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Research Article

Realness Detection of Image using Frequency and Texture Observation

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Abstract

Detecting with biometric system is a popular and advanced approach in social area. Face recognition method is advanced technique of them to controlling attacks which can be achieved by inserting wrong data using craft faces, programs (Including viruses) and other crafting software thereby gaining ultimate access. An easy task to snippety the face verification system is to use antecedent selected photographs instead of at a time. A simple and furious technique for geometrical feature detection of several human face organs such as eyes and mouth Thus, genuineness verification is required to develop a safe system to protect like such unwanted tactics. According to resultant facts, the images captured from the 2D and genuine faces have much difference in characteristics features like size, shape, gravity and detailednes. Face conversion having printing quality fluctuation which can easily detects via using micro-texture analysis, energy level detected by analyzing the frequency level and posture is carried by gravity features. We are presentencing a vigorous approach to analyzing gravity, frequency analysis and texture calculation and by using frequency descriptor, gravity-center template matching and Local Binary Pattern respectively. This approach generates a special feature space for group unauthorized accessing, detection and face recognition. Experiments on which we have perform, a globally available general database produced better result and we can clearly justify unmasked faces and craft face in 2-D. A specially defined recognition rate of ▯ 89.7% has been achieved for such faces.

Keywords: *Frequency Descriptor (FD); Local Binary Pattern (LBP);Edge extraction face feature extraction; Gravity.*

1. Introduction

The general public need potential for better security area against spoof attack, today the great deal of progress during the current years is 2D face biometric, still a major concern in research area. It is a wide and have versatility in Biometrics'. This technology providing the identity of an individual verification based on the unique properties like behavioral attributes, physical appearance of the person etc. There are various techniques for against security but face recognition is best one of them which is rapidly developing in recent years. But in general it is quite tough to differentiate genuine live faces pictures which are a major concern for security purpose to illegal access. Spoof attacks can be occurs in various ways such as presenting a previous taken picture, portrait, masking and videos in front of the high definition camera, one can also use makeup or plastic surgery as the other means of spoofing, photographs normally the most common sources of intruding because anyone can easily download or captured it. A secure system requires true detection in order to guard against such intruder operations. Liveness is the act of verification, the feature space into genuine and portrait i.e. Live and nonliving. Thus it helps in biometric system to classify real faces from a photo and reducing artificiality.

Spoofing attacks is caused when a non-authorized person introduce a craft information in front of camera for illegal access, like using printed 2D photographs or snapshot of the real person. It is the common unauthorized activity done by the person for accessing in secured system. As shown in fig.1, fake face pictures captured from 2D camera (picture from picture) may be looked like similar to the live face images (normal camera pic). Fig.1 distinguishes some common examples of the live face images and their fake (craft) pictures taken from their printed photographs. But fake face images lack texture richness as compared to the texture components of live face images due to the fact that live faces reflect light in a different way than that of a photograph and frequency level and center gravity value is also changed in crafted images. Except of it, sequential fake face images won't shows any temporal changes in the facial unveiling whereas, live human faces would have some variety of changes like pose and expression which will result in changes in facial appearance. Gravity of crafted image is always more than the live current images having no modification. All the three components together

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worked properly and distinguish the attractive results for differentiating the genuine image and fake and crafted images. Basic idea is generating by the next giving example of fake and live images.

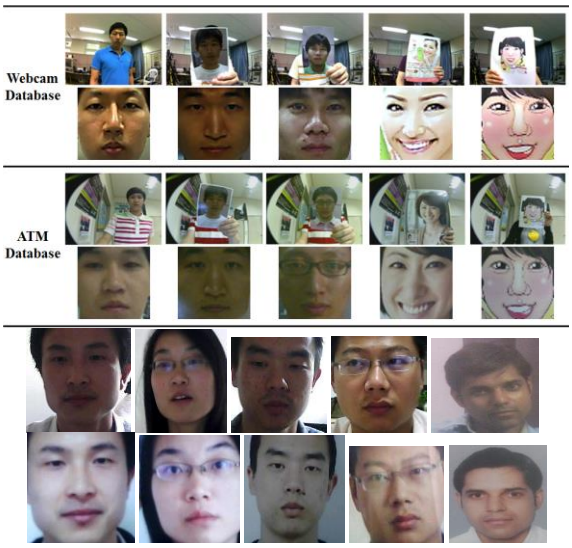


Fig.1 Examples of live faces (upper row) and fake face images (lower row)

