analysis. This method uses the entire face image to extract the details that best describe a face. Kirby and Sirovich have demonstrated that any specific face may be represented in terms of a collection of ideal coordinates called "eigenfaces," which is based on the Karhunen-Love expansion in pattern recognition. These are the mean covariance of the group of faces' eigenfunctions. Later, Turk and Pentland introduced an eigenface-based face recognition technique. An unsupervised pattern recognition method that is independent of excessive geometry and computing is suggested in this work. Implemented is a recognition system based on eigenface, PCA, and ANN. In order to extract the most useful information from a face image, principal component analysis for face recognition uses an information theory method. Additionally, classification was done using artificial neural networks. The ability of neural networks to "learn" from seen data is why this term is used. Entries in the face library are normalised. The training set is used to calculate and store eigenfaces. A linear combination of eigenfaces can be used to accurately represent a single face. Only the best M eigenfaces, which have the biggest eigenvalues, can be used to approximate a face. Within a collection of face photos, it has the most variations. The "face space" of all possible images is an M-dimensional subspace that contains the ideal M eigenfaces. The calculation was done using the eigenphase PCA technique. Image preparation techniques include grayscale conversion, histogram equalisation, and image size normalisation. In order to enhance face recognition performance, this module automatically lowers each face image to X*Y pixels (depending on user request) and can spread the intensity (histogram equalisation) of face images. The face library on the computer houses pictures of faces. This face library is used for every operation, including creating training sets and eigenfaces. The face library is then split into two sets: the training dataset, which contains 60% of the total number of photos, and the testing dataset, which contains the remaining 40%. Every user in the database is subjected to an ANN, which uses facial expressions as training data. Facial descriptors pertaining to the same person are utilised as positive examples for the individual's network during the training of ANNs, and other facial descriptors are used as negative examples for the network. A fresh test image is used for recognition; its face descriptor is eigenfaces from the test dataset (M previously seen). Each network receives these new descriptors as input, and these networks are simulated. If the maximum output surpasses a predetermined threshold value when comparing the simulated results, this new face is the maximum output. Its authorization to own it has been verified.For the statistical analysis, we used SPSS software version 16.

Analysis and Discussion

TABLE 1. The recognition rate of 1-3 results is average

No of Eign Facs	Recognition Rate (%)			
	Result 1	Result 2	Result 3	Average of Result 1-3
10	97.042	96.011	95.46	96.171
20	98.037	96.425	96.487	96.983
30	96.037	96.581	96.581	96.39967
40	96.506	96.45	97.012	96.656
50	96.525	97.231	97.3	97.01867

60	94.006	94.987	95.587	94.86
70	94.643	96.031	95.556	95.41
80	94.95	94.837	95.212	94.99967
90	93.356	94.431	93.439	93.742
100	95.25	93.993	93.893	94.37867
110	94.123	98.152	92.147	94.80733
120	95.78	95.36	97.456	96.19867
130	98.74	98.135	95.361	97.412
140	96.45	97.431	98.123	97.33467
150	97.123	94.123	94.125	95.12367
160	94.128	96.1235	98.47	96.2405
170	98.763	94.571	98.474	97.26933
180	94.258	98.456	94.158	95.624
190	97.251	96.347	96.358	96.652
200	96.154	93.258	94.137	94.51633

Table 1 shows The proposed technique is analyzed by varying the number of eigenfaces used for feature extraction. The recognition performance is shown in Table I.

TABLE 2. Descriptive Statistics

Descriptive Statistics							
	N	Range	Minimum	Maximum	Mean	Std. Deviation	Variance
No of Eign Facs	20	190	10	200	105.00	59.161	3.500E3
Recognition Rate Result 1	20	5.4070	93.3560	98.7630	9.595610E1	1.5978181	2.553
Recognition Rate Result 2	20	5.1980	93.2580	98.4560	9.594668E1	1.4858424	2.208
Recognition Rate Result 3	20	6.3270	92.1470	98.4740	9.576680E1	1.7635153	3.110
Recognition Rate Average of Result 1-3	20	3.6700	93.7420	97.4120	9.588986E1	1.1049664	1.221

Table 2 Shows Given the N, Range, Minimum, Maximum, Mean, Standard Deviation, and Variance Curve values, Table 2 presents a descriptive statistical analysis of the number of foreign faces, recognition rate results 1, 2, and 3, and recognition rate results 1-3.

