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A Survey on Quality Enhancing Local Descriptor for Biometric Spoofing Detection Using Various Techniques

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Abstract: Biometric systems are available at present are more often used for identification and verification in various security applications. Face, Fingerprint, Iris are the biometric traits, frequently used in the present authentication system, its features offer simplicity of use and reliability. Biometric features are unique in nature, so this type of method can be used to avoid typical problem of systems based on use of password which can be forgotten or stolen.To keep a good level of security, spoofing detection tools are preferably implemented as software modules. The research in this field is very active with extracting the features of local descriptor based on the analysis of micro-textural features like Local Binary Pattern (LBP).The term biometric is becoming highly important in security world. The recent year researches are aim to increase the accuracy and quality of the livenesss detection. Finger print system can be possible to fool by reproducing the biometric pattern on simple moulds made of materials such as silicone, clay or gelatine. Iris-based systems can be fooled with sophisticated 3D masks.To enhance the accuracy and quality of biometric systems, many works has been conducted in the liv-ness detection. LBP, CoA-LBP, LPQ, WLD local descriptor and distortion method are used for the recognition works and these extracted components and templates are the processed to build the discriminative features used to linear kernel SVM classifier.

Keywords: Specular reflection, Image blurriness, Image Chromaticity, Color diversity, Image Distortion Analysis.

INTRODUCTION

Biometric authentication systems, based on fingerprints, face, iris, or other distinctive traits provide security with little involvement on part of the user. Biometric systems are commonly used for authentication in various security applications. By relying on features that are unique for each individual (iris, fingerprints).To keep a good level of security, reliable spoofing detection tools are necessary and preferably implemented as software modules. Fingerprint-based systems are among the most commonly used and for this very same reason more subject to attacks. Software-based systems use image processing algorithms to gather information directly from the collected fingerprint to detect liv-ness.In this survey report,it includes various investigation techniques the which is used in spoofing detection. The first technique is, use of a local discriminative feature space for fingerprint liv-ness detection. In particular it rely on the Weber Local Descriptor (WLD)[7] which is a powerful and robust descriptor recently proposed for texture classification.The second method is a new machine-learning technique for detecting the presence and type of contact lenses in iris images called segmentation. The next one is another texture classification algorithm called BSIF (Binarized Statistical Image Features)[3], which t is a local image descriptor constructed by binarizing the responses to linear filters. Image Distortion Analysis [4] (IDA), there are fourth different features (specular reflection, blurriness, chromatic moment, and color diversity) are extracted to form the IDA[8] feature vector. Various image processing techniques have been developed so far for the detection of liveness spoofing detetion. In this survey, a study of various spoofing detection methods and their comparisons are performed.

LITRETURE SURVEY

Liveness spoofing detection are for the liveness detection task in authentication systems based on various biometric traits, like Iris, Face and Fingerprint. They are unique in nature and also lot of fake attempts will be detected in the authentication field. This literature survey will helps to know and to aware of some methods used to find the fakes.

These reports are also help to reduce the error occurred in the detection field on the past researches. For example, in case of fingerprint all tested descriptors improve the winner of the Liveness detection competition of just 3 years ago,

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and some reduce the average error by as much as 75% by the help of some local descriptors.There are more techniques which is available for this detection and they resulted in good manner.

DETECTION METHODS

I. Weber Local Descriptor

The WLD[7] is built starting from two dense fields of features,differential excitation and orientation.

$$€(x)=\arctan[\![\sum_{i=0}^{x} xi - x/x]\!]$$

where, again, x is the target pixel while the and xi's are its neighbors in a 3*3 patch

x0	x1	x2
x7	x	x3
x6	x5	x4

The difference between the intensity of the target pixel and the average intensity of its neighbors. Therefore, the feature is zero in flat areas of the image and grows larger in the presence of discontinuities [4].The very same difference can have a quite different perceptual importance depending on where it occurs in the image it can be barely distinguishable in a high intensity region, and quite significant instead in low-to-medium intensity regions. This observation is captured by the well-known Weber's law that states that the just-noticeable difference between two stimuli is proportional to the magnitude of the stimuli. Upon this principle, this difference is normalized to the pixel intensity itself. Finally, the arctan non-linearity serves to limit the feature in the finite state$[-\pi/2, \pi/2]$.These WLD features are combined, taken from different approaches as the morphology- and the perspiration based ones[1].Then, for each sensor the subset of features with highest discriminant power and the classifier with the highest accuracy are selected.

