SECURE FACE SPOOF DETECTION ON ANDROID PLATFORM

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ABSTRACT

Now a day, smart phone users are increasing rapidly. Information access from Smart-phones and tablets has become main stream both in business and personal environments over the last years. The use of these devices for accessing services like social networks, email or electronic commerce and banking has surpassed the access from traditional computers, turning mobile devices into essential tools in our everyday life. People use simple passwords, they reuse them on different accounts and services, passwords can be shared and cracked, etc. As a result, biometric technologies are now offered as alternatives to passwords, including face authentication on devices with front-facing cameras. However, face authentication is vulnerable to spoofing attacks, to address these issues with face authentication, we take the first step to design Secure Face Detection System On Smart-phone for device unlock. Meanwhile, most of existing databases only concentrate on the antispoofing of different kinds of attacks and ignore the environmental changes in real world applications. In proposed system, we focus on public-domain face spoof will show that the proposed approach is effective in face spoof detection for both replay attack and printed photo attack.

Keywords : - *Image aliasing, smart phone security, phone unlock, print attack, replay attack etc.*

1. INTRODUCTION

Security in the access to information is one of the most important issues to consider in mobility scenarios. Passwords have been the usual mechanism for user authentication for many years. However, there are many usability and security concerns that compromise their effectiveness. People use simple passwords, they reuse them on different accounts and services, passwords can be shared and cracked, etc. The amount of different accounts and passwords we deal with these days contributes in making harder the proper usage and maintenance. As a result, we often see news and reports that alert of stolen accounts and passwords. This problem becomes critical in mobile devices, since they can be easily lost or stolen. Nevertheless, mobile devices can also become part of the solution, providing increased levels of security due to their new authentication options and capabilities.

As the increasing deployment of face recognition in a variety of applications, its security concern becomes increasingly important. Like the other biometric modalities, a major security issue is to detect the spoofing attack. Traditionally, photos and videos are the two medium to carry out the face spoofing attack. In order to detect them, numbers of methods have been proposed and achieved promising results.

In this paper, we focus on video replay attacks (display video or photo on a screen) because these attacks are easier to launch than either printed photo attack. Replay video attacks can be easily launched simply using a Smartphone to obtain a photograph or video of the target subject. We study the problem of face spoof detection on Smartphone using a large unconstrained Smartphone spoof attack database, and provide a sample face spoof detection system running on Android. This paper expands upon our preliminary work in the following ways:

- We analyse the image distortion of print and replay attacks using different
    1. Intensity channels (R, G, B and grayscale)
    2. Image regions (whole face image, detected face)
    3. Feature descriptors
- Analyses of face liveness.
- Determining the spoof faces by comparing RGB colour value with existing face and live face smile and eye detection to efficiently reject
- Verifying the drawn conclusion by using detected face and RGB colour value.
- Implementation of the proposed method on Android Smartphone

2. LITERATURE SURVEY

X. Tan, Y. Li, J. Liu, and L. Jiang, present a real-time and non-intrusive method to address this based on individual images from a generic web camera. The task is formulated as a binary classification problem, in which, however, the distribution of positive and negative are largely overlapping in the input space, and a suitable representation space is hence of importance. Using the Lambertian model, we proposed two strategies to extract the essential information about different surface properties of a live human face or a photograph, in terms of latent samples. Based on these, we developed two new extensions to the sparse logistic regression model which allow quick and accurate spoof detection.

J. M¨a¨atta, A. Hadid, and M. Pietik¨ainen, proposed to approach the problem of spoofing detection from texture analysis point of view. Indeed, face prints usually contain printing quality defects that can be well detected using texture features. Hence, they presented a novel approach based on analyzing facial image textures for detecting whether there is a live person in front of the camera or a face print. This provides a unique feature space for coupling spoofing detection and face recognition.

Z. Zhang, J. Yan, S. Liu, Z. Lei, D. Yi, and S. Z. Li, present a face anti-spoofing database which covers a diverse range of potential attack variations. Specifically, the database contains 50 genuine subjects, and fake faces are made from the high quality records of the genuine faces. Three imaging qualities are considered, namely the low quality, normal quality and high quality. Three fake face attacks are implemented, which include warped photo attack, cut photo attack and video attack.