Table 3 Reliability Statistics

Cronbach's Alpha Based on Standardized Items	N of Items
.616	5

Table 3 shows Cronbach's Alpha Reliability result. The overall Cronbach's Alpha value for the model is 0.616 which indicates 61% reliability. From the literature review, the above 50% Cronbach's Alpha value model can be considered for analysis

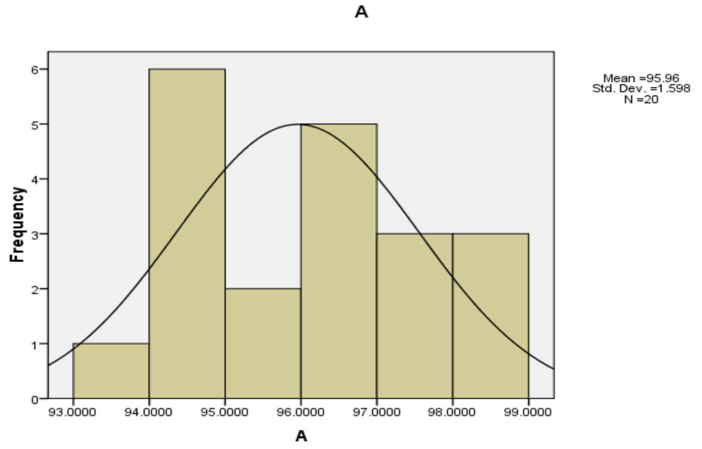

FIGURE 1. Frequency for Recognition Rate Result 1

Figure 1 shows a histogram plot for Recognition Rate Result 1 from the figure where it can be clearly seen that the data is slightly skewed to the right due to high values for 98.00-99.00, while all other values are under the normal curve, the sample substantially follows a normal distribution.

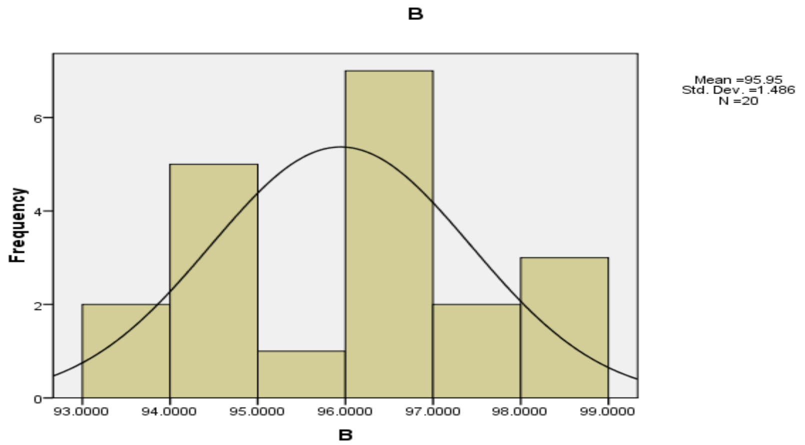

FIGURE 2. Frequencies for Recognition Rate Result 2

Figure 2 shows the histogram plot for Recognition Rate Result 2as the data is skewed due to values for 93.0000-99.0000, while all other values are under the normal curve, the sample is significant Follows a normal distribution.

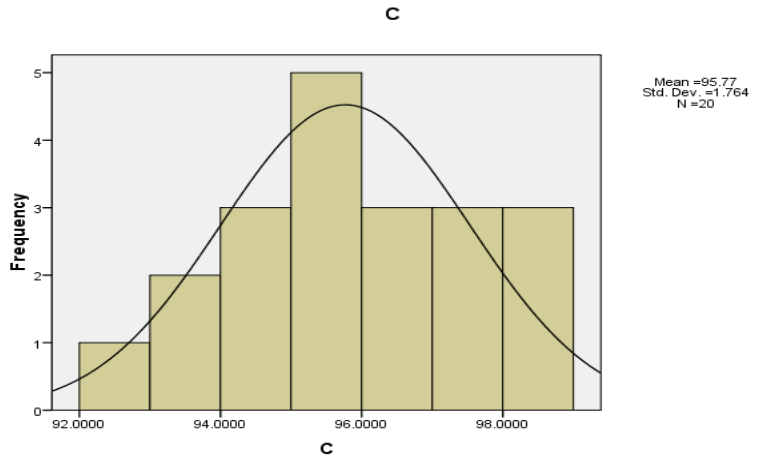

FIGURE3. Frequencies for Recognition Rate Result 3

Figure 3 shows a histogram plot for Recognition Rate Result 3 where it is clear that the data is slightly skewed to the right due to high values for 96.000-98.000, while all other values are under the normal curve, the pattern follows substantially.

