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DEEP LEARNING BASED FACE AUTHENTICATION AND MONITORIDEEP LEARNING BASED FACE AUTHENTICATION AND MONITORING SYSTEM

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Abstract
Among the biometric information processes, the face recognition system has a wider operational range and easier applicability than other traditional Biometric systems. A variety of approaches from the fields of face detection and recognition are used in the design, implementation, and testing of a face recognition system. Face detection is carried out on real-time acquired photos without consideration for the intended application field. The system uses processes like facial feature extraction, skin-like region segmentation, and white balance correction for facial feature detection. Next, a Feed-Forward Neural Network-based face classification technique is incorporated into the system. Within the specified parameters, the tested system performs acceptably when it comes to face recognition. In real-time acquired photos, the system can also identify and distinguishseveral faces.

Keywords
Biometric information, Neural Network-based face detection and recognition.

INTRODUCTION

A growing body of research has focused on facial recognition software, which are a component of applications of face image processing. Instead of using fingerprints, iris scans, signatures, or other biometric data, they employ human biometric information and are readily adaptable

Not very appropriate for those who don't collaborate well. In urban areas, face recognition technology is typically used and favoured for security cameras and people. These devices are useful for person verification, video monitoring, crime prevention, and other security-related tasks.

In real-world applications, face recognition systems provide a challenging image processing problem due to the intricate impacts of lighting, obstruction, and picturing conditions on the live images. It is a combination of identification and recognition of faces approaches in picture analytics. The facial orientations in a particular image is determined using a detection application. The majority of computer vision applications use recognition algorithms, which are used to classify provided images with known structural attributes. Applications for recognition use standard photos, and faces—including the eyes, nose, mouth, and eyebrows—are identified by detection algorithms. As a result, the method is more complex than a single algorithm for recognition or detection

Getting a picture from a camera is the initial step in the facial recognition system's process. An image from a camera is the first thing a face recognition system needs to get. Detecting faces from the acquired image is the second stage. The third stage of the facial recognition uses the output of the detecting part's face photographs. And after the recognition portion, identification of the person is the last and final phase.

Figure 1 shows the process flow for the face recognition system.

The initial stage in face recognition system applications is obtaining images for the computer via a frame grabber from the camera and computational media (environment). Thesoftware's face detection algorithm receives the input image as digital data and uses it to extract each face in the picture. Numerous techniques are available in the literature [1 – 9] for identifying faces in the photos.

The existing techniques can be divided into two primary categories: appearance-based [5 – 9] and knowledge-based [1 – 4] techniques. In a nutshell, human knowledge of the features that comprise a face is the source of knowledge- based approaches. Methods for finding faces throughtraining and/or learning are the source of appearance-based approaches.

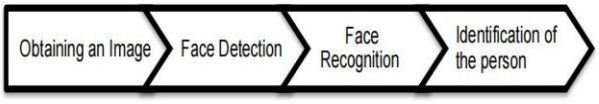

Figure 1: Face Recognition System Application Steps

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To identify the people in the face photos, faces must first be detected and then identified. The majority of the techniques employed in the literature made use of standard photos from an accessible face library [10–17]. Standard photos should be produced using a few techniques once faces have been identified. The face data may be given to a facial identification formula while the standard photos are being generated. The two categories of methods seen in the literature are two and three dimensional based procedures. In two dimensional methods, people's identities are classified by the application of learning/training techniques on two dimensional photographs as input [1–15]. Three- dimensional facial data are utilized as an input for recognition in three dimensional techniques. Various methods are employed for recognition, such as the use of three dimensional geometric analysis and matching point measure. This following part provides an explanation of the approaches in detail. Occlusion, picture orientation, imaging circumstances, position, the availablity of structured components, facial expression, and time delay (for recognition) can all have an impact on face detection and recognition methods. Researchers have focused their limited capabilities on well-structured applications, as the applications they have produced are often confined to handling one or two impacts. It is challenging to create a face recognition system that is reliable, effective, and operates in all environments.

METHODOLOGY

A comprehensive survey has demonstrated that several approaches and combinations of these approaches can be used to create a novel face recognition system. Out of all the potential ways, we have chosen to combine neural network approach for face recognition with knowledge-based methods for face detection. Their ease of application and dependability problems are the primary factors in this choice.Figure 2 shows our technique for a face recognition system.

