

# Survey on Face Liveness Detection

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**Abstract**— Biometric systems is a security technology that uses information about a person to identify the real person. To develop advance security system for detecting spoof attack ,face liveness detection technology has been proposed. The main trouble of applying face recognition is that system not able to detect spoofing faces ( ex – 2D image). The objective of this work is to find spoof attack in our system .

**Keywords**— Face liveness, Biometric systems, Spoofing attacks, Illumination characteristic, Face spoof detection

## I. INTRODUCTION

Biometric system is generally used for security functions in face recognition like fingerprint or iris detection and hand writing verification. Face detection is a technology which is used in many number of application such as facial motion capture, eye blinking, facial recognition to analyze human faces in digital pictures[1]. In modern and advanced technologies for security purpose, face recognition technology has developed rapidly in few years. Although like other biometric system face recognition also quickly spoofed. Image and video of a person (character, individual) can be easily accessible from internet or social media platform. Usually spoof method are classified on proof provided verification system such as picture or video stolen from social media or internet [2]. A secure systems needs liveness detection guard to secure against spoofing . For securing the system face liveness detection method is the best technique to avoid spoof attacks on our system.

Such many methods are available for face recognition but on the other hand face recognition method are unsafe and also poorly unsecured and can easily be fooled. In todays era of technology many advanced methods are their to fool such system using spoofing. To avoid spoofing from unsecured face recognition , face liveness detection is proposed.

In our survey of face liveness detection , liveness is detected by adopting some different methods . In this section various method for detecting face liveness are proposed. In liveness detection, anti-spoof depends on feature used like eye blinking, lip moment and various facial expressions. In this proposed work photo ,mask, video image can be easily determinate (recognized) depends on some characteristic of face . In the next section a reviews on different face liveness detection technology and other methods are proposed.

## II. LITERATURE SURVEY

Depend on methods used to avoid spoofing, liveness detection methods classified mainly as motion based, frequency based or quality based.

Gang Pan et al. [3] proposed a constant liveness discovery technique so as to verify photo parodying in face acknowledgment, by perceiving eyeblinking, which is a nonintrusive way. Eye squinting is extremely mind boggling structure to get it. The objective of this face liveness location technique is to oppose the caricaturing assault in non-intrusive manner without any external hardware except a generic camera. Physiological activity of eye blink is to instantaneously close and open eye lids, it helps to spread the tears across and removes irritants from surface. Normally blinking rate of human being is around 15 to 30 eyeblinks per minute, that is human blinks once after every 2 to 3 seconds and blink time is about 205 millisecond's. So generic camera can easily capture face video with more than 15 frames per second, so time duration between frames is not more than 70 milliseconds. Then camera can capture two or more frames at the time of face in looking in camera. It makes a clue to use eyeblinking to use against face spoofing.

Jukka et al.[4] proposed a technique of face spoof attack detection using micro texture analysis. The concept to highlight the differences of micro texture in the feature space. For describing micro texture and spatial information the author accept local binary pattern (LBP). The vector in this feature are then given to SVM (support vector machine) classifier as a input which determine whether the micro texture pattern is fake or live.

Kollreider et al. [5] present a movement based counter-measure that check the connection between distinct part of the face utilizing optical stream field. In this methodology, the information is viewed as a phony if the optical stream field on the focal point of the face and on the focal point of the ears present a similar heading. The work was assessed utilizing the subset 'Head Rotation Shot' of the XM2VTS database whose genuine access was the recordings of this subset ,and the assaults were created with printed copies of those information. Using this database, which was not available, an equal error rate (EER) of 0.5% was obtained.

August 2010 Gang Pan, Lin Sun, YuemingWang and ZhaohuiWu [6] present a non-intrusiveface liveness detection system by combining eyeblink and scene context. Antispoofing clues i.e inside a face (eye blinks) and outside a face(scene context) are owned in this system. Eyeblinks are working for against caricaturing of photos and 3D models while the scene settings are utilized for hostile to parodying of video replays. Outside-face intimations can fill in as a compelling enhancement part to inside-face pieces of information. Here eyeblink conduct are executed in a Conditional Random Field system and consolidated with a discriminative proportion of eye states. There are three-state set for eyes,  $Q = \{\alpha :open, \gamma : close, \beta :ambiguous\}$ . With the possibility of the versatile boosting calculation, a genuine esteem discriminative component for the eye picture, called eye closity,  $U(I)$  is characterized as estimating the level of

Eye's closeness. In the event that the estimation of closity is higher, at that point the level of eye closeness is additionally higher. For scene setting examination, left and right parts close to the recognized face are taken as scene area for its rich enemy of satirizing intimations. The decision of locale choice depends on : (1) The top and base parts almost a face are hair and neck yet not the scene; (2) The district a long way from a face isn't considered as scene setting, in light of the fact that the parodying video scene does not show up in that choose area. Scene setting investigation needs to work fine despite the fact that a noise is available in the video, for example, changes of enlightenment, for strong scene comparison..