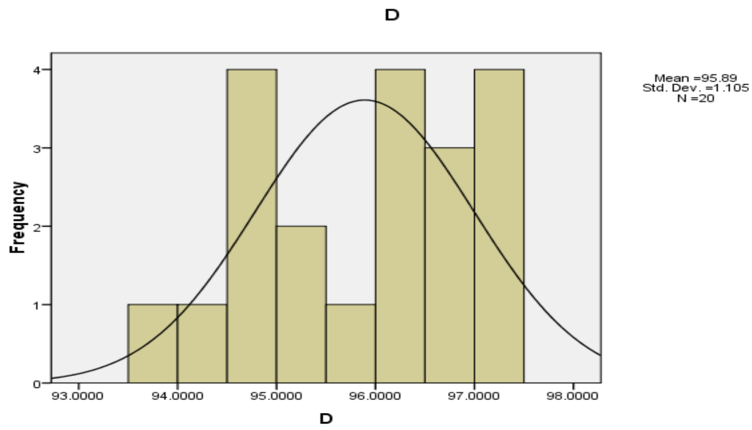

FIGURE 4. Frequencies for Recognition Rate Average of Result 1-3

Figure 4 shows a histogram plot for Recognition Rate Average of Result 1-3 from the figure where it can be clearly seen that the data is slightly skewed to the right due to high values for 96.00-97.00, while all other values are under the normal curve, the sample substantially follows a normal distribution.

TABLE 4. Correlations

	No of Eign Facs	**Recognition Rate Result 1**	**Recognition Rate Result 2**	**Recognition Rate Result 3**	**Recognition Rate Average of Result 1-3**
No of Eign Facs	1	.033	-.110	-.040	-.055
Recognition Rate Result 1	.033	1	.058	.404	.723**
Recognition Rate Result 2	-.110	.058	1	.108	.534*
Recognition Rate Result 3	-.040	.404	.108	1	.775**
Recognition Rate Average of Result 1-3	-.055	.723**	.534*	.775**	1

Table 4 shows the correlation between the stimulus parameters for No of Eign Facs. Line plotting has the highest value of 0.033 so it has a high correlation with Recognition Rate Result 1 and the lowest value is -0.110 so it has a low correlation with Recognition Rate Result 2. Next is the correlation between Recognition Rate Result 1 stimulus parameters. Line plotting maximum value is 0.905 so it has high correlation with Recognition Rate Average of Result 1-3 and minimum value is 0.000 so it has low correlation with parameter No of Eign Facs. Next the correlation between the stimulus parameters for Recognition Rate Result 2. Line plotting has the highest value of 0.855 so it has a high correlation with Recognition Rate Average of Result 1-3 and the lowest value is -0.261 so it has a low correlation with No of Eign Facs. Next the correlation between the stimulus parameters for Recognition Rate Result 3. Line plotting has the highest value of 0.766so it has a high correlation with Recognition Rate Average of Result 1-3 and the lowest value is 0.245 so it has a low correlation with No of Eign Facs. Next the correlation between the stimulus parameters for Recognition Rate Average of Result 1-3. Line plotting has the highest value of 0.245 so it has a high correlation with Recognition Rate Result 3and the lowest value is -0.056so it has a low correlation with No of Eign Facs.

Conclusion

Given the enormous availability of accessible information archives, the framework for face recognition has progressed over the past decades, reaching the provision of more advanced equipment. Law enforcement can perform time-consuming and challenging jobs more quickly and accurately by using facial recognition for crime identification. In order to gain from learning models for feature extraction and try to mitigate probable area issues, it focuses on deep learning techniques. More accurate results are produced by face embedding and perpetrator face identification using deep neural networks. It has the potential to be used in real-time applications. Real-time facial recognition technology allows it to locate criminals' faces in the picture and video stream received from the camera and to warn the user when it does. For face detection in the Open CV technique, we used layer classifiers based on Haar features. This approach uses machine learning, and a layer function is trained using both positive and negative images. It is employed to find items in other pictures. For face recognition, we have also used local binary patterns histograms. This algorithm has a number of benefits, including: instead of measuring the image itself, we measure features for effective feature selection, size and position invariant detection, and image processing. Such a generic detection method can be made to recognise different kinds of items (eg cars, signboards, number plates, etc.).

Faces may be accurately recognized using LPPH identification under a variety of lighting situations. Furthermore, LBPH may be accurately detected even with just one training image per person. The study presents a face recognition approach that makes use of PCA and neural network techniques. In terms of recognition rate, the suggested technique performs better than the other two. The majority of mismatches arise for photos with large head orientations because the eigenphase approach is particularly sensitive to head orientations. The spatial dimension can be reduced from 2576 to 50 when PCA is used as the feature selection approach (equal to the number of selected eigenfaces of the highest eigenvalue). The model's overall Cronbach's Alpha rating is 0.616, which denotes a 61% reliability level.

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