In this assembled paper, genuine face detection and verification technique done based on texture, center of gravity and frequency analysis is illustrate which can verify between the fake and genuine faces. For differentiating a live image of face and 2D photograph, we have used a threshold operation based on the analysis of Fourier spectra and frequency descriptor value. For analyzing the texture information, we will use Local Binary Pattern (LBP). The results of LBP are then received by Support Vector Machine (SVM) classifier which determines whether the captured image is live face or not as well as it processed by for finding gravity values. Experiments performed on publicly available database which is NUAA Photograph for Imposter Database showed promising results. In the next session, a discussion held on related works for face liveness detection. Our proposed approach and flow-graph is then described in section III. Result and Conclusion shown in section IV. and V. respectively.

2. Related work

Without real face verification, most of the face recognition systems are fail to spoof or secure from attacks. Spoof attack can be operating by using a 2D pictures, imposter images, 3D mask, video etc. A short survey of 2D face realness identification was proposed by (Kahm *et al*. 2012). There are various live face detection techniques based on the type of liveness indicator used to helps the liveness detection of faces. On those indicators are live signature, Texture and motion are two different form for identification (Jee *et al*. 2006) stated an approach based on the movement of the eyes. The authors have detected eyes in one by one sequential input form of images and diversity is then calculated. Similarly, using life sign as an indicator, (Pan *et al*. 2008) gave a technique of blinking-based liveness verification. They have used Conditional Random Framework (CRF) to identify the eye blinking behavior. Another technique using lip movement classification and face detection based on face landmarks was introduced by (Kollreider *et al*. 2007). Support Vector Machine (SVM) was used for classification of lip dynamics once after recording the person speaking digits 0-9. (Bao *et al*. 2009) introduced a method based on optical flow field which analyzes the differences and properties of optical flow generated from 2-D planes and 3-D objects. Experiments were performed on a private database which showed a ≃6% false alarm and ≃14% false acceptance. In a similar work (Kollreider *et al* 2007). Presented a method based on optical flow field and used it to capture the movements of different facial parts.

Next section of real face detection is based on the analysis of micro-texture (Li *et al.*) proposed a original face identification approach based on the analysis of Fourier spectra on a single facial 2D image. Their method was based on the assumption i.e. size of the photo is smaller than that of the live face and frequency components of photo images is less than that of live face picture. But the effect of illumination was ignored by the authors which would affect the results in a great way. In another work (Kim *et al*. 2013) proposed a technique using variable focusing. Based on the assumption that there is no movement, the authors utilize the variation of pixel values of two images taken sequentially in different focuses. Focused regions of real faces will be clear and blurred in case of fake pictures. Their main constraint was that it relies on Depth of Field (DoF) which determines the range of focus variation.

Another live face detection technique based on 3D structure of the face was presented by (Lagorio *et al* 2013). Their technique was based on the computation of mean curvature of the surface and the authors have showed that the surface variation is low when the picture is taken from a 2D source. The problem of anti-spoofing was introduced by (Tan *et al*.2010) as a binary classification problem. The authors have used the Lumberton reflectance to distinguish 2D face prints image from 3-D real and fake faces. By using a variation retina-based method and difference-of-Gaussians (DoG) based approach, they retrieve latent reflectance features which are then used for classification.

It has been observed that most of the live face detection methods are very complex and some of them using non-conventional parameter and devices and image system. Our proposed technique is computationally easy and fast and does not require old devices. Furthermore it does not require user cooperation.

3. Proposed Technique

Current picture which are captured from live faces using high definition camera may look like similar to the masked pictures which are captured from 2D photographs. The pose and expression of real live face have variations in one by one captured images sequentially but in the case of picture captured from fake faces, the expression and the pose will be fixed. There are a change in size and detailedness which is caused by surface reflections and shades of pictures. In addition, the images taken from masked faces shows single flat surfaces compared to real current faces.