Anjos et al.[7] proposed a method based on motion correlation for checking liveness of person. This method classified in motion detection. This approach works on correlation between head rotation of user and its background. To find correlation author uses fine grained motion direction. Optical flow is used to find the direction of motion. This approach is easy process but require multiple frames to check liveness, so user should be co-operative.

Maatta et al. [8] proposed a method based on local binary pattern [LBP], it extracts the micro-textures which are used to avoid spoofing attack. This method analyses the facial image textures for detecting whether live person or fake image in front of camera. Textures of face image are extracted using LBP which gives a robust method compared to other methods.

Wang et.al.[9] uses Fourier spectra of single image or sequence of images to find the face liveness. Structures of live face and fake face such as image or video are different. In this method albedo surface normal are used to differentiate fake and live face. This gives the different light reflectivity. Fourier spectra of live and fake face having so much difference which helps to decide easily fake and live face i.e. Fourier spectra of fake face contains high value frequency component than live face frequency component

### III. EXISTING METHODOLOGIES FOR FACE LIVENESS DETECTION

To differentiate spoof and live face some fundamental illumination characteristic ,texture factor and other image properties are used. Light reflected from live face is random because 3D structure of the nose ,eyes of the live face. But when we use 2D image (spoo image) light reflected from 2D image is uniform because the surface is plane. So according to this phenomena of reflecting light gives values so that we get differentiation in fake and live face.

For 3D image ,these fundamental features are input to SVM classifier to which easily detect face liveness of person. Machine learning , SVM ( support vector machine ) are supervised learning models with associate learning algorithm that detect data used for classification and feature extraction analysis. As show in figure 1(a) light reflected from 2d image is uniform while light reflected from fig (b) 3d image is random. The entire thought depended on the way that the light energies diffuse gradually on a uniform 2D surface, while these energies move quicker on a 3D live face on account of its non-consistency.

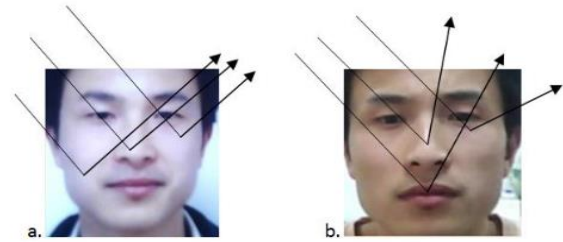


Figure-1: Illumination characteristics of (a) fake (b) live face

### IV. FACE LIVENESS DETECTION BASED METHODS

Lih-heng chan[10] proposed a method based on two subspace method i.e, Principal Component Analysis (PCA) and Linear Discriminant Analysis (LDA) of facial biometric for facial biometric. Both the methods are explain below;

#### (A) PCA( principal component analysis) Algorithm :

PCA used for dimension reduction where original face are projected into lower dimensional. This method hold some variation in image and also reduce dimensionality of image, this method is most widely used for face image. It converts image data into feature space of known image. Those features are principal component of set of face. The projection operation listed an individual face by a weighted sum of the Eigen faces features. So to identifying individual face, only compare these weight to those individual. Eigen object recognizer class applies PCA on each image, the result of which be an Eigen Values. To execute PCA some steps be followed:

- Step 1 Calculate mean of data and subtract it from each variable.
- Step 2 Form a covariance Matrix.
- Step 3 Obtain eigen value and eigenvectors from covariance matrix.
- Step 4 Choose a name for a matrix of vector.
- Step 5 Multiplied feature vector by transposed data.

#### (B) LDA ( linear discriminant analysis ) Algorithm :

This is another dimension reduction method. LDA maximize between class matrix and minimize within class matrix measure.For better discriminant LDA technique was proposed. LDA-based methods outperform PCA for both face recognition and verification. This method based on appearance method. In 1930 Fisher created direct discriminant examination for face recognizable proof which shows victory in face acknowledgment process [11].The bad mark of LDA is that inside the class the dissipate network is constantly single, since the quantity of pixels in pictures is beyond what the quantity of pictures so it can expand location of shortcoming rate if there is a distinction in posture and lighting condition inside same pictures. So to beat this issue numerous calculations has been proposed.

Anyway the fisher faces method utilizes the benefit of inside class data so it limits the variety inside class, so the issue with varieties in similar pictures, for example, lighting varieties can be defeated [12].

