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Noval Approach Fraud Prevention System on the Principle of 3WPCA (Dual Vision Face Recognition)

Shriram Dhurwey
Assistant Professor
Department Information Technology
Jabalpur Engineering College
Jabalpur (M.P.), India
Email: srdhurve@jecjabalpur.ac.in

Loveleen Kaur
Head of Department
Department Information Technology
Jabalpur Engineering College
Jabalpur (M.P.), India
Email: loveleenkaurpabla@gmail.com

Sujeet Kumar Tiwari
Assistant Professor
Department Information Technology
Jabalpur Engineering College
Jabalpur (M.P.), India
Email: sujeet.tiwari08@gmail.com

Shachi Mandloi
UG Student,
Information Technology
Jabalpur Engineering College
Jabalpur (M.P.), India
Email: jn.shachi@gmail.com

Shreya Agrawal
UG Student,
Information Technology
Jabalpur Engineering College
Jabalpur (M.P.), India
Email: chinky13.agr@gmail.com

Saurabh Patel
UG Student,
Information Technology
Jabalpur Engineering College
Jabalpur (M.P.), India
Email: saurabhpatel2510@outlook.com

Vishwas Wadhwani
UG Student,
Information Technology
Jabalpur Engineering College
Jabalpur (M.P.), India
Email: vishwas2404w@gmail.com

ABSTRACT

Dual vision cameras in face recognition systems can be used to prevent fake face images on face recognition systems. A dual-vision camera is used to obtain identifiable facial images from two positions of the left and right lenses. A merged face image database of left and right lens face images can be created by image retrieval at the two corners of the left and right lenses. To prevent the falsification of facial data by using a person's face photo or another image that closely resembles a person's face, two sides of the face are photographed.

In this study, the feature extraction model is 3WPCA (Three Level Wavelet Decomposition - Principal Component Analysis), and the pre-processing approach is dual-vision face recognition. To create an image that is ready to be extracted using 3WPCA for dual-vision face recognition, we merge half of the left picture and half of the right image using the half-join approach. With a face recognition accuracy of up to 98%, this research can create a presence system that is based on good face recognition and can be used to predict the falsification of face data.

Keywords:— *Dual-vision, Stereo Vision Camera, Face Recognition, 3WPCA.*

I. INTRODUCTION

Face detection and identification systems can be employed as presence systems by using a human face as the object.

One of the most trustworthy attendance systems is the present system which uses a real-time video camera for human face detection and recognition. Due to the advantages of application flexibility, a face detection system camera does not require users to interact directly with the attendance system.

This study makes use of a dual-vision camera (stereo vision camera) to reduce the possibility of fake facial data. A stereo vision camera with a left and right lens can create recognizable face image data from two positions [1].

The employment of cameras as a face image acquisition method in face recognition systems is crucial. To identify or recognize the facial identity, the camera is used to take images of faces using face detection. These images are then processed using **normalization algorithms, feature extraction, and classification**. The face recognition system's camera is used to capture facial images that will be processed as 2D or 3D. **Single vision cameras** are typically used for 2D image acquisition models on face recognition, while stereo vision cameras or other image acquisition equipment, including scanners, are used for 3D image acquisition models.

Stereo vision cameras are frequently utilized in facial recognition processing to create 3D imagery in some face recognition investigations. Reconstructing facial dots to create a 3D face image that may be used for face recognition methods is a widely used approach. According to several earlier studies, stereo vision cameras have not been frequently employed to create a 2D composite of pictures from the right lens and left lens. Due to the symmetry of the face recognition pattern, the employment of stereo vision cameras will be very helpful in developing a face recognition approach that can be used to predict the falsification of facial data in the present system.

Face geometry, which includes the eyes, nose, mouth, and cheeks on a human face, is used in face identification based on the pattern of facial symmetry. The placement of facial organs by the vertical axis of the face results in this pattern of facial symmetry. Face detection and recognition study is classified into half-face, full-face, and half-face and full-face research based on the usage of facial symmetry patterns.