J. Komulainen, A. Hadid, M. Pietik¨ainen, A. Anjos, and S. Marcel, present address issue by studying fusion of motion and texture based countermeasures under several types of scenic face attacks. They provide anintuitive way to explore the fusion potential of different visual cues and show that the performance of the individual methods can be vastly improved by performing fusion at score level. The Half-Total Error Rate (HTER) of the best individual countermeasure was decreased from 11.2% to 5.1% on the Replay Attack Database.

J. Galbally, S. Marcel, and J. Fierrezin presented a novel software-based fake detection method that can be used in multiple biometric systems to detect different types of fraudulent access attempts. The objective of the proposed system is to enhance the security of biometric recognition frameworks, by adding liveness assessment in a fast, user-friendly, and non-intrusive manner, through the use of image quality assessment. The proposed approach presents a very low degree of complexity, which makes it suitable for real-time applications, using 25 general image quality features extracted from one image.

D. Crouse, H. Han, D. Chandra, B. Barbello, and A. K. Jain, worked on a face-based continuous authentication system that operates in an unobtrusive manner. This Paper presented a methodology for fusing mobile device (unconstrained) face capture with gyroscope, accelerometer, and magnetometer data to correct for camera orientation and, by extension, the orientation of the face image. But all the function are not perform on device and require separate server for matching.

S. Tirunagari, N. Poh, D. Windridge, A. Iorliam, N. Suki, and A. Ho, proposed a classification pipeline consisting of DMD, Local Binary Patterns (LBP), and Support Vector Machines (SVM) with a histogram intersection kernel. They advanced the state of the art in facial anti-spoofing by applying a recently developed algorithm called Dynamic Mode Decomposition (DMD) as a general-purpose, entirely data driven approach to capture the above liveness cues. The pipeline of DMD+LBP+SVM proves to be efficient, convenient to use, and effective. In fact only the spatial configuration for LBP needs to be tuned. The effectiveness of the methodology was demonstrated using three publicly available databases: print-attack, replay-attack, and CASIA-FASD.

D. Wen, H. Han, and A. K. Jain, they proposed an efficient and rather robust face spoof detection algorithm based on Image Distortion Analysis (IDA). Four different features (specular reflection, blurriness, chromatic moment, and color diversity) are extracted to form the IDA feature vector. The proposed approach is extended to multi-frame face spoof detection in videos using a voting based scheme. We also collect a face spoof database, MSU Mobile Face Spoofing Database (MSU MFSD), using two mobile devices (Google Nexus 5 and MacBook Air) with three types of spoof attacks (printed photo, replayed video with iPhone 5S and iPad Air).

W. Kim, S. Suh, and J.-J. Han, proposed a real-time and nonintrusive method based on the diffusion speed of a single image to address this problem**.** In particular, inspired by the observation that the difference in surface properties between a live face and a fake one is efficiently revealed in the diffusion speed, They exploited antispoofing features by utilizing the total variation flow scheme. One important advantage of the proposed method is that, in contrast to previous approaches, it accurately identifies diverse malicious attacks regardless of the medium of the image.

Z. Boulkenafet, J. Komulainen, and A. Hadid, introduces a novel and appealing approach for detecting face spoofing using color texture analysis. They exploit the joint color texture information from the luminance and the chrominance channels by extracting complementary low level feature descriptions from different color spaces. More specifically, the feature histograms are computed over each image band separately.

3. PROBLEM STATEMENT

Face recognition is an advance method used to unlock Smartphone but hacker can easily attack existing systems using replay attack, printed photo, 3D mask etc. So it is necessary to develop a novel approach for face spoofing detection to provide more security.

4. EXISTING SYSTEM

There are many approaches implemented in face spoofing detection. The existing methods for face spoofing detection can be classified into four groups: user behavior modelling, user cooperation, methods that require additional software and hardware and methods based on data-driven characterization.

The first method user behavior modelling captures the user behavior with respect to acquisition sensor (e.g. eye blinking or small head and face movements) to determine whether a captured biometric sample is synthetic. In this method attack is detected based on eye blinking modelling under the assumption that a spoofed attack with photographs differs from valid access by the absence of movements.

The second method user cooperation is used to detect spoofing by asking challenging questions or by asking the user to perform specific movements which adds extra time and removes the naturalness inherent to biometric systems.

The third method that require additional hardware (e.g., infrared cameras or motion and depth sensors) use the extra information generated by these sensors to detect possible clues of an attempted attack. The final method based on data-driven characterization looking for clues and artifacts that may detect attempted attack and exploit only the data captured by acquisition sensor. Methods that require additional hardware have the disadvantage of not being possible to implement in computational devices that do not support them, such as smart phones and tablets.

