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Design and Implementation of Secure System for Human Identification by Using Face and Gait Biometrics

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Abstract-In surveillance system, the identification of face and gait in video has received in sufficient attention. They have challenges in identification problems due to their large varying appearance and high complex pattern distributions. This paper introduces the face and gait identification system by feature extraction from their images and fusion of them. For face identification, the image captured by camera and that face image is represented by active lines face landmark points (ALFLP) feature vector. For gait, the gait identification is at a distance. Information utilized for the certain distinct phases and stances. The gait image is represented by active horizontal level (AHL) feature vector. The feature vectors of face and gait are fused by using effective fusion method. The experimental results expose the effectiveness of our proposed method against other identification methods to achieve better accuracies.
Keywords-Face Identification, Gait Identification, Feature Level fusion and biometric authentication.

I. INTRODUCTION

Human identity verification is a challenging to recognize a person from arbitrary views, especially when one is walking at a distance. To obtain optimal performance, a fusion system, which combines face and gait cues from video sequences is a practical approach to accomplish the human recognition. The biometric based technologies include identification based on physiological characteristics and behavioral traits. That characteristics are related to the shape of the body and pattern of behavior of a person .identifiers are distinctive, measurable characteristics used to label and describe individuals.

Identification of face is individually performed number of times in every day. In many face analysis and face modeling techniques have progressed significantly in last decade. It is natural, intrusive and easy to use. The basic face information consists of landmark points is set of coordinates that describes facial feature like eyes, nose and mouth corners. Face is an important field for many identification techniques. It is considered as a biometric authentication in many surveillance systems. The most important issue in Face identification is the features extraction from the Face's images of the person's images.

In this paper, the proposed method has introduced to identify person images, which is captured by camera. This method depends on the distance values between Face landmark points. Gain ratio feature selection has been used to choose the Active Lines that lead to the highest identification rate. The proposed method was evaluated against BioID Face database, to identify person from one image.

Gait identification has recently gained attention as a method of identifying individuals at a distance. It utilizing gait as identification for the certain distinct phases and stances. Human gait analysis is applicable for different areas like surveillance, medical diagnosis, car parking, banks, and video communication etc. It can be detected in low resolution video and it recognizable from distance. Gait identification is a term used in computer vision community to refer automatic extraction of visuals cues that characterize the motion of a walking person in video for identification purposes. For the gait image, gait feature extraction is extracted by horizontal alignments.

The normal size of image is done by proportionally resizing the each silhouette so that all silhouettes have same height. In gait person identification a new feature extraction algorithm is introduced. The extracted feature represents person's presence at different horizontal levels. Active Horizontal Levels are selected to create a set of horizontal levels that achieves the best identification results.

Multimodal biometric data used for the tasks sensory as well as non-sensory. The integration of multimodal biometric and their associated features or the intermediate decisions are perform an analysis task is referred to as multimodal fusion. Multimodal Biometric systems can be designed to operate in different scenarios: multiple sensors, multiple biometrics, multiple units of same biometrics, multiple snapshots of same biometrics, multiple representations and matching algorithms for the same biometrics. Thus,

identification of the frontal face is generally easier than that of the side face. However the situation happens to be reverse in case of gait. It is easier to identify the side view of gait than frontal view gait due to the motion characteristics in the side view of a walking person. These complementary properties of face and gait inspire fusion of them to get more accurate results.

II. LITERATURE ON RELATED WORK

In the surveillance systems, identity of the person for recognition, it cannot perform very well due to low quality video or inappropriate processing techniques. In previous system, it has been made visual based person identification through utilizing different biometrics, including face recognition, gait analysis, iris and fingerprint recognition. Each of these techniques work in highly controlled operating environments such as border control or immigration check points, pose and facial expressions. To the next generation security and surveillance requirement for just high security environments but also for day to day civilian access control applications need a robust and invariant biometric trait. Most of the behavioral biometrics is not unique enough to provide reliable human identification they have been proved to sufficiently highly accurate. The biometric techniques work in highly controlled operating environment.

Image fusion is a technique that used to integrate multiple images into a single image to retain more features, so that the fused image is more suitable for the human visual perception and computer processing. The new image should have more accurate, more comprehensive and more stable information compared with the input images. The advantages of image fusion are improving reliability and capability. Image fusion is a powerful tool used to increase the quality of image. Image fusion technique classified into two categories: direct image fusion and multi resolution image fusion. Multi resolution image fusion techniques based on pixel level fusion and feature level methods and direct image fusion technique based on decision level fusion. Levels of fusion are used for integrating data from two or more biometric systems. Fusion consists of image registration, which brings the input images to spatial alignment and combining the image functions in the area of frame overlap. Image registration works usually in four steps: Feature detection, Feature matching, Transform model estimation, Image re-sampling and transformation.