Based on density characteristics from specific organ parts, such as eyes, ears, nose, mouth, and cheeks on a facial image captured from a camera at some angle of retrieval, research has been performed to rebuild half-face photos into full-face images [2]. Face detection research has been carried out using the traits of facial symmetry patterns to identify human faces as well as the gender of the facial picture captured on camera [3]. [4] conducts research on face recognition based on facial symmetry using the half-face approach to interpret 2D pictures as training images.

Following [4]'s half-face methodology face recognition research, [5] created face recognition using the same technique but with 3D images.

Employ facial symmetry techniques during the training procedure to undertake face recognition research. Based on previously completed face symmetry research by [6], [7] continues facial recognition research.

For application in face identification, this work also blends the original 2D image of a single vision retrieval technique with the original image mirroring technique.

The development study for facial recognition that [6] has done has been carried out by [8]. The study makes advantage of patterns in facial symmetry for face recognition methods. [9] has also conducted facial recognition studies using geometric methods and facial symmetry types such as the points on the eyes, nose, and mouth.

This study will create two 2D images on each camera lens using a dual-vision camera to create a face recognition model [10]. After utilizing the normalization technique to produce a region of interest (RoI) image for face detection, the result is processed using the technique of combining left and right lens image outputs. Combining some of the left images from the face detection of the left lens with some of the right images from the face detection of the right lens results in the joining of two images. The result of this combination can provide an integrated image of face recognition results on each lens from a stereo vision camera, making it useful for the feature extraction and classification processes.

II. Face Detection Method

This paper suggests a face identification approach using 3WPCA for feature extraction and half-join normalization with a dual-vision camera for face image acquisition. This method makes use of the testing stage's face detection, normalization, feature extraction, and classification steps in the face recognition process. The stage of image processing when acquisition findings are prepared for use in the feature extraction step is called image normalization. After normalization, the image is reduced in dimension during feature extraction. We employ Principal Component Analysis (3WPCA) using a three-level model wavelet decomposition during the extraction process [11]. The image feature matching stage, classification, tests the accuracy of the trained image features. The suggested method for facial recognition can be seen in Figure 1.

Image Acquisition

The process of face detection uses the image of a human face that is captured during image acquisition.

Using a stereo vision camera with the capability of capturing faces on the left and right, two lenses. The frontal view of the human face is used to capture the image in real-time, and the facial deviation from the camera on the X, Y, and Z axes is around 15.

Face Recognition

Face detection is carried out using a stereo-vision camera and is based on the Viola-Jones face detection algorithm [12]. Face detection is done using the left and right stereo-vision camera lenses. A raw image that contains both the face image and the backdrop image is a face image that was taken with both the left and right lenses.

Now that facial features have been identified and located on the camera, the algorithm marks the output as a tracked image and decides whether or not the pattern is a face. Each camera lens's detected face picture is identified by the location of the coordinate point of the region of interest (RoI) of the generated face image.

