Fusion of Multiple Biometrics for Photo Attack Detection in Face Recognition System

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***Abstract*—**

A spoofing attack is a situation in which one person successfully masquerades as another by falsifying data and gaining illegitimate access. Spoofing attacks are of several types such as photograph, video or mask. Biometrics are playing the role of a password which cannot be replaced if stolen, so there is the necessity of counter-measures to biometric spoofing attacks. Face biometric systems are vulnerable to spoofing attack. Regardless of the biometric mode, the typical approach of anti-spoofing systems is to classify the biometric evidence which are based on features discriminating between real accesses and spoofing attacks. A number of biometric characteristics are in use in various applications. This system will be based on face recognition and lip movement recognition systems. This system will make use of client-specific information to build client-specific anti-spoofing solution, depending on a generative model. In this system, we will implement the client identity to detect spoofing attack. With this, it increases efficiency of authentication. The image will be captured and registered with its client identity. When user has to be authenticated, the image will be captured with his identity manually entered. Now system will check the image with respect to client identity only. Lip movement recognition will be done at time of authentication to identify whether client is spoof or not. If client is authenticated, then it will check for captured image dimension using Gaussian Mixture Model (GMM). This system also encrypts and decrypts a file by extracting parameter values of a registered face.

Keywords— Biometric system, Face recognition system, Spoofing, Anti-spoofing.

I. INTRODUCTION

Passwords and ID cards are commonly used to restrict access to a variety of systems. However, security can be easily breached when a password is revealed to an unauthorized user or a card is stolen by an impostor. Biometrics is better way than traditional security. Biometrics refers to the automatic identification or verification of an individual or a claimed identity by using certain physiological or behavioral traits associated with the person. Biometrics allows us to establish an identity based on 'who you are', rather than by 'what you possess' (e.g. an ID card) or 'what you know' (e.g. a password). Most of the installed biometric systems make use of fingerprints, hand geometry, iris, and face to establish a person's identity. In addition to enhanced security, biometric systems also introduce an aspect of user convenience. For example, they obviate the need to remember and maintain multiple passwords [1].

Face recognition system is the high possibility of the system being deceived or spoofed by non-real faces such as photograph, video clips or dummy faces. Anti-spoofing is a method used to automatically distinguish between real biometric traits presented to the sensor and forged one. The fact that the biometric traits cannot be kept secret should not be an obstacle for using biometrics. Such reasoning has inspired an ever increasing number of liveness detection and anti-spoofing algorithms for many biometric modes. Non-invasive, user friendly, fast, good performance, low cost is some of the requirement of good anti-spoofing technique. Anti-spoofing techniques are mainly classified into: texture, motion and life sign. Texture analysis techniques take the advantage of detectable texture patterns such as print failures, and overall image blur to detect attacks. Motion analysis differentiates the motion pattern between 3D and 2D faces. Detection of life signs can be of two types. First one assumes some known interaction from the user. The second category focuses on certain movements of certain parts of the face, such as eye blinking and considers those movements as a sign of life and therefore a real face. Some anti-spoofing techniques uses specific hardware device ensuring the presence of a living person in front of the system. Others combine multiple modalities, presuming that this increases the difficulty of spoofing the system .Among systems which depend on additional hardware or require user interaction, software-based solutions which use only the evidence taken by the biometric sensor may be the most favorable due to their inexpensiveness and convenience of use [2].

Face recognition is also useful in human computer interaction, virtual reality, database recovery, multimedia, computer entertainment, information security e.g. operating system, medical records, online banking., Biometric e.g. Personal Identification - Passports, driver licenses, Automated identity verification - border controls , Law enforcement e.g. video surveillances , investigation , Personal Security – driver monitoring system, home video surveillance system[3].