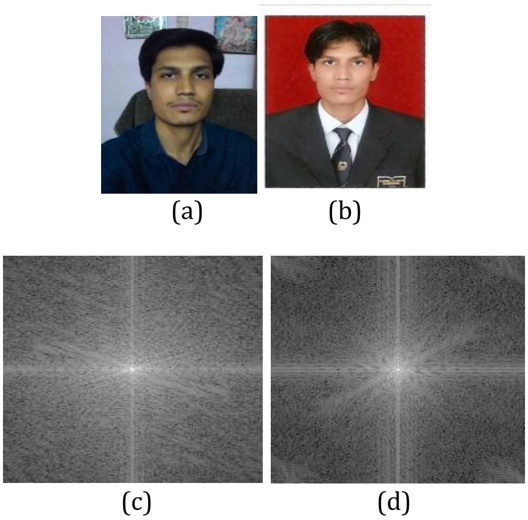


Fig.2 Difference between live face and fake face image in domain (a) Live face image; (b) fake face image; (c) Log magnitude Fourier spectra of (a); (d) Log magnitude Fourier spectra of (b)

Our presented approach describes texture and frequency based analysis as well as gravity values to differentiate between masked and that of real face images with craft images. The images captured from 2D photographs do not have that much of texture richness (dense pixel orientation) as compared to images captured from real live faces. Furthermore, there is a difference in frequency and cardinal value of gravity in the images taken from live faces and crafted image faces. The main point for using frequency based analysis is that the difference in shapes and detailedness of real faces and masked faces leads to the discrepancy in low frequency regions and high frequency information respectively (Fig. 2).

A-Frequency Based Analysis

In a sequentially captured image sequence, the expression and pose of a genuine generic face have variance whereas, in case of crafted faces, the pose and expressions will be fixed. An effective way to identify real genuine face is to monitor temporal changes of facial pose behavior and expression over to time. Facial expression having some specific energy value presented in frequency domain. At first, four random images are selected from an input image sequence and a subset is constructed. The images are then processed into the frequency area domain by using 2D discrete Fourier transform (Fourier spectra). An energy value of each image (genuine and crafted images) are showed in (2), the subset is calculated. The standard deviation of the image are resulting values, called frequency descriptor (FD), is calculated to determine the temporal changes of the facial image. The frequency descriptor is defined in (1).

$$FD = \left(\frac{2}{n}\sum_{i=1}^{n}(x_i - x_m)^2\right)^{\frac{1}{2}}$$
(1)

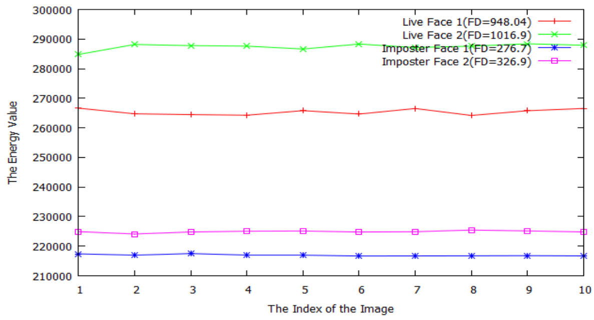


Fig.3 Energy value curves of four different images

$$x = \iint |F(u,v)|\,du\,dv$$
(2)

Where, *xi* corresponds to the energy of the i^{th} image, x_m Indicates the mean of the energy values and *n* denotes the total number of energy values. The energy value curves (fig. 3) of four random sequences of input face image and their related frequency descriptor value shows that the energy and frequency descriptor of masked face image sequence are less than that of the image sequence of live faces. That's why; the FD of live faces should be more than a threshold value *td*.

B-Texture based analysis

The method based on temporarily unfixed changes using frequency based analysis will fail if there are no temporal variations of facial expression of the live face. Thus, we have to considered differences in micro texture. When the value of frequency descriptor of a facial image is greater than the threshold value, those images were passed on to the second section of the algorithm i.e. texture based analysis. For analyzing micro-texture creates differences of the pictures captured from genuine live faces and fake faces (2D photographs), we are using the LBP for that. As introduced by (Ojala *et al*. 2002), the LBP texture based analysis operator consist a gray-scale invariant texture feature. It is one of the most popular and powerful method of image description as in terms of textures and some of its advantages are its illustrating power and its simplicity in computation. Equation (3) shows that by considering and calculating the relative intensity, the LBP assigns a code for each and every pixel and its neighbors.