#### (C) FREQUENCY BASED FEATURE EXTRACTING :

Gahyun Kim [13] proposed a fake face detection method which is based on frequency and texture analysis method. Extracting frequency information from given image may follow several steps. Firstly, facial image transformed into frequency domain by using discrete fourier transform. The Fourier-transformed result is shifted so that the zero-frequency component lies in the center of the spectrum. The result is then divided into several categories in the form of concentric ring. The difference of two neighbouring ring radius is set to 1. From an image, a set of 32 concentric ring are generated from an image. Each ring represent a corresponding region. Ring with small radius contain low frequency information of image.

#### (D) TEXTURE BASED :

For examine texture features taken from live face, this paper utilize local binary pattern (LBP). LBP is used for texture information/features of the image. LBP assigns a code for each pixel by considering the intensity differences between the pixel and its neighbors.

#### (E) VARIABLE FOCUSING BASED ANALYSIS :

The technique for face liveness identification utilizing variable centering was executed by Sooyeon Kim et al. [14]. The essential of this strategy is that it depends on the level of Depth of Field (DoF). The DoF is the space between the closest and most remote articles in a given core interest. To build the liveness location, the creators have expanded out focussing impact for which the DoF ought to be small(narrow). In this technique (SML) is utilized for focus value measurement. Two sequential picture focusing on camera, one is focus closest to camera lens (nose) and one is focused on farthest to camera lens (ears). The depth gap is enough to express 3d effect. The difference of pattern between real and fake face is used to detect live face. For testing, the creators have considered False Acceptance Rate (FAR) and False Rejection Rate (FRR).

#### (F) MOVEMENT OF THE EYE BASED ANALYSIS :

The strategy dependent on the examination of development of eyes was given by Hyung-Keun Jee et al. [15] for inserted face acknowledgment framework. The fundamental supposition that will be that in view of flickering and uncontrolled developments of the students in eyes, there ought to be huge shape variations.. Firstly, center point of both eyes is recognized in input face image. Using identifying both eyes, face region are normalized and eye regions are extracted. After extracting eye regions, each

binarized eye regions are compared and variation is noted. In the event that the outcome crosses the limit, the information picture is perceived as live face, if not, it is segregated to the photo. For detecting of the eye regions, the authors used the

fact that the intensity of the eye region is lower than the face region if the image is taken as a 3D curve. To discover the eye area, first, Gaussian separating to the face picture is done, with the goal that the smooth 3D bend is acquired. In the bend, we remove all the nearby essentials utilizing the strategy for the inclination plummet. To lessen the invalid eye, the eye classifier, which is arranged by Viloa's AdaBoost strategies, is utilized. From that point onward, face locale is being standardized by about a size and turn by utilizing focus purpose of eyes in light of the fact that the info face can be differs in size and direction. To limit the impact of light, Self Quotient Image is connected. In the wake of Normalizing face locale, eye districts are extricated. At that point eye areas are binarized so as to have the pixel of 0 and pixel of 1 esteem by using a threshold. The threshold is acquired from the mean pixel value of each region of eye. Eye regions from real faces have more variations in shape than regions obtained from fake faces. Hamming separation technique is utilized, for ascertaining liveness score of every locale of eye, If two arrangements of pixels are thought about, the Hamming separation is the quantity of pixels that don't have careful esteem. On the off chance that the normal liveness score is more than edge esteem, at that point the info picture is recognize as live face and on account of inverse it is separated as a photo or spoof attack.

#### (G) LIP MOVEMENT BASED ANALYSIS :

The liveness detection approach based on lip movement was introduced by Kollreider et al. [16]. Their work is based on liveness detection using face landmark. The proposed approach identify lip movements and lip reading for liveness detection. SVM classifier was used to analyze the lip movement and lip reading. They used XM2VTS for various region of mouth. They extract OFL in real time after locating the mouth region. The goal was to recognize various lip movement only so person were recorded lip movement from 0 to 9. For a particular digit they used 100 short videos. For training there were total of 60 short videos and for testing purpose 40 short videos were used. For each digit videos feature are extracted from mouth region and given to 10-class SVM. Out of 100 total videos, 73% (0.73) is the recognition rate. This analysis approach only for indication for liveness.

## V. CONCLUSION

This survey paper provided an overview of different methods of face liveness detection. It introduced approach dependent on the sort of strategies utilized and kinds of liveness pointer utilized for face liveness discovery. An overview/audit of most proposed methodologies for liveness identification was exhibited. The most common difficulties that have been observe in many liveness detection approach are the effects of illumination change, effects of amplified noise on images which damage the texture information.. PCA and LDA approaches used for projected original face into lower dimension. LBP is used for texture information of image. Our main goal is to give a clear result for future development of more secured, user friendly and good efficient performance approaches for face liveness detection.



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