II. REVIEW OF LITERATURE

In [4], to resist the main fake approach, i.e., using a photo to spoof the face recognition system, a new technique based on the analysis of 2-D Fourier spectra is proposed. In [5], authors says that when an image is displayed or printed on a medium and captured again, the image obtained is technically an image

of the medium only. The main idea is to detect the properties of the medium in question and not what the medium seems to look like. The approach discussed in [6], analyses the texture of the facial images using multi-scale local binary patterns (LBP) and encodes the micro-texture patterns into an enhanced feature histogram. The results are then fed to a support vector machine (SVM) classifier. In [7], a novel and appealing approach to detect face spoofing using the spatiotemporal (dynamic texture) is introduced which is an extension of the highly popular local binary pattern operator. The key idea of the approach is to learn and detect the structure and the dynamics of the facial micro-textures that characterize real faces but not fake ones. In [8], face part detection and optical flow estimation are combined to determine a liveness score. The purpose of this system is to assist in a biometric authentication framework, by adding liveness awareness in a non-intrusive manner. The degree of difference between the fields generated by movements of 2D planes and 3D objects is used to distinguish between a 3D face and 2D photograph in [9]. The high correlation between the movements of the face region and the background as an indication of a spoofing attack is used in [10]. In [11], a linear fusion combination between static and video analysis is proposed. In [12], fusion of motion and texture based countermeasures under several types of scenic fake face attacks is addressed.

III. PROBLEM STATEMENT

The anti-spoofing systems are designed as binary classifiers whose task is to distinguish between real access and spoofing attack samples, with no regards to the client identity. The face anti-spoofing features proposed in the literature uses several aspects for differentiating between real accesses and spoofing attacks, like texture quality, motion patterns etc., and they show great discrimination capabilities between the two classes of samples. The extracted anti-spoofing features are influenced by the characteristics of the individual clients and may retain some client-specific information. This information may be useful to make better discrimination between the real accesses and spoofing attacks of a particular client. If client specific information is used with face anti-spoofing features, there would be great improvement over client-independent approaches which do not use information about the client identity. So, there is need to implement a face anti-spoofing system based on client identity.

The drawback of existing system is that face detection and client ID verification is done separately and score of both are combined to detect the user is spoofed or real. It takes more time to display the result. This drawback will overcome by proposed work by detecting face and if it is real then only it will go for client ID verification else it will display the user as a fake. The proposed system will upload and download the files by using various parameters of captured image as a key.

IV. PROPOSED WORK

In the proposed system client-specific information is used to build client-specific anti-spoofing solution, depending on a generative model. In proposed system, the client identity is implemented to detect spoofing attack. With this, efficiency of authentication is increased. The image is captured and registered with its client identity. When user has to be authenticated, the image is captured with his identity manually entered. Now system checks the image with respect to client identity only. If client identity is authenticated, then it will check for captured image dimension .The client identity spoofing can be detected with the help of lip movement at time of authentication. This system also encrypts and decrypts a file by extracting parameter values of a registered face of a registered client.

Architecture

A biometric system is a pattern recognition system that operates by acquiring biometric data from a user, extracting a feature set from the acquired data, and comparing this feature set against the template set in the database. Various modules of biometric system are designed for enrollment of client, for uploading a file and for downloading a file.

Enrollment of Client

Below fig 1 shows the architecture of the process of enrollment of users and other of file uploading.

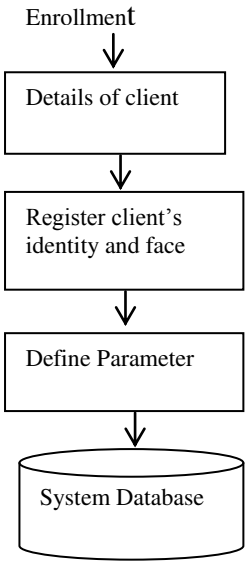

Fig 1: Enrollment of client

Enrollment of users:

1. Give all the details of the client.
2. Register the client identity and face of the client using sensor. This module captures thebiometric data of an individual.
3. Define the parameters of the biometric data. This is called as feature extraction. This module gets the biometric data and processes it to extract a set of salient or discriminatory features.
4. Store the extracted features in the database.

File Uploading

Below fig 2 shows the architecture of the file uploading process.