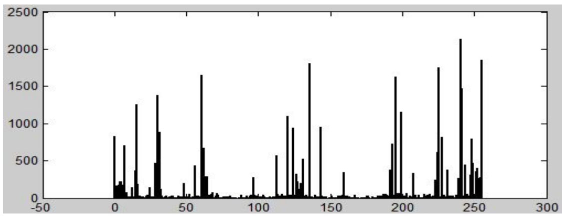
$$LBP_{P,R} = \sum_{P=0}^{P-1} s(g_P - g_C)2^P ; S(x) = \begin{cases} 2 & x \geq 0 \\ otherwise\ 0 & x = 0 \end{cases} \quad (3)$$

Where, P = Number of neighboring pixels.
R = Radius of the corresponding circle i.e. the distance from the center to the neighboring pixels.
g_c and g_p corresponds to the grayscale value of the center pixel and the grayscale value of the p equally spaced pixels on the circle of radius R respectively.
S(x) = denotes the threshold function of *x*.

To calculate the micro-texture resolution we have to use various values of P and R were set to 8 and 1, respectively.


(a)


(b)



(c)

Fig.4 Feature vector extraction based on texture: (a) Live face image; (b) LBP coded image of (a); (c) Feature Histogram of (b)

The process of acquiring the feature vector from local vector pattern from a given input images are shown in fig. 4(a) as well as the genuine facial image and the LBP coded image of fig. 4(a) is shown in fig. 4(b). Fig. 4(c) shows the resultant feature histogram of fig. 4(b) which is being used as the feature vector for the classification and distribution. For classification, we are using Support Vector Machine (SVM) classifier with radial basis function kernel. To train the SVM classifier, we have to use real live faces as positive and fake faces as negative samples feature. Finally, it is notify to determine whether the input current facial image is genuine or not.

C-Center of Gravity

For finding the center of gravity of an image first we have to divide full image through the center of gravity coordinates into number of blocks and find out the mean block as centric of that image.

There are two basic techniques used to estimate the centroid of a star object. They are:

1) The image moment analysis
2) Profile fitting or point spread function (PSF) fitting.

1) When a set of values has a trend to cluster around some particular value, then it may be useful to distinguish the set by a few numbers that are wired to its particular moments, the sums of integer powers of the values (Horn,1986 pp.34 and Press *et al* 1992, pp. 610-613). If an object in an image is defined by the function B(x,y), then the moments generated by this function give interesting features of the object. For digital images the $(k+L)_{th}$ order is defined by Papoulis theorem

$$B_{kl} = \sum_x \sum_y x^k y^l B(x,y) \quad (4)$$

The total intensity of the image is given by B00. We find that moments depend on the intensity or grey level. One important thing about moment features of objects is that they can be used regardless of location in the image and size of the object. Image moments include the following; centre of mass, variance and orientation.

2) PSF Fitting the basic principle in this technique is that all images of stars on a CCD frame have, baring distortion introduced by the camera optics, the same form but differ from one another in intensity or scaling ratio and position. (Teuber, 1993). Thus fitting a suitable defined PSF to a series of images will give relative magnitudes

$$m = zpt - 2.5 \log (\text{scaling ratio}) \quad (5)$$

Where *zpt* is the magnitude assigned to the PSF. Mathematical curves are fitted to the real data until a good match is obtained. The parameters determined are the position and the scaling ratio. The mathematical equation is used to generalize for the profile of the selected image is usually the Gaussian function (Buil, 1991).

$$I(r) = I(0)\exp\left(-\frac{r^2}{2\sigma^2}\right) \quad (6)$$

Where, **r** is the radius with respect to the centre of the star image
σ is a parameter characterizing the stars spreading
I (0) is the maximum intensity Linearizing equation
In this approach centroids of real picture were determined using both the fit momentum analysis and PSF fitting methods.

