World Journal of Engineering Research and Technology
WJERT
www.wjert.org
SJIF Impact Factor: 5.924

A NOVEL FACE RECOGNITION APPROACH BASED ON MACHINE LEARNING TECHNIQUES

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Article Received on 25/06/2022 **Article Revised on 15/07/2022** **Article Accepted on 05/08/2022**

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ABSTRACT

In today's age of networked multimedia information access, face recognition has triggered a lot of curiosity. Although great progress has been made in the field of face detection and recognition for security, identity, and attendance purposes, there are still obstacles in the way of reaching human-level accuracy. Faces have the unique ability to aid human recognition, which is important in surveillance applications. Furthermore, the non-intrusive nature of these technologies leads to high collectability and acceptance, making them ideally suited for wider use. Machine learning algorithms play a critical role in facial recognition. Even if face methods focus more on face descriptor and feature extraction methods, classification techniques have an impact on recognition performance. There are various traditional classification techniques. Face detection in noisy scenes is the starting point for face recognition, which is followed by pre-processing, normalising the face samples data, feature extraction, and classification. Our experiments show that our face identification system is reliable, trustworthy, and durable, and that it can be employed in a real-world situation.

KEYWORDS: Face Detection, Face Recognition, Feature Extraction, Normalization.

INTRODUCTION

In today's networked environment, maintaining the security of information or physical property is becoming both more important and harder. The human face is a complex

multidimensional structure that may reveal a great deal about a person's personality, including emotion, feeling, and facial traits. Analysing face information features effectively and efficiently is a difficult undertaking that takes a lot of time and effort. The reason for this is that physiological characteristics are often irreversible unless severely injured. Face recognition is one of the few biometric procedures that is both accurate and non-intrusive. It's just as accurate as a physiological method. Face detection and recognition algorithms have been proposed in a multitude of ways. Machine learning is a branch of computer science that entails analysing a variety of data samples, creating a model, and acting like a trained model. The input data are the visual features that represent the image behaviour. In our research, we categorised our findings into two sections: The first segment was primarily concerned with enhancing face recognition training, while the second was concerned with face recognition training based on recognised human faces.

LITERATURE SURVEY

Due to a variety of factors, face recognition and detection has recently gained a lot of traction. Recent efforts to improve the security environment are the key factor. Criminal Identification Security System is one example of its potential and wide application. Pose, illumination, structural component, and occlusion are all issues in an uncontrolled environment. Despite the fact that automated facial recognition research has been going on since the 1960s, it has only recently gained the scientific community's attention. In the recent decade, many face analysis and modelling approaches have advanced dramatically. However, the scientific community continues to face a significant issue in determining the trustworthiness of facial recognition algorithms.

Radhika C. Damale's proposed algorithm takes a variety of approaches, including camera, image quality, illumination, and other variables, to reach a promising accuracy of face recognition in real time.

Xiaoguang Lu proposed a variety of methods that are classified into model and appearance approaches. The methods based on appearance describe three linear subspace analyses. Non-linear manifold analysis is also presented for face recognition.

S.T.Gandhe presents a face recognition approach for identifying people through several experiments. This system uses facial recognition as a biometric for system authentication.

Different applications, such as identity, access control, and document control, were suggested by this system.

For face recognition, Anil Kumar Sao et al. suggested a template matching technique. The posture problem in face recognition is addressed with this method. The faces are first represented in edge view. The image is then subjected to template matching. The image is represented in one dimension using an edginess-based technique. The matching score is used to accomplish the individual identification.

Face detection systems are examined by Sujata G. Bhele. This study focuses on face detection using soft computing approaches such as SVM, ANN, and others. These methods may produce better outcomes. The different feature extraction methods such as PCA, LDA, and ICA were explored in this study. Image quality, position fluctuations, and illumination changes are all noted in this research as issues that limit accuracy.

Riddhi Patel presented a description of facial recognition and discussed how the approach works. It also compares various face recognition techniques. It emphasises strategies that provide great efficiency under a variety of lighting and environmental situations.