File uploading process:

1. The user interested for uploading files has to login first.
2. Check whether the interested user is valid or not. This is done by matcher module, in which the features extracted during recognition are compared against the stored templates to generate matching scores.
3. If match is found, then a file is encrypted using face parameters and total characters of files.
4. Take text to be encrypted, fetch parameter value to encrypt the text, store the encrypted values into system with field.

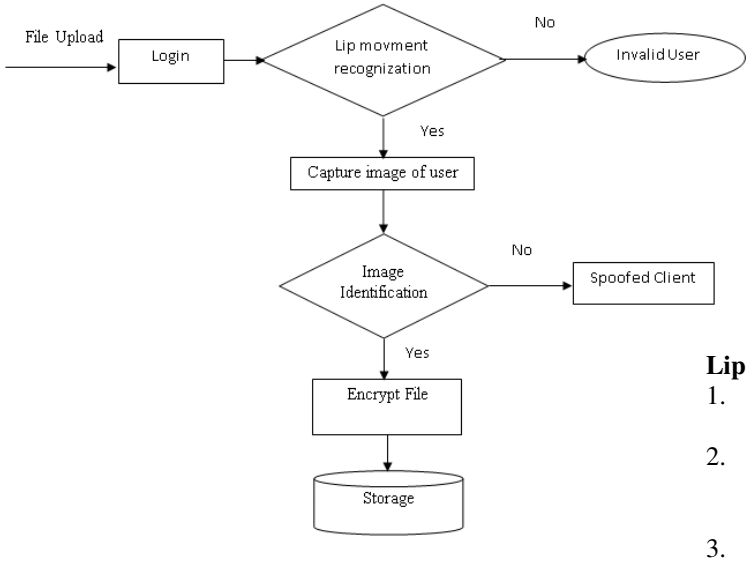

Fig 2: File Uploading Process

File Downloading

Below fig 6.3 shows the flow of file downloading process.

Following are the steps for downloading process:

1. The user interested for uploading files has to login first.
2. Lip movement recognition is done. If is it recognized then move further or considered the user as spoofed user.
3. Image of user is captured and processed for face identification. In the identification mode, the system recognizes an individual by searching the templates of all the users in the database for a match. Therefore, the system conducts a one-to many comparisons to establish an individual's identity.
4. If image is identified as a valid user then he is allowed to select a file for decryption.
5. Fetch parameter value to decrypt selected field. Decrypt the file and get plain text as output.
6. Decrypted file is displayed.

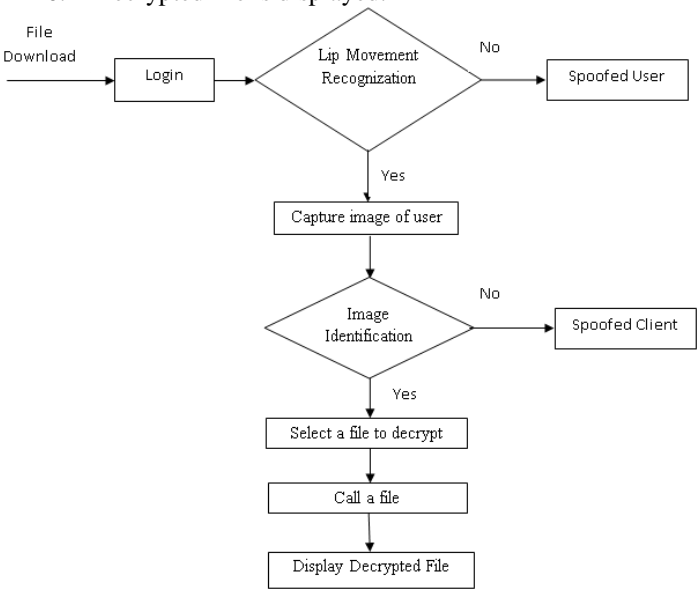

Fig 3: File Downloading Process

Lip Movement Recognition Algorithm

1. Face Localization: A user's face is detected in every image frame captured by a web camera.
2. Mouth Region Localization: Then, a mouth region is localized and its shift from the reference mouth position is calculated.
3. Detection of lip region and lip shape: A small region (blob) placed on user lip is found in mouth region. This blob is used as a starting condition for an iterative method for lips hape extraction.
4. Gesture Recognition: Lip shape and lip region image features are used by an decision system to classify gestures made by a user [17].