5. PROPOSED SYSTEM

In our propose system, we implementing an android application for spoof face detection. For this purpose we will use two approaches as follows.

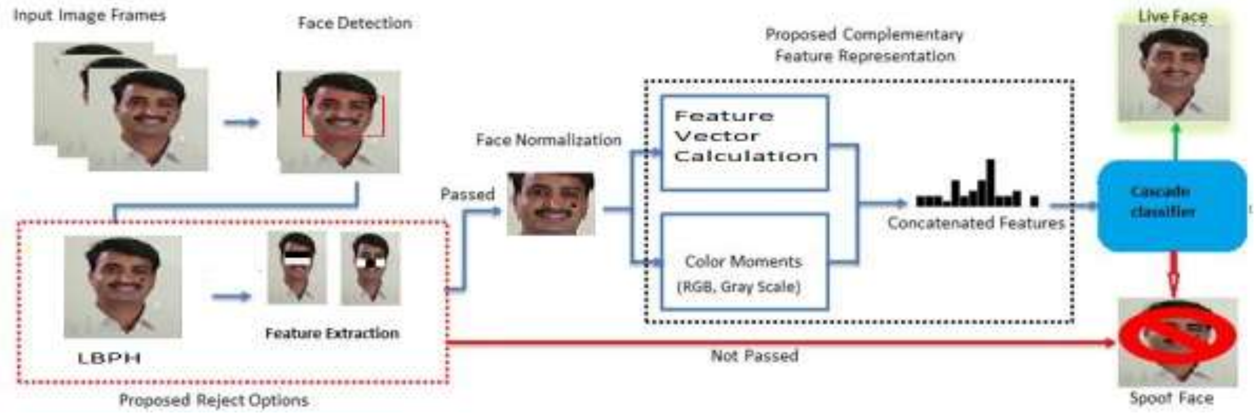


Fig. Proposed System

5.1 Face Detection Framework

The face detection algorithm proposed by Viola and Jones will be used in our proposed system. The face detection algorithm looks for specific HAAR features of a human face. When one of these features is found, the algorithm allows the face candidate to pass to the next stage of detection. A face candidate is a rectangular section of the original image called a sub-window. Generally this sub-window has a fixed size. This sub-window is often scaled in order to obtain a variety of different size faces. The algorithm scans the entire image with this window and denotes each respective section a face candidate. The algorithm uses an integral image in order to process HAAR features of a face candidate in constant time. It uses a cascade of stages which is used to eliminate non-face candidates quickly. Each stage consists of many different HAAR features. Each feature is classified by a HAAR feature classifier. The HAAR feature classifiers generate an output which can then be provided to the stage comparator. The stage comparator sums the outputs of the HAAR feature classifiers and compares this value with a stage threshold to determine if the stage should be passed. If all stages are passed the face candidate is concluded to be a live face.

5.2 Face Recognition Framework

Despite of the fact that at this moment already numerous of commercial face recognition systems are in use, this way of identification continues to be interesting topic for researchers. This is due to the fact that the current systems perform well under relatively simple environments, but perform much worse when variations in different factors are present, such as pose, viewpoint, facial expressions, time, and illumination. The goal of my proposed system is to minimize the influence of these factors and create robust face recognition system.

5.3 Registration Phase

In registration phase we will use face detection framework. We provide sample faces as input to store image in database. Image has stored in encrypted format on database in smart phone. While storing face image in database, system will extracting image features using face detection framework and storing their RGB values and other values. User need to register once time while using this application. After saving their details in application user will ready to use this app by login their credentials.

5.4 Login Phase

While login user need to provide sample face as input to spoof detection application. After providing face input to the application face detection and recognition framework will work. Face recognition framework will retriving their features from the system while giving input face to the app. Then feature extracted face images values will matching with existing face images which is store at the time of registraton. We are using eye and smile detection techniques for face liveness. If system found real face liveness then it will unlock the smart phone otherwise doesn’t open lock. By this way we will identify the real face liveness and spoof detection system on smart phone.