In feature level fusion method, the input images are first transformed to multi-resolution representations. The source images are segmented into adjacent regions and regions are extracted from the transform coefficients in each scale. For every segmented region some activity level are calculated and the regions are fused at all scales which are based on these activity levels. The fused image is obtained using the inverse transformation. In this feature-level methods are proposed that use soft computing algorithms to select the most important coefficients or regions from the source images, using the features extracted in transform domain. The feature level fusion attempt to process features within the image as the image feature and objects in the scene are more important than the individual pixels.

The discrete wavelet transform is one of simplest and commonly used in wavelet transform for image fusion. Discrete wavelet transform is a spatial frequency decomposition that provides a flexible multi-resolution analysis of an image. Discrete wavelet transforms (DWT), which are multi-resolution image analysis tools that decompose an image into low and high frequencies at different scales have been successfully used in a face and gait identification schemes as a dimension reduction technique and as a tool to extract a multi-resolution feature representation of a given face and gait image. The multi-resolution property of DWT enables one to efficiently compute a small sized feature representation that is particularly desirable for face and gait identification.

Presently there are several methods available on fusion of face and gait Biometric. For example, Xiaoli Zhou et al [1], introduced a new video-based recognition method to recognize non cooperating individuals at a distance in video who expose side views to the camera. Information from two biometrics sources, side face and gait, was utilized and integrated for recognition. For side face, an enhanced side-face image (ESFI). For gait, the gait energy image (GEI). Xin Geng1 et al [2], proposed the adaptive multi-biometric fusion, which dynamically adjusts the fusion rules to suit the real-time external conditions. Two factors that the relationship between gait and face in the fusion are considered i.e. the view angle and the subject-to-camera distance. L.Q.Shen et al [5], introduces to integrate information from gait and face for recognizing individuals at a distance in video. Gait energy image and side face image both of which integrate information over multiple frames in video. Alice J. O'Toole et al [6], presented the database contains a variety of still images and videos of a large number of individuals taken in a variety of contexts. Zhou and Bhanu[11], present a new approach that utilizes and integrates information from side face and gait at the feature level. Kale et al. [12] present a fusion of face and gait cues for the single camera. A view invariant gait recognition algorithm was employed for gait recognition.

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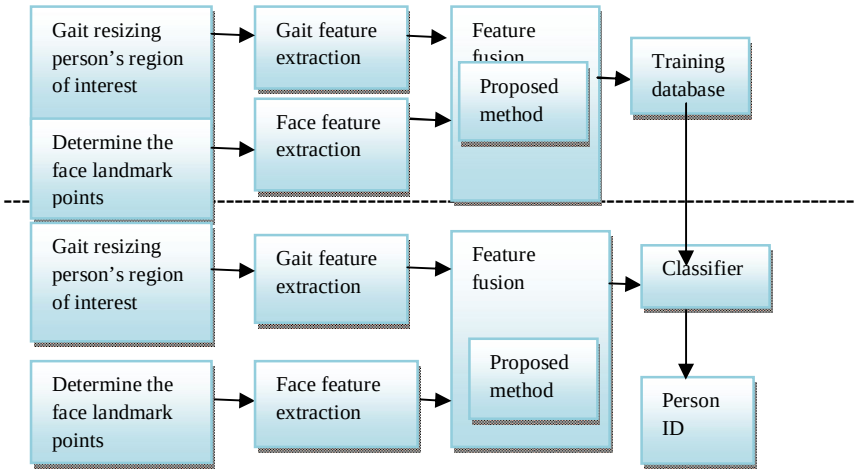
III. PROPOSED SYSTEM ARCHITECHTURE

(Training process)



(Testing process)

In proposed system the face and gait identification depends on the features in human face and gait with considering the issues of distance metrics and scales. The major contribution of this method is to fuse face and gait features carried out with help of image processing and neural network algorithm in MATLAB.