Algorithms
Architecture has various modules .Each module has its own specific use. Algorithms for different modules are given below.

Algorithm for Registration of New User
Step1: Capture the image of user.
Step2: Extract Features of face from the image.
Step3: Detect the mouth region. If mouth region is detected, goto step 4 else go to step 6.
Step4: Display Message" Human Face"
Step5: Person ID is generated for new user and user is registered.
Step6: Display Message "No Human Face".

Algorithm for Authentication for User
Step1: Enter the Person ID.
Step2: Capture Temporary image of the user.
Step3: If features of ID image are matching with Temporary image then go to step 4 else go to step 5.
Step4: Display message "Authenticated User".
Step5: Display message "Unauthenticated User".

Algorithm for Client Identity for User
Step1: Capture the image of user and create three temporary files..
Step2: Extract Features of face from the image.
Step3: Detect the mouth region. If mouth region is detected, goto step 4 else go to step 5.
Step4: Display Message" Human Face"
Step5: Display Message "No Human Face".

Algorithm for Lip Movement
Step 1: Temporary images are compared with each other.
Step 2: Total data and matched data is calculated.
Step 3: Total matched data percentage is calculated.
Step 4: If the total matched data percentage is between 90 % to 95%, then lip movement is present otherwise no lip movement.

V.RESULTS AND DISCUSSIONS

The authorized interested user has to register his image with its identity, if he is using the system first time. After enrollment of the image and its identity, the system checks for the authentication. If user is authenticated, the system goes for the detection of lip movement. If valid lip movement detection occurs, system results in valid user otherwise results in spoofing attack. The snapshots of results are given below.