FACE RECOGNITION

Face recognition is a visual pattern recognition problem. Face detection, alignment, feature extraction, and matching are the general components of a face recognition system, with localization and normalisation (face detection and alignment) being processing steps before face recognition (facial feature extraction and matching). Face detection separates the areas of the face from the background. Face alignment aims to achieve more accurate localization and thus normalise faces, whereas face detection provides coarse estimates of each detected face's location and scale. The face is typically normalised further in terms of photometrical properties such as illumination and grey scale.

Following the normalisation of a face, feature extraction is performed to provide effective information that is useful for distinguishing between faces of different people and stable in terms of geometrical and photometric variations. For face matching, the extracted feature vector of the input face is compared to those of enrolled faces in the database; if a match is found with sufficient confidence, it outputs the identity of the face; otherwise, it indicates an unknown face. Face recognition results are heavily reliant on the features extracted to

represent the face pattern and the classification methods used to differentiate between faces, whereas face localization and normalisation serve as the foundation for extracting effective features.

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Feature extraction plays the vital role in face recognition algorithm. Each face has unique characteristics that helps to distinguish one person from another. In this approach, PCA and LDA are used for feature extraction. Database is divided into train and test images.

Proposed work for face recognition is as follows

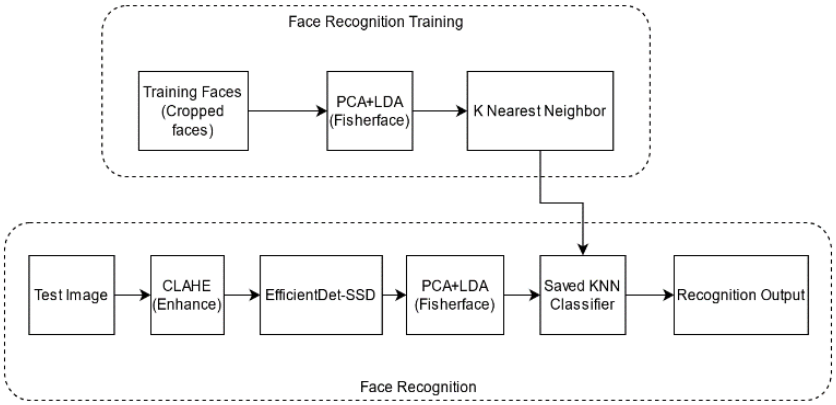

Figure 1: General model for face recognition and Training.

IMAGE ENHANCEMENT WITH CONTRAST LIMITED ADAPTIVE HISTOGRAM EQUALIZATION (CLAHE)

CLAHE was created to boost the contrast of low-contrast medical images. CLAHE's contrast limiting differs from that of standard AHE. To combat noise amplification, the CLAHE included a clipping limit. The CLAHE limits the amplification before computing the Cumulative Distribution Function by clipping the histogram at a predetermined value (CDF). The CLAHE approach divides an input original image into non-overlapping contextual sections called sub-images, tiles, or blocks. The two most important CLAHE parameters are Block Size (BS) and Clip Limit (CL) (CL). These two parameters are primarily to blame for improved image quality. Because the input image has a low intensity, increasing CL brightens the image, and increasing CL flattens the Histogram. The dynamic range of the image and its contrast increase as the BS increases. The CLAHE approach applies histogram

equalisation to each contextual zone. The original histogram's clipped pixels are reallocated to each grey level. The redistributed histogram differs from the ordinary histogram because each pixel intensity is limited to a specific maximum.. The following are the steps in the CLAHE method for enhancing the original image:

Steps:

Step 1: Split intensity image into contextual regions that are not overlapping. M. N is the total number of image tiles, and 8.8 is a good value for preserving image chromatic data.

Step 2: Creating a histogram for each contextual region based on the grey levels in the array image.