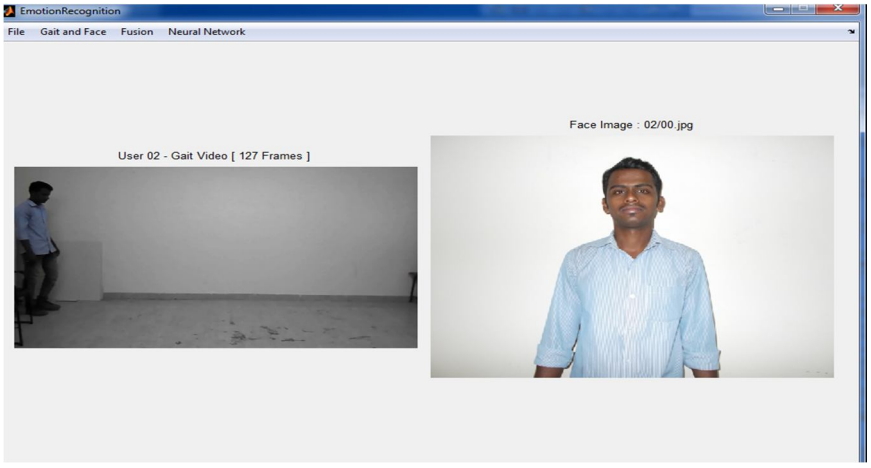
With the help of camera, images of face and gait are taken. The images and respective features points are recorded and this is used as database for further processing. The feature points represented using ALFLP (Active Lines Face Landmark Points) and AHL (Active Horizontal Levels) feature vector. Next step is feature fusion is carried out by face and gait feature points.

Neural network is chosen as a classifier for due to its well known technique as a successful classifier for many real applications. Neural network is selected as classifier because it gives high accuracy and basically used for nonlinearity detection. Hence, by using image processing and neural network technique the person ID will be estimated from face and gait feature points.

IV. EXPERIMENTAL RESULTS

A. Preprocessing phase

The preprocessing phase of face is to determine the face landmark points on the image in BioID face datasets. Mark up the active points with a numbers to the center and corners points of eyes, nose and mouth. The BioID face is largest database that is used in human identification using face. The preprocessing phase of gait is includes resizing the silhouette images in gait database to each pixels. Then, the resized silhouette is followed by the person's region of interest in dataset. The main reason for the preprocessing is the attempt to reduce the size of pattern vector and to isolate only information that distinguishes individuals for images.



B. Feature extraction phase

Each preprocessed face image contains landmark points. The discrete wavelet transform is decomposes the image with maximum

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possible lines that connect these points. The function of active lines face landmark points (ALFLP)algorithm the feature selection is the process of removing features from the data set that are irrelevant with respect to the task that is to be performed and it can be extremely useful in reducing the dimensionality of the data to be processed, reducing execution time and improving predictive accuracy.

On the other hand, each preprocessed gait image has been number of horizontal levels. In that we are using active horizontal levels algorithm (AHL) and the discrete wavelet transform to obtain the maximum possible effective horizontal levels that is used for person identification. At each horizontal level, the valid numbers of human pixels are recorded. Thus, for each silhouette a vector of the valid number of human pixels in these horizontal levels are recorded so as to obtain a vector of human pixels counter along all horizontal levels.

C. Proposed fusion method

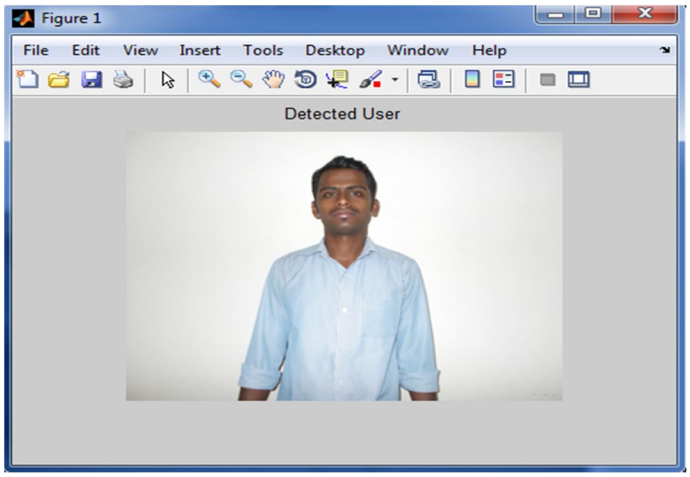
This proposed method depends on matrices properties for fusing the sequence of gait and face images which are represented by AHL (active horizontal lines), ALFLP (active lines face landmark points) features and discrete wavelet transform features for reducing the dimension of extracted features. Then, it calculates the Eigen vector by representing the fusion feature vector for the proposed method.

D. Training database

The database consists of fusion of gait and face landmark points

E. Classifier

The comparison of the face and gait fusion in training database and testing process is carried out by neural network classifier. The neural network is a mathematical model or Computational model based on biological neural networks. It consists of an interconnected group of artificial neurons and processes information using a connectionist approach. The Neural Network is built with a systematic step-by-step procedure to optimize a performance criterion. There are used the feed-forward neural network that allow signals to travel one way only; from input to output. The input layer takes the input fused features and distributes them to the hidden layers which do all the necessary computations and give it to the outputs.