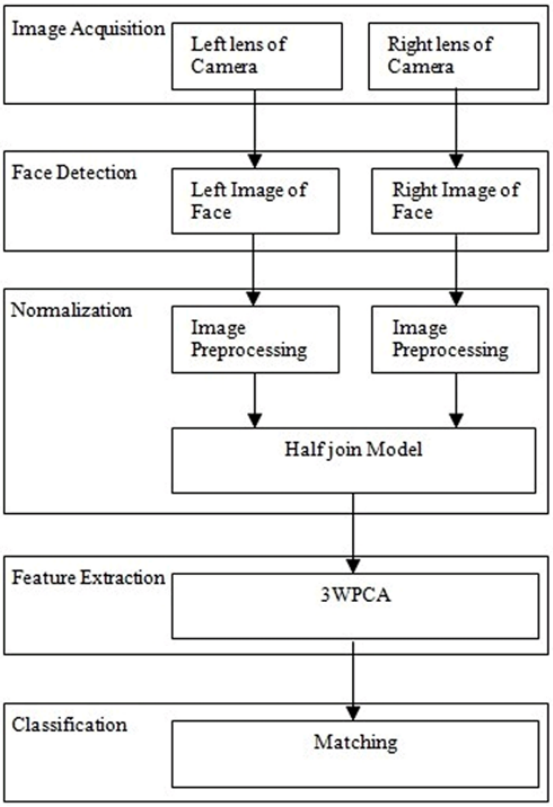

Figure 1: The Proposed Face Recognition System

Normalization

Face detection-processed facial photography is subjected to the normalisation technique. Pre-treatment and half-join are the first two processes in the normalisation of facial image processing.

Pre-processing

Pre-processing is the process of merging various models for processing facial images. To provide data that can be used to make face recognition more accurate, we use the methods of cropping, RGB-Gray, scaling, and contrast-brightness correction utilizing histogram equalization during the pre-processing stage. The pre-processing technique utilized in this study is used to enhance the image's clarity and can be used to foresee the existence of illuminance changes that will arise at the time the facial image is captured.

Half-join

A human perspective model called the Half -join method uses two eyes to perceive and identify a person. A dual vision camera with a left and right lens, therefore, simulates both eyes in people. This technique creates an image that is ready to be extracted by combining the left picture by half and the right image by half. The half-join technique, which was used in this study, divides the facial image on a camera's left and right lenses into segments of roughly equal width. We first calculate the face image's width (w/width) in pixels before dividing it into two equal portions to calculate the face image's center (c/ center).The image of the left lens's face is specifically located at the intersection of the far left (x = 0) and one pixel before the picture's midway (x = c-1).

The image of the right lens's face is specifically the spot where the picture's middle (x = c) and rightmost point (x = w - 1) overlap. The combined facial picture is created using the images captured by the left and right halves of the camera's left and right lenses, respectively. Figure 2 depicts the algorithm for the half-join approach of face recognition.

Feature Extraction

Three Level Wavelet Decomposition - Principal Component Analysis (3WPCA) is the feature extraction technique employed in this study [11]. The preprocessing result image is next subjected to 3WPCA processing, which results in a dimensional decrease of the facial image resolution. A huge variable's data is transformed into a smaller representation of other variables using 3WPCA.

Classification

The Mahalanobis distance approach was employed as the classification technique in this investigation. To achieve a more accurate face identification, the Mahalanobis distance method measures the degree of similarity between features. Comparing the face features from the training that were recorded in the database to the facial features present during the test allows for the evaluation of facial feature similarity. As a result, the data are identified, and this information is subsequently recorded as presence data.

III. Results and Discussion

The three levels of the wavelet are then used to process the half-join method's output image. A dimensional reduction of the facial image resolution up to 20x20 pixels is produced after the wavelet decomposition image has been treated using PCA. Figure 4 depicts the integration of the PCA and 3-level wavelet decomposition methods.

By decreasing the image resolution, three-level wavelet decomposition is employed to break down the size of the face image. Before being processed using PCA, the resulting image, which has a relatively poor resolution, will slow down face recognition.

The 160×160 pixel face image obtained after the pre-processing and half-join stages is then divided into 80×80 pixels on wavelet level 1, 40×40 pixels on wavelet level 2, and 20×20 pixels on the wavelet level 3 before being returned to its original 160×160 pixel size. The PCA algorithm will be used to process the 20x20 pixel face image.

1. Start
2. Determine w, w ← wide of image
3. Calculate the center of face c, c ← w/2
4. Det. left face area shj_{left}, $shj_{left} \leftarrow \sum_{x=0}^{c-1} c$
5. Det. right face area shj_{right}, $shj_{right} \leftarrow \sum_{x=c}^{w-1} w$
6. Joining process shj , $shj \leftarrow shj_{left} + shj_{right}$
7. End

Figure 2: Half-Join Algorithm

The PCA approach is used to lower the dimension (number of variables) on certain 20×20 pixel face photos that have been wavelet processed, but the resulting set of variables must still have characteristics that are somewhat similar to the previous variables. By converting connected native variables into an independent new variable that is a linear combination of the original variable, PCA is used to minimize the dimensionality of data.