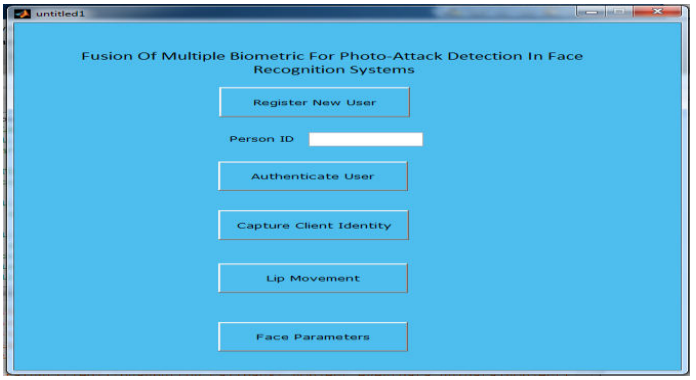

Fig 8.1 Main page

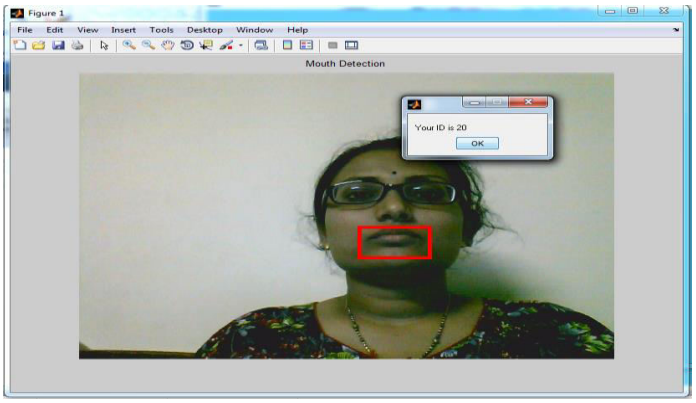

Fig 8.2 Displaying User id

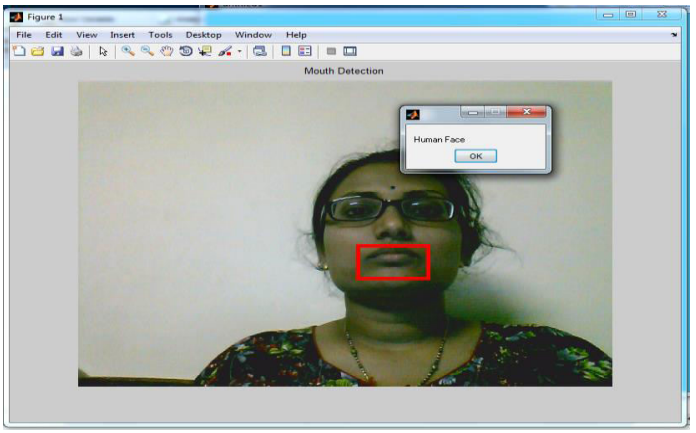

Fig 8.3 Detects the Human Face

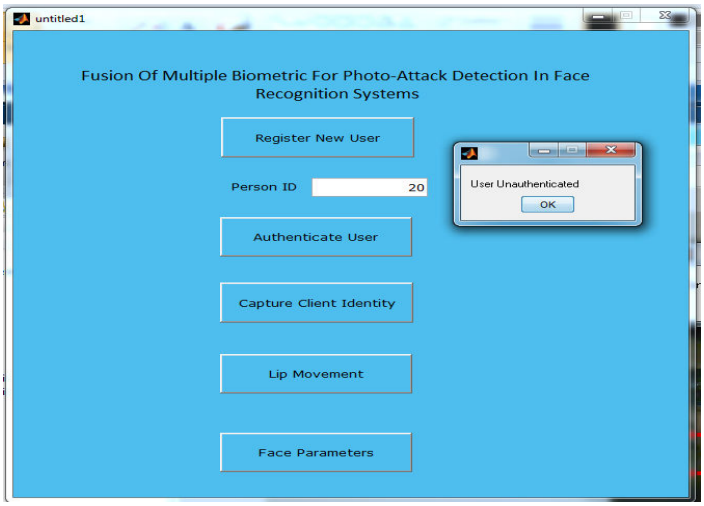

Fig 8.4 User Authentication

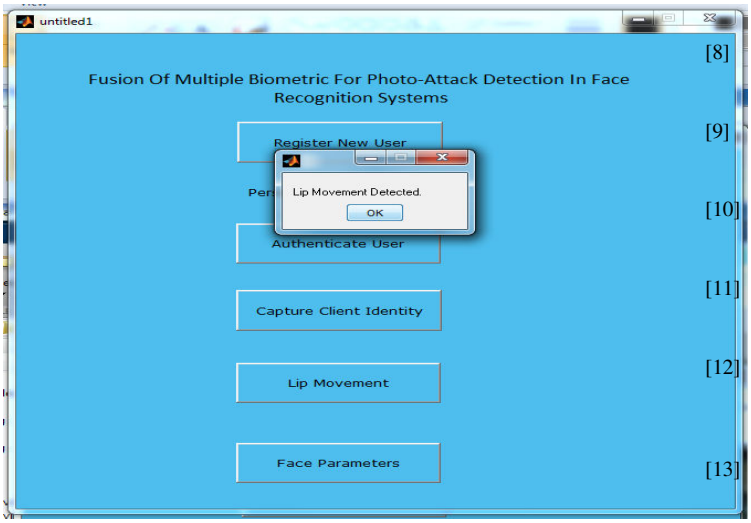

Fig 8.5 Lip Movement Detection

VI .CONCLUSION AND FUTURE SCOPE

Anti-spoofing systems are most frequently designated to secure and work in cooperation with biometric recognition systems. This system makes use of the information about the identities of the enrolled clients to improve the performance of anti-spoofing systems. A client-specific anti-spoofing system is implemented based on generative model which use client identity information to detect spoofing attacks. Use of client identity information gave a great help in successfully detecting spoofing attacks. Performance of this anti-spoofing system is better as compared to the existing anti-spoofing systems which does not use information related to client identity. This system encrypts and decrypts a file only if there is genuine user.

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