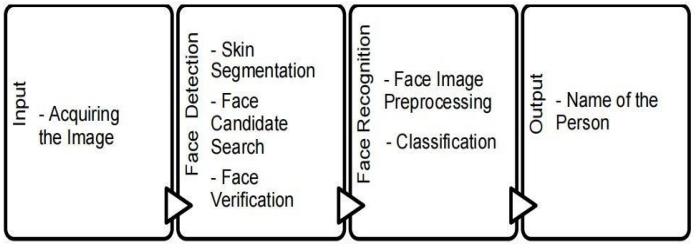

Figure 2: Face Identification Strategy

2.1 : Data Feed Section :

A prerequisite for a face recognition system is the inputcomponent. This section is where the image acquisition operation is completed. Images taken in real time are transformed into digital data so that image processing operations can be carried out. These photos are taken and submitted to a method for facial detection.

2.2 : Detection Section:

For face recognition systems, face detection locates and extracts faces from images. Figure 3 shows the algorithm forthe face detection portion. According to our tests, the initial stage of skin segmentation in face detection lowers the computing time required to search the entire image. Only the segmented region is searched when segmentation is applied, regardless of whether the segment contains anyfaces.

Skin segmentation is used as the initial stage of the procedure for identification because of this. Skin tones are described using the RGB sequence.

The variations in ambient illumination throughout the photoshoot cause variations in the white balance of the photographs. Things which are related to the skin but are notskin are created in this way

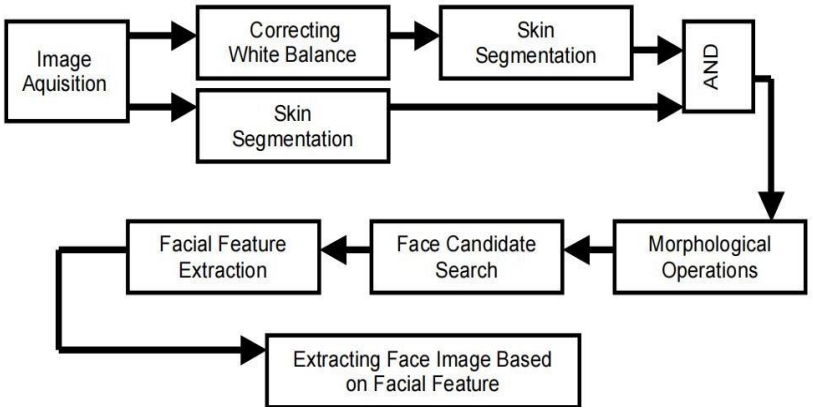

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Figure 3: Face Detection Part Algorithm

As a result, before segmenting the acquired image, its white balance needs to be adjusted [18]. Figures 4 and 5 shows theoutput of the segmented image on the original image and theimage with the white balance adjusted.

Figure 4&5: Example of taken/white balance correctedimage and skin color segmentation

Following the application of "logical and" to image that are segmented, morphing process are executed on it's corresponding picture in order to identify prospective faces. Ending procedures are noisy, similar to the eradication of small regions. Next, face candidates are selected based on two criteria: filling in some gaps inside the candidate region and the candidate's bounding box ratio. Bounding box ratios should range from 0.3 to 1.5.

Picture Before Filter Picture After Filter

Figure 6 Output of filtering process on a face image

Face images are taken from the source using a modified bounding box derived from the classic bounding box based on these conditions. The bounding box's height was adjustedto be 1.28 times larger than its width as the region below the person's neck gets disqualified if they are included. Experimental methods have been used to determine this modification value. To verify the applicants, these faces willbe forwarded to the facial feature extraction section.

The facial feature extraction procedure is used after acandidate's final verification and face picture extraction. Aface's most important element is its facial feature. Facefeatures include the lips, nose, tip of the nose, cheeks, andeyebrows. The ability to extract the mouth and eyes is basedon the fact that two of them form an isosceles triangle, andthe distances between the midpoint of the eyes and themouth are equal [2]. The extraction of facial features from aface candidate is achieved by using several filteringprocedures and the Laplacian of Gaussian (LoG) filter [19]. Figure 6 demonstrates how choosing facial traits is simple.Following the acquisition of the filtered picture, a labellingprocedure is performed to identify the labels that maycorrespond to facial features. Face image extraction ispossible once the face cover corner points have beendetermined. Figure 7 provides extracting face attributes,hiding, and extracting the facial image. Thus far, the facedetection portion has been finished, and the obtained photoscontain face images.