SEGMENTATION

Segmentation is new machine-learning technique for detecting the presence and type of contact lenses in iris images.The goal of our segmentation algorithm is to extract the iris and the sclera regions, which both convey precious information for the classification task.To this it aim at identifying the iris-sclera and iris-pupil circular boundaries, and then the boundaries with the upper and lower eyelids.The algorithm based on the Circular Hough Transform (CHT)[2].The well-defined structure of the regions of interest follows a parametric approach, where a circle of suitable center and radius is fit to the each boundary of interest, partially detected by means of an edge detection step.In this method of implementation it adopt the well-known Canny edge detector.However we apply a large-window median filter on the image so as to flatten out the iris pattern while preserving the strong irissclera and iris-pupil edges thereby preventing the detection of useless edges in the region of interest. When looking for iris boundaries we assign larger weights to vertical edges than to horizontal ones in order to de-emphasize the edges related to upper and lower eyelid boundaries.The independent quantization,Joint quantization and Local Binary Pattern are calculated in this method.

(a)LBP(Local Binary pattern)

Local Binary Pattern is defined as the process of calculating the neighbouring pixels.

$$Ci(x)=\left\{\begin{Bmatrix} \left\{\begin{matrix}0\\1\end{matrix}\right. fi(x) \leq 0 \\ \text{otherwise} \end{Bmatrix}\right.$$

(b)Independent Quantization

Independent Quantization is defined as the sepration of feature vector components[1] .The corresponding indexes are combined to obtain the scalar local descriptor[5] ,this solution is very simple,hence preferable for low-power context comparing to when a fast response is required.

(C)Joint Quantization

Joint quantization is a process of quantizing the feaure of vector as a whole through a suitable partition of the feature space,like the K-means clustering and the partition index represents the local descriptor[1].Vector quantization process is relatively complex and requires a careful training phase, on the other hand it exploited a joint dependencies which can be expected to provide a better performance.

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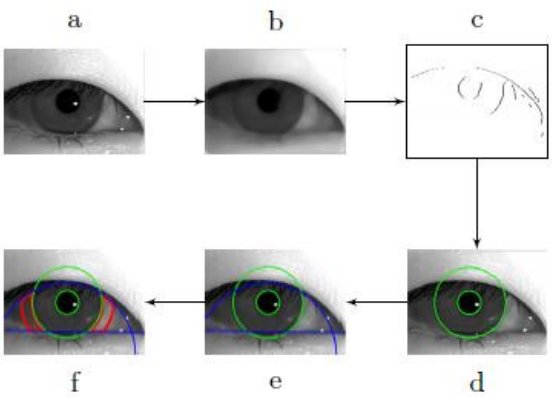

fig 1 Steps in segmentation

The above pictures shown the steps which is used in the segmentation [2].
(A) Original image, (B) Median filtering, (C) Edge detection (D) Iris boundaries detection (E) Eyelids detection(F) Sclera regions identification. A more important point and major difference of the algorithm is that it look jointly for the two iris boundaries that is, it try to identify two concentric circles, the iris-pupil and the irissclera boundaries, with significantly different radii. Although this condition might not fully hold, because pupil and iris can happen not to be perfectly concentric, this approach allows to avoid most false alarms because the algorithm look for a very particular structure which can hardly arise due to spurious detected edges. For each candidate center (x, y) the two largest maxima of C(x, y, r) along the radius coordinate r, with the further constraint that the selected radii, r1 < r2, are at least Δr pixels apart. In particular, in this case, the horizontal edges are emphasized, and the results obtained by the iris boundary detection are used to help localizing the upper and lower eyelids.

$$F = 2TP/2TP + FP + FN,$$

Segmentation accuracy can be assessed by computing the F-measure between the detected region and the ideal circular ring provided with the dataset .From this result of the Fmeasure can detected the mask in iris.

BSIF (BINARIZED STATISTICAL IMAGE FEATURES)

The that a fingerprint verification system can be repeatedly proved deceived by fake fingerprints. In Fingerprint Liveness Detection additional information used to verify if a fingertip image is authentic[1].To overcome this problem the BSIF can be introduced in the past detection method.BSIF is a local image descriptor constructed by binarizing the responses to linear filters but, in contrast to previous binary descriptors, the filters are learnt from natural images using independent component analysis (ICA).The BSIF descriptor has two parameters: the filter size and the number of features extracted. These algorithms extract from a fingertip image a certain number of features that will be used to classify the fingerprint as either live or fake. This algorithm clearly outperformed the LBP and LPQ methods.