All the sets of images were multiple images of four. The sequences of operations described below were followed throughout the observations:

1) Set up the instrument
2) Check instruction status from operator
3) Prepare the CCD - unrecorded readouts to flush
4) Open the shutter for a time period
5) Close the shutter
6) Readout the CCD according to a precise pattern
7) Digitize the signal from each pixel
8) Store the data in a computer
9) Return the CCD to a standby mode if appropriate. Apart from 1 and 2 all the other events occurred in time sequence under computer control

D-Algorithm

The flow chart of the designed technique is shown in fig. 5 the designed algorithm uses both temporal changes using frequency analysis and difference in micro-texture using LBP.

4. Experiments and Result

A-Database

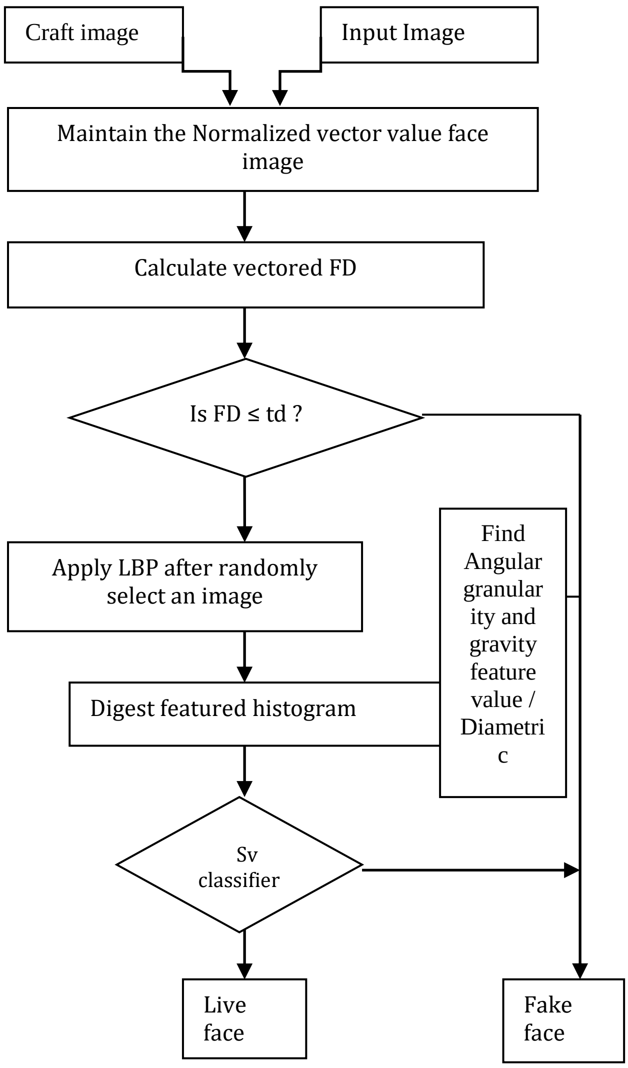


Fig.5 Flow chart of the proposed algorithm

In this paper, we are using the publicly available NUAA Photograph Imposter Database. The database contains both real images and masked photographs. The database was collected using cheap webcams and in three sessions with about 8 weeks interval between two sessions. The illumination conditions of each session of the database are also different. The examples for both live face and crafted photograph images from the database are given in fig 1. The resolution of all the images in the database is of 640 x 480 pixels. The images were taken in a sequential pattern with a frame rate of 20-30 fps and altogether of 600 images of each subject. For collecting photograph samples, high definition photos of each subject were taken using a Sony camera. Gravity value for craft images are make difference and quality of camera may also affected that's why we took a general purpose camera. We can also pick another company camera but its implicitly should be fine for texture and in gravity analysis

B- Experimental Result

In the frequency based model we considered the threshold value *td* = 500. In our experiments, the performance of the frequency descriptor was found to be better and it was able to clarify between fake and live faces quite well. The values of frequency descriptor for both genuine faces and crafted face images are shown in table I. If the frequency descriptor of a facial image is greater than the threshold value, the pictures were analyzed on the basis of micro-texture difference and calculate the gravity value for specific image. Now for the texture based analysis, we have divided the database into two parts for training and testing of SVM classifier. There were a total of 635 face images of real clients and 455 false images in the training object set. The testing set was composed of 1090 real face images and 1000 imposter photographs. In all experiments of SVM, we are using Lib SVM Library for the implementation. We have also compared the method of LBP with previous traditional methods such as Local Phase Quantization (LPQ) and Gabor wavelets, the results of which are shown in table II. Table II indicates that Equal Error Rates (EER) of LBP is 2.7% which is less than that of LPQ (4.6%) and Gabor Wavelets (9.5%). Optimal SVM parameters were used for texture descriptor for fair comparison. Our proposed algorithm is also compared with the approach of (Tan *et al.*). Our approach performed well in comparison to the approach of (Tan *et al.*) (0.97 versus 0.94).