MATLAB is used to develop this approach, which has been tested on over a hundred photos. This method finds several faces in addition to only one. A small degree of focused expression is appropriate. The outcomes are adequate for all purposes.

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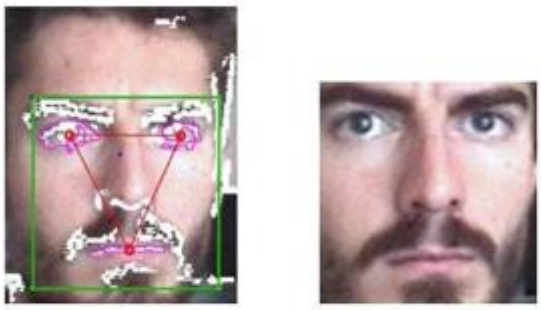

Figure 7 Extracting the Facial Attributes of a Picture

2.3. Face Recognition Section:

The altered picture of the face that the face recognition software acquired has to be classified in order to identify theperson in the database. Pre-processing face images, vectorizing image matrices, creating databases, and finally classifying the results make up the face recognition portion. Feed Forward Neural Network (FFNN) is used to achievethe classification [13]. Figure 8 shows the face recognition portion of the algorithm.

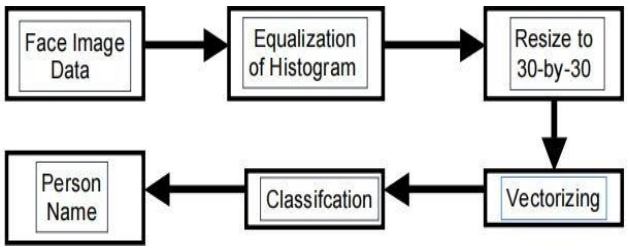

Figure 8 Facial Recognition Process

The network is taught to categorize the provided photos in relation to the face database once the structure has been created. As a result, creation of the face database comes before testing. A database including four samples for eachof the 26 individuals is established. This yields a training sample of 104. As a result, the training matrix will have a 900-by-104 dimension. Because there are four groups in the training matrix vector element, there are samples for every individual. However, the first 26 vector elements correspond to the first 26 samples of individuals, and so on. The columns of the training matrix are created by vectorizing a pre-processed image into a face image, which creates a database.

Neural network training can be done once the training matrix and target matrix have been generated. Through backpropagation, the network is trained.

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The system's initial implementation focuses on finding facesin the acquired image. As a result, skin-like region segmentation has become the foundation of face detection. In addition to providing the best results, RGB may also provide skin-like colours on laboratory walls because of thecamera's white balance value. Unwanted skin, such as colour patches, might skew facial features and interfere withidentification. By correcting the acquired image's white balance, this colour issue can be resolved.
Figure 9 illustrates the application of white balance adjustment. In reality, the wardrobe colour is white (Figure 9). However, the acquired image's (left image) cream colour and the wall's colour, which resembles skin tone, have an impact on the segmentation findings. The segmentation findings on the captured image are displayed in Figure 10.

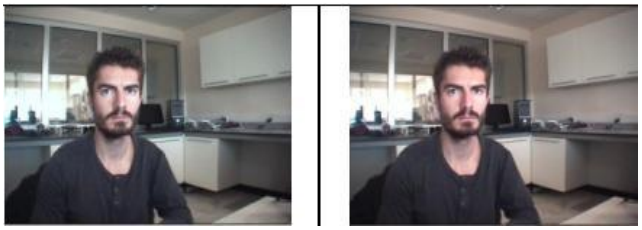

Figure 9 Before and After Correcting the White Balance

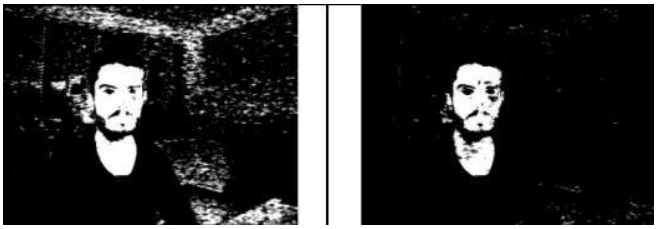

Figure 10 Output of Skin Segmented Image Before andAfter White Balance

In order to ensure colour correction, both segmentation and logical "and operation" are carried out on the obtained and corrected images. Following segmentation, the prior chapter's descriptions of morphological operations and candidate search are realised.
The Laplacian of Gaussian (LoG) filter can be used for edgedetection. Compared to edge detection, LoG filter responds less well. It improves face characteristics in a helpful way. The LoG filter's results are superior than those of the first three trials. The mouth is more important than the other senses, and the eyes allow for more precise selection.