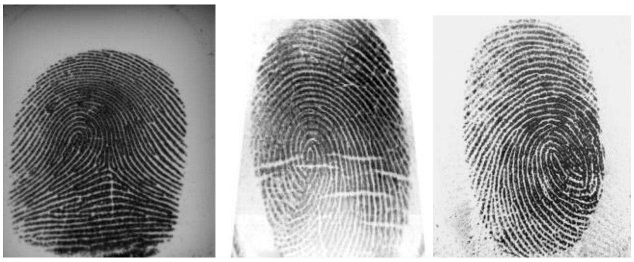

fig.2 Some finger print images corresponding to BSIF

IMAGE DISTORTION ANALYSIS (IDA)

Image Distortion AnalysisFour different features (specular reflection, blurriness,chromatic moment, and color diversity) are extracted to form the IDA feature vector[4].

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IDA is effective in grasping the intrinsic distortions of spoof face images with respect to the genuine face images.Image Distortion Analysis (IDA) with real-time response (extracted from a single image with efficient computation) and better generalization performance in the cross-database. The IDA[4] can be check the facial images by using the four methods to discriminate the original and fake images.

- Specular reflection from the printed paper surface or LCD screen.
- Image blurriness due to camera defocus.
- Image chromaticity and contrast distortion due to imperfect color rendering.
- Color diversity distortion.

There might be some other distortions are also present in spoof face images such as geometric distortion (e.g.paper warping) and artificial texture patterns (e.g.Moiré pattern).These distortions are camera and illumination dependent,it focus only on the above four general sources of image distortion in spoof face images like[8],(specular reflection, blurriness, chromaticity, and color diversity), and design the corresponding features for face spoof detection.

(i)Specular Reflection

Specular reflection component image has been widely used for specular reflection removal and face illumination normalization.Specular reflection extract the feature from a genuine face and from the corresponding spoof image,It calculate the specular reflection and it also extracts specular components based on chromatic difference analysis[4].

(ii)Image blurriness

Image blurriness feature is used to overcome the limit size of the spoofing medium[1].Spoof faces tend to be defocused and the image blur due to defocus can be used as another cue for anti-spoofing[6].Blurriness is measured based on the difference between the original input image and its blurred version.The larger difference is the lower the blurriness in the original image.

(iii)Image Chromaticity

The role of image chromaticity is to recaptured face images tend to show a different color[4] distribution compared to colors in the genuine face images.This chromatic degradation was explored for detecting recaptured images.

(iv)Color Diversity

This diversity tends to fade out in spoof faces due to the color reproduction loss during image or video recapture[4].It shows the another difference in the colored images and to normalized the captured image.The above four types of feature (specular reflection[2], blurriness, chromatic moment, and color diversity) are finally concatenated together and its resulting in an IDA feature vector with dimensions.

INDEPENDENT QUANTIZATION FEATURES

1.LBP: Local Binary Pattern[1] is defined as the process of calculating the neighbouring pixels[5].

$$Ci(x)=\left\{\begin{cases}0 & fi(x) \le 0\\ 1 & \text{otherwise}\end{cases}\right\}$$

2.CoA-LBP & Ric-LBP

Multi-resolution LBP[1] testifies of a first effort towards the use of larger neighborhoods.The Ric-LBP is used to exploit richer and longer-range dependencies and CoA-LBP is Co-occurrence of adjacent LBP,which is used to seprate the couples occur in the LBP pattern.

3.WLD

The Weber LD is built starting from two dense fields of features orientation and differential excitation.The WLD is to take into account jointly the local orientation of the gradient and the local activity of the neighbouring pixels.

4.LCPD

The basic idea of WLD [7]is further developed in the Local Contrast-Phase Descriptor (LCPD) with some important improvements.Again two features are defined and analyzed jointly, describing roughly orientation and contrast.

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CONCLUSION

Biometric spoofing detection is the method to identify the corruption occur in the liveness authentication sysytems.Here this survey report may exaplain all the feature extraction methods and techniques which is used in this biometric detection field.All the main techniques and functions in this liveness detection area are included in this survey,this techniques will help to reduce the 80% of error in the spoofing detection of biometric traits.The Independent quantization method is better than the other techniques to perform a good result in this detection field.

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