Step 3: Using the CL value to calculate the contrast limited histogram of the contextual region

$$I\,avg = (IrX \times IrY) / I\,gray \quad (1)$$

where I avg is the average number of pixel, I gray is the number of gray levels in the contextual region, IrX and IrY are the numbers of pixels in the X dimension and Y dimension of the Contextual region.

The actual CL can be expressed as

$$I\,CL = I\,clip \times I\,avg \quad (2)$$

where I CL is the actual CL, I clip is the normalized CL in the range of [0, 1]. If the number of pixels is greater than I CL, the pixels will be clipped. The total number of clipped pixels is defined as I∑ clip, then the average of the remain pixels to distribute to each gray level is

$$I\,avggray = I\sum clip / I\,gray \quad (3)$$

Step 4: Redistribute the remaining pixels until all of them have been distributed.

Step 5: Interpolate grey level mapping to create a better image. In this process, four pixel clusters are used and a mapping process is applied. Each of the mapping tiles will partially overlap in the image region, after which a single pixel will be extracted and four mapping will be applied to that pixel. Interpolate between those results to obtain an enhanced pixel, then repeat over an image.

KNN CLASSIFIER

The kNN classifier stands for k nearest neighbour classifier. It is a simple classification technique that is based on calculating the distance between training and test data and then assigning test data to the class with the smallest distance value. Euclidean distance is generally used for this which can be computed as:

$$d(x,y) = \sqrt{\sum_{i=1}^{n} (x_i - y_i)^2}$$

In kNN, the value of k determines the voting system for the classification and class that receives votes.

Maximum votes, i.e. the greatest number of minimum distance data, then the data belongs to the class. If the value of k is 1, the simplest kNN is known as the nearest neighbour classifier (NNC).

EXPERIMENT RESULT DISCUSSION

In this proposed work, we will certainly present analysis of our proposed face detection and recognition system. The training of the face datasets is done module by module, using piece photos as favourable details extracted from the data of several hundred people. As false negatives, various peripheral piece shots taken from historical photographs are used. The total number of training data created, including face photographs, is 4192.The input shape of 768x768 and the batch size of 6 were used for the model's training. The loss and learning rate curves are depicted in the diagrams below. Each input image's label will be predicted by the classifier model. After that, the anticipated and true labels are shown.

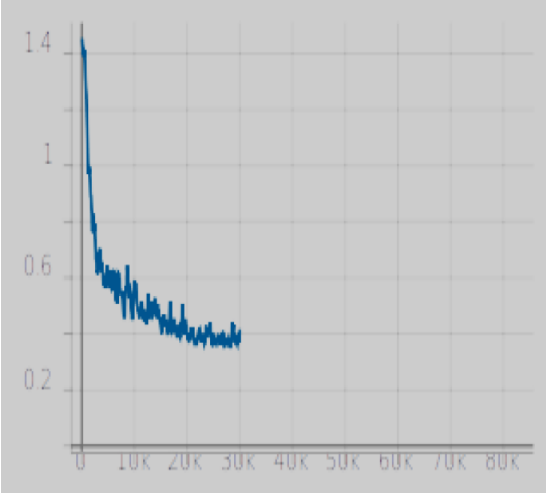

Figure 2: Total Loss.

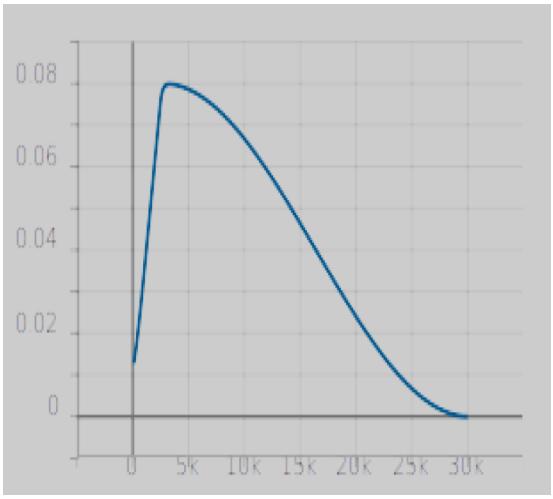

Figure 3: Learning Curve.