3.1 Recognition:
The eyes and mouth are located and the facial picture is cropped with the inclusion of the isosceles triangle method, as mentioned in the preceding part. After that, a database of face pictures might be created.
26 persons contributed to the database, and each participant has four example images. The face detection portion is used to generate the database.
To create and train neural networks, using the Neural Network Toolbox's Pattern Recognition Tool. The two layers of the created network have sigmoid transfer functions. The output layer and concealed layer are the two layers. There are 26 neurons in the output layer and 41 in the hidden layer. Based on the findings, the obtained image needs to have its white balance adjusted.
3.3. Face Recognition System:
The face recognition system is finally implemented bycombining the face detection and recognition components. The system is also capable of managing many faces in theobtained picture. The MATLAB environment is used togenerate code. Findings are displayed in these Figures.

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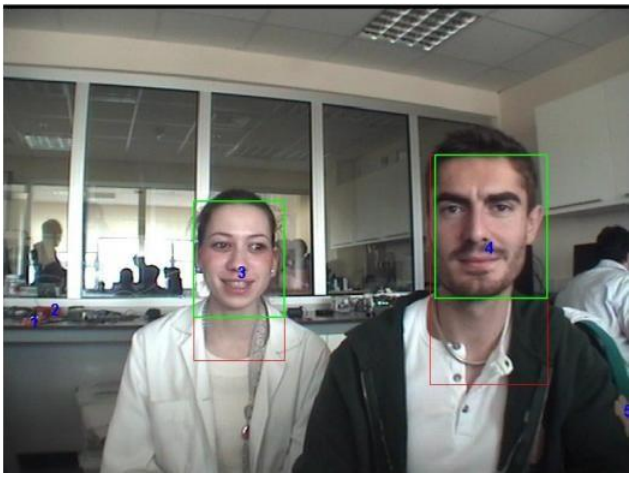

Figure 11 Detected Persons

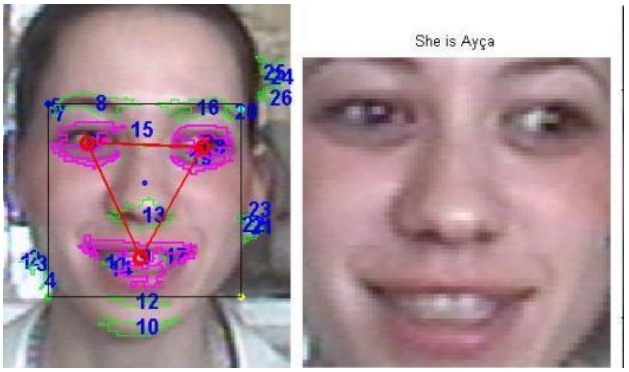

Figure 12(a): Acquiring Face Attributes of Face

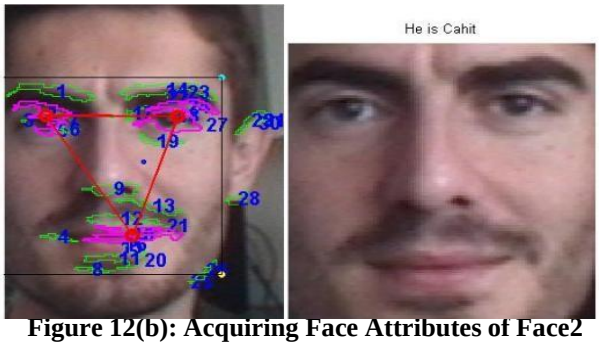

Figure 12(b): Acquiring Face Attributes of Face2

The experiment's outcomes demonstrate that the algorithm is capable of correctly classifying and identifying several faces in the obtained image. This is significant since certain techniques are limited to identifying a single face in an image. A lot of tests are run using real-time acquired photos.The components for face recognition and detection worked properly. Skin segmentation reduces the search area for faces as well as computational time.
Experiments demonstrate that the relationship between the detection and recognition components is well-established. When one or more closed eyes are detected, brows are raised, the face is smiling, or if teeth are shown, the network can accurately classify those situations. Additionally, more users can be added to the database, and the majority of them will most likely properly classify faces.