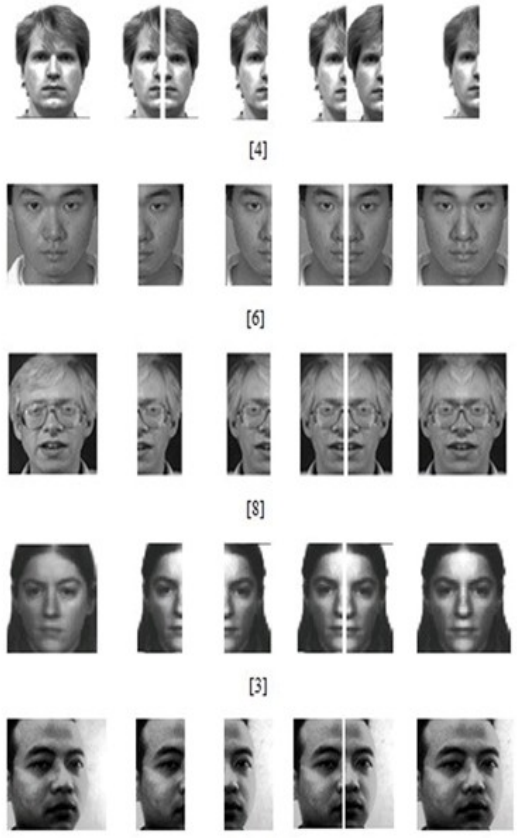

Figure 3: Proposed Half-Join image comparing with other methods

A huge variable's data is converted into a more manageable form of representation for other variables using principal component analysis. The wavelet level 3 results on some facial photos are transformed using the PCA method, but the resulting information almost exactly matches the original.

The classification step will next use the findings of the PCA procedure to compare the training data from the database to the testing data using the Mahalanobis distance approach [11].

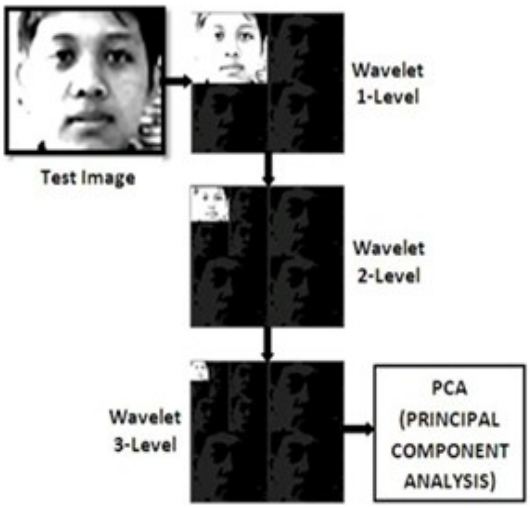

Figure 4: Three label wavelet decomposition

The classification step will next use the findings of the PCA procedure to compare the training data from the database to the testing data using the Mahalanobis distance approach [11].

IV. CONCLUSION

This study uses a two-lens camera (stereo vision camera) to reduce the risk of facial data on facial presences systems being faked. From the left lens and the right lens, which are the two capture points for stereo vision cameras, detectable face image data can be produced. Half of the left lens image and half of the right lens image are combined to create a new image using the half-join technique. With 3WPCA, it is possible to extract features from photos of small size without sacrificing the information contained therein.

The preprocessing half-join approach with the feature extraction 3WPCA method can provide a face recognition with high accuracy and quick face recognition times.

This technique can be employed in a face presence system to reduce the forging of facial data, such as the use of a person's face-like picture or facial images. This method can provide face recognition accuracy up to 98% and is superior to the face recognition method based on another half-face picture pattern in comparison test results.

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