6. FACE RECOGNIZATION USING LOCAL BINARY PATTERNS

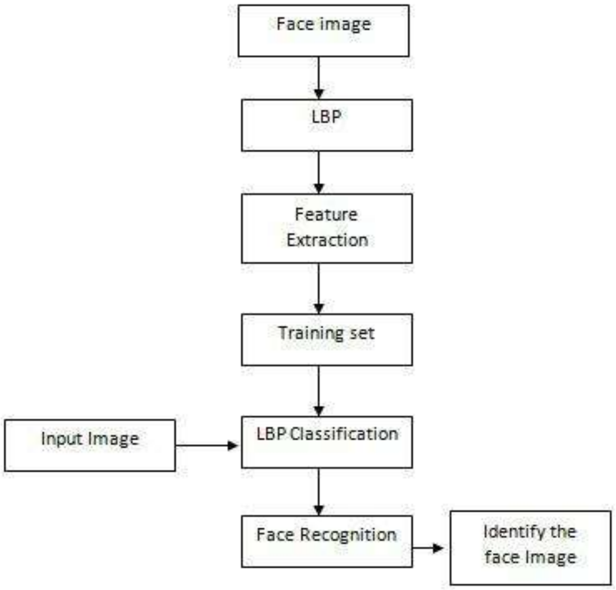
We explained how the LBP-method can be applied on images (of faces) to extract features which can be used to get a measure for the similarity between these images. The main idea is that for every pixel of an image the LBP-code is calculated. The occurrence of each possible pattern in the image is kept up. The histogram of these patterns, also called labels, forms a feature vector, and is thus a representation for the texture of the image. These histograms can then be used to measure the similarity between the images, by calculating the distance between the histograms.

The image with only pixels with uniform patterns still contains a considerable amount of pixels, namely 99 % of the original image. So, 99% of the pixels of the image have uniform patterns. Another striking thing is the fact that, by taking only the pixels with uniform patterns, the background is also preserved. This is because the background pixels all have the same colour and thus their patterns contain zero transitions. It also seems that much of the pixels around the mouth, the noise and the eyes (especially the eye have uniform patterns.

6.1 Feature Vector Calculation

Once the Local Binary Pattern for every pixel is calculated, the feature vector of the image can be constructed. For an efficient representation of the face, first the image is divided into K2 regions. In figure a face image is divided into 82= 64 regions.

For every region a histogram with all possible labels is constructed. This means that every bin in a histogram represents a pattern and contains the number of its appearance in the region. The feature vector is then constructed by concatenating the regional histograms t one big histogram.



For every region all non-uniform patterns are labeled with one single label. This means that every regional histogram consists of P (P − 1) + 3 bins: P (P − 1) bins for the patterns with two transitions, two bins for the patterns with zero transitions and one bin for all non-uniform patterns. The total feature vector for an image contains K2 (P (P− 1) + 3) bins. So, for an image divided into 64 regions and eight sampling points on the circles.

If an image is divided into k × k regions, then the histogram for region (kx, ky), with kx belongs to {1, . . . ,k} and ky belongs to{1, . . . , k}, can be defined as

$Hi\ (Kx\ , Ky) = \Sigma I\ \{LBPP,R(x,y)\ x,y = L(i)\},\ i = 1,$

$\ldots\ldots\ldots.\ P(P - 1) + 3$

6.2 Algorithm

To implement the face recognition in this research work, we proposed the Local Binary patterns methodology. Local Binary

Pattern works on local features that uses LBP operator which summarizes the local special structure of a face image.

The Algorithm is defined as,

Input: Training Image set.

Output: Feature extracted from face image and compared with centre pixel and recognition with unknown face image.

```
1. Initialize temp = 0
2. FOR each image I in the training image set
3. Initialize the pattern histogram, H = 0
4. FOR each center pixel tc belongs to I
5. Compute the pattern label of tc, LBP(1)
6. Increase the corresponding bin by 1.
7. END FOR
8. Find the highest LBP feature for each face image and combined into single vector.
9. Compare with test face image.
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7. CONCLUSION

Spoofing using photographs or videos is one of the most common methods of attacking face recognition and verification systems. Spoof face detection and tracking is being a challenge for many researchers with real time applications. A simple and effective method is proposed in this paper. We are the first time proposed the spoof face detection using HAAR algorithm with the help of smart phone database. We also identify the face liveness using eye and smile detection in propose system. Both analysis and evaluation results confirm that our work can provide an effective solution to identify the spoof faces while unlocking the Smart phone. In future, more work should be on facial expression to identify the system easily.

8. ACKNOWLEDGEMENT

We express gratitude to our lead authorities such as College, University. The guide and the Prof. of our Department Mrs. S.E. Ingale in valuable guidance for the success of this project.

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