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CONCLUSION

Systems for facial recognition are among the uses of facial image processing, and in recent years, its importance as a research field has grown. The system's implementations include person verification, video monitoring, crime prevention, and other related security measures. This facial recognition technology will be used in the humanoid robot research project at Atılım University.
Face detection and recognition algorithms helps to identify, acquire, and withdraw faces from acquired pictures. Face features and tone of the skin are the approaches implemented. Face recognition is accomplished via neural networks.

Skin colour values are specified in the RGB colour space, and segmentation shortens the time it takes to find faces in photos. Face candidates' facial components display when the LoG filter is used. The LoG filter performs well when it comes to extracting facial compositions in various lighting scenarios.
The process of recognizing face is much similar to recogonizing patterns, hence FFNN is used to organize and recogonize the patterns. The classification outcome is
precise. When an extracted facial image with limited orientation and smile is used, classification is also flexible and accurate. The suggested algorithm can identify several faces, and the system's performance yields respectable, goodresults.

REFERENCES

[1] L. Zhi-fang, Y. Zhi-sheng, A.K.Jain and W. Yun-qiong, 2003, “Face Detection And Facial Feature Extraction In Color Image”, Proc. The Fifth International Conference on Computational Intelligence and Multimedia Applications (ICCIMA’03), pp.126-130, Xi’an, China.
[2] C. Lin, 2005, “Face Detection By Color And Multilayer Feedforward Neural Network”, Proc.2005 IEEE International Conference on Information Acquisition, pp.518-523, Hong Kong and Macau, China..
[3] S. Kherchaoui and A. Houacine, 2010, “Face Detection Based On A Model Of The Skin Color With Constraints And Template Matching”, Proc. 2010 International Conference on Machine and Web Intelligence, pp. 469 - 472, Algiers, Algeria.
[4] . M. Ş. Bayhan and M. Gökmen, 2008, “Scale And Pose Invariant Real-Time Face Detection And Tracking”, Proc. 23rd International Symposium on Computer and Information Sciences ISCIS '08, pp.1-6,Istanbul, Turkey.O.
[5] C.C. Tsai, W.C. Cheng, J.S. Taur and C.W. Tao, 2006, “Face Detection Using Eigenface And Neural Network”, Proc. 2006 IEEE International Conference on Systems, Man, and Cybernetics, pp.4343-4347, Taipei, Taiwan.
[6] M. Tayyab and M. F. Zafar, 2009, “Face Detection Using two dimensional-Discrete Cosine Transform And Back Propagation Neural Network”, Proc. 2009 International Conference on Emerging Technologies, pp.35-39, Islamabad, Pakistan.
[7] W. Wang, Y. Gao, S. C. Hui and M. K. Leung, 2002, “A Fast And Robust Algorithm For Face Detection And Localization”, Proc. 9th International Conference on Neural Information Processing (ICONIP'O2), pp.2118-2121, Orchid Country Club, Singapore.
[8] Y. Song, Y. Kim, U. Chang and H. B. Kwon, 2006, “Face Recognition Robust To Left-Right Shadows Facial Symmetry”, Pattern Recognition Vol.39 (2006), pp.1542–1545.
[9] C. Liu and H. Wechsler, 2003, “Independent Component Analysis Of Gabor Features For Face Recognition”, Proc. IEEE Transactions On Neural Networks, Vol. 14, pp.919-928.
[10] A. Rida and Dr BoukelifAoued, 2004, “Artificial Neural Network- Based Face Recognition”, Proc. First International Symposium on Control, Communications and Signal Processing, pp.439 – 442, Hammamet, Tunisia.
[11] D.N Pritha, L. Savitha and S.S. Shylaja, 2010, “Face Recognition By Feedforward Neural Network Using Laplacian Of Gaussian Filter And Singular Value Decomposition”, Proc. 2010 First International Conference on Integrated Intelligent Computing, pp.56-61, Bangalore,India.
[12] C. Gürel, 2011, “Development of A Face Recognition System”, M.S. Thesis in Mechatronics Engineering, Atılım University, Ankara, Turkey.