V. RESULTS AND OBSERVATIONS

In this paper, the performance of our proposed feature fusion method was evaluated with neural network classifier. The used neural network classifier is a predictive model based on biological neurons placed in several layers. The input layer takes the input fused features and distributes them to the hidden layers which do all the necessary computations and outputs. The neural network is used to train the database and for non linear application, hence with the help of neural network we get the better results as compared to other methods. The fused features are used to train the neural network so that the system will be identifying the person ID. This proposed system will be used for human identification based on biometric technologies such as face and gait for security system. The image is captured and processing techniques are applied on to it so that face and gait biometric information available and also person is identify with the help of extracted features and hence this database is used to train the neural network so that it gives the person ID.

VI. CONCLUSION

In the proposed system, the feature level fusion using face and gait identification depends on the features in human face and gait, with considering the issues of distance metrics and scales. The major contribution of this method is to fuse face and gait features. These features are invariant under scale and transform. The results on database indicate that the proposed algorithm is to achieve a better accuracy.

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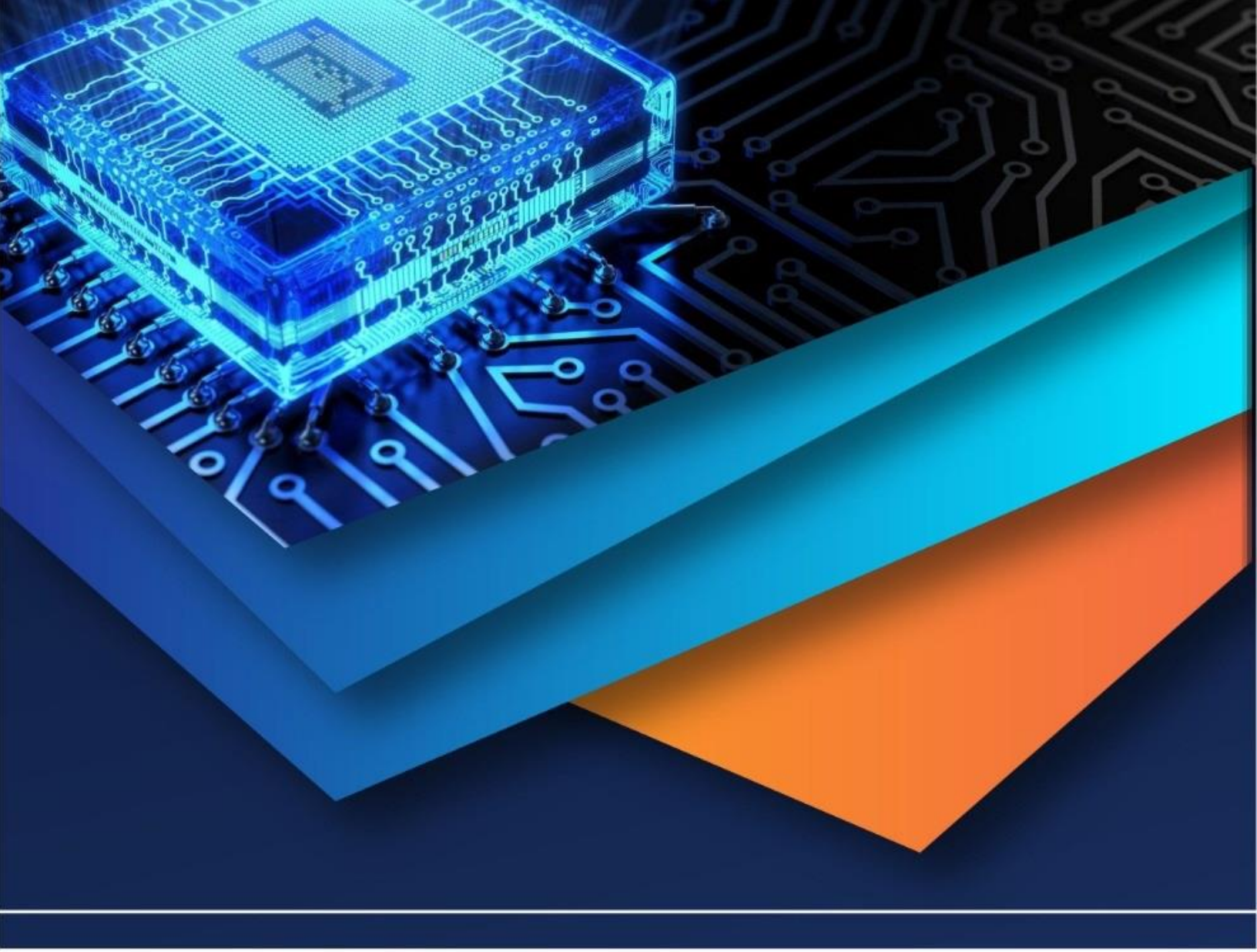

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