Training evaluation was done on 1291 test images for the goal of evaluating the suggested approach. Overall mean average precision of 89.66% was achieved.

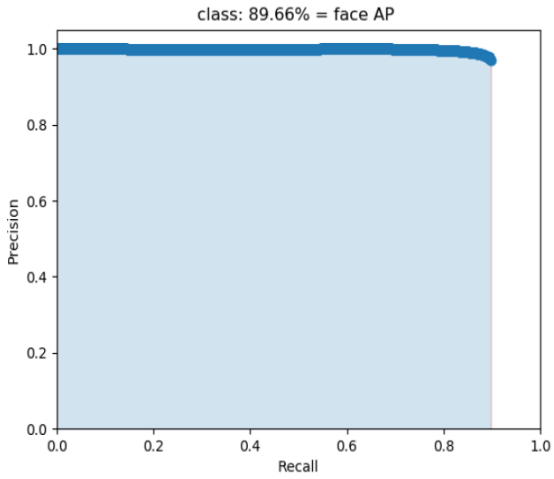

Figure 4: Recall & Precision.

CONCLUSION

Face recognition was used in this study to recognise faces from a dataset using machine learning techniques. Face detection is done with the EfficientDet-SSD object detection model, which constantly achieves higher accuracy and efficiency. A large number of photos are used to train the pre-trained module. Face detection has an accuracy of roughly 89 percent. Face recognition using a mixture of CLAHE, PCA and LDA yielded a accuracy of around 90 percent in each case. The accuracy of the outcome reduces as a function of factors such as lighting conditions. It's also worth noting that our study doesn't address the problems

of occlusion and mask faces in facial recognition; however, solving these challenges could be a great future project for this paper.

REFERENCES

1. Insaf Adjabi, "Past, Present, and Future of Face Recognition: A Review", Electronics, 2020; 9: 1188.
2. Vats, S., S.K. Dubey, and N.K. Pandey, Criminal Face identification System. LAP Lambert Academic Publishing, 2012.
3. Y. C. Chen, V. M. Patel, P. J. Phillips, and R. Chellappa, "Dictionary based face recognition from video," in Proc. ECCV, 2012; 766–779.
4. Xiaoguang Lu" Image Analysis for Face Recognition" published by Dept. of Computer Science & Engineering Michigan State University.
5. S.T.Gandhe, K.T.Talele, A.G.Keskar "Intelligent face recognition techniques: A comparative study" published in IAENG International Journal of Computer Science.
6. Anil Kumar Sao and B. Yegnanaarayana "Template matching Approach for Pose Problem in Face Verification Speech and Vision Laboratory" Department of Computer Science and Engineering, Indian Institute of Technology Madras.
7. Sujata G. Bhele and V. H. Mankar "A Review Paper on Face Recognition Techniques" published in International Journal of Advanced Research in Computer Engineering & Technology (IJARCET).
8. Riddhi Patel and Shruti B. Yagnik "A Literature Survey on Face Recognition Techniques" published innternational Journal of Computer Trends and Technology (IJCTT).
9. X. He, S. Yan, Y. Hu, P. Niyogi and H. Zhang, "Face Recognition using Laplacian Faces," IEEE Trans. on Pattern Analysis and Machine Intelligence, 2005; 27(3): 328–340.
10. J. Fagertun, "Face Recognition," M Eng Thesis, Technical University on Denmark, 2005.
11. Yang, M.-H., D. Kriegman, and N. Ahuja, Detecting faces in images: A survey. Pattern Analysis and Machine Intelligence, IEEE Transactions on, 2002; 24(1): 34-58.
12. Shang-Hung Lin., "An Introduction to Face Recognition Technology", Information Science Special Issue on Multimedia Informing Technologies - Part 2, 2000.
13. Bowers, D.M., Access control and personal identification systems. Butterworths London, 1988.