Table 1 Results of Frequency Descriptors

Sr.No.	Images	Frequency Descriptor Values		
		Max	Min	Mean
1	Live Face	256	1268	982
2	Masked Face	≃210	≃417	≃268

Table 2 Performance Comparison between three texture operators

Sr.No.	Descriptor	LBP	LPQ	Gabor Wavelets
1	Equal error Rate	≃2.1%	≃4 %	≃10 %

Table 3 value of gravity for 2D

Sr. No.	Fake Image	Genuine Image
1.	≲ 28	37 ≳

Conclusions

The talk illustrated In the article, shows an excellent features and results, we have discussed a unmasked live facial verification and identification assumption using frequency level in both types images and texture based analysis along with gravity concept in facial images for electic 2-D masking doing crafting in faces. For frequency level information, we have used idea based on Fourier spectra (frequency descriptor) and for texture based calculations. We have used multiple of scale for local binary pattern (LBP) method to convert the micro-texture arrangement into an informative featured histogram data and result processed in to SVM. The experimental results explained that our assumption is able to clarify efficiently between genuine face images and crafted facial images or crafted images. The outcomes of Excellency is calculated by comparison with the previous done jobs also turned forward for to be better. In the future, we are proposing a plan for to doing originality identification in respect of video and 3D craft and genetic system more safe against such unauthorized spoofing attacks.

References

Surya Prakash Dwivedi,(2015),'Masked Face Detection Based On Micro-Texture and Frequency Analysis',E-ISSN 2277 – 4106, P-ISSN 2347 – 5161, Inpressco-IJCET.

Anil K. Jain,(2008),Handbook of Biometrics, Springer.

Kahm, O.,(2012),2D face liveness detection: An overview, Biometrics Special Interest Group (BIOSIG), 2012 BIOSIG-Proceedings of the International Conference of the, IEEE.

H. K. Jee,(2006),Liveness detection for embedded face recognition system, International Journal of Biological and Medical Sciences, vol. 1(4), pp. 235-238.

Gang Pan,(December, 2008),Liveness Detection for Face Recognition, Recent Advances in Face Recognition, I-Tech, on Page(s): 236.

K. Kollreider,(2007),Real-time face detection and motion analysis with application in "liveness" assessment, IEEE Transactions on Information Forensics and Security, 2(3-2):548–558.

Wei Bao,(April 2009),A liveness detection method for face recognition based on optical flow field, In Image Analysis and Signal Processing, International Conference on, pages 233 – 236.

K. Kollreider,(2009),Non-intrusive liveness detection by face images, Image and Vision Computing, vol. 27(3), pp. 233-244.

J. Li,(2004),Live face detection based on the analysis of Fourier spectra, In Proc of Biometric Technology for Human Identification, Orlando, FL, USA. (SPIE 5404), pp. 296-303.

Sooyeon Kim,(2013),Face liveness detection using variable focusing, Biometrics (ICB), International Conference on, On page(s): 1 – 6.

X. Tan,(2010),Face liveness detection from a single image with sparse low rank bilinear discriminative model, In Proceedings of the 11th European conference on Computer vision: Part VI, ECCV'10, pages 504– 517, Berlin, Heidelberg.

Andrea Lagorio,(2013),Liveness Detection based on 3D Face Shape Analysis, Biometrics and Forensics (IWBF), 2013 International Workshop on Page(s).

T. Ojal,(July 2002),A Gray-scale and rotation invariant texture classification with local binary patterns, IEEE Trans. Pattern Anal. Mach. Intell., 24:971–987.

C. C. Chang,(2011),LIBSVM: A library for support vector machines, ACM Transactions on Intelligent Systems and Technology, 2:27:1–27:27.