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A Novel Approach for Face Spoofing Detection

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Abstract: The face spoofing detection schemes has mainly been focused on the analysis of the luminance information of the face images, hence discarding the chroma component which can be very useful for discriminating fake faces from genuine ones. This work introduces a novel and appealing approach for detecting face spoofing using colour texture analysis. We exploit the joint colour-texture information from the luminance and the chrominance channels by extracting complementary low-level feature descriptions from different colour spaces. The colour spatiotemporal local binary patterns explore the facial colour texture content using four other descriptors: the phase quantization ,the adjacent local binary patterns the binarized image features and the invariant descriptor that have shown to be effective in gray-scale texture based face anti-spoofing. Here by using these features the colour texture is analyzed and extracted by face descriptors from different colour bands .To gain insight into which colour spaces are most suitable for discriminating genuine faces from fake ones, considered three colour spaces, namely RGB, HSV and YCbCr. A new and appealing approach using colour texture analysis and demonstrate that the chroma component can be very useful in discriminating fake faces from genuine ones. First, the face is detected, cropped and normalised into an M×N pixel image. Then, holistic texture descriptions are extracted from each colour channel and the resulting feature vectors are concatenated into an enhanced feature vector in order to get an overall representation of the facial colour texture. The final feature vector is fed to a binary classifier and the output score value describes whether it is a real or a fake image.

1. INTRODUCTION

A spoofing attack occurs when someone tries to bypass a face biometric system by presenting a fake face in front of the camera.[1,2] For researchers inspected the threat of the online social networks based facial disclosure against the latest version of six commercial face authentication systems (Face Unlock, Face lock Pro, Visidon, Veriface, Luxand Blink and Fast Access). While on average only 39% of the images published on social networks can be successfully used for spoofing, the relatively small number of usable images was enough to fool face authentication software of 77% of the 74 users.[2] Also, in a live demonstration during the International Conference on Biometric (ICB 2013), a female intruder with a specific make-up succeeded in fooling a face recognition system.[3] These two examples among many others highlight the vulnerability of face recognition systems to spoofing attacks.

Literature survey

."An Investigation of Local Descriptors for Biometer Spoofing Detection",by Diego Gragnaniello.

Biometric authentication systems are quite vulnerable to sophisticated spoofing attacks. To keep a good level of security, reliable spoofing detection tools are necessary, preferably implemented as software modules.[3] The research in this field is very active, with local descriptors, based on the analysis of microtextural features, gaining more and more popularity, because of their excellent performance and flexibility. This paper aims at assessing the potential of these descriptors for the liveness detection task in authentication systems based on various biometric traits: fingerprint, iris, and face [4]. Besides compact descriptors based on the independent quantization of features, already considered for some liveness detection tasks, we will study promising descriptors based on the joint quantization of rich local features. The experimental analysis, conducted on publicly available data sets and in fully reproducible modality, confirms the potential of these tools for biometric applications, and points out possible lines of development toward further improvements[4,5].

2. METHODOLOGY

Colour conversion

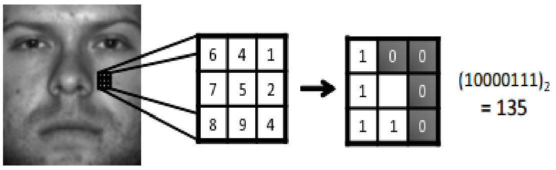
INPUT: colour image

RGB is the most used colour space for sensing, representating and displaying colour images. However, its application in image analysis is quite limited due to the high correlation between the three colour components (red, green and blue) and the imperfect separation of the luminance and chrominance information[5]. On the other hand, the different colour channels can be more discriminative for detecting recapturing artefacts, i.e. providing higher contrast for different visual cues from natural skin tones[9]. In this work, we considered other colour spaces of YCbCr, to explore the colour texture information in addition to RGB. The YCbCr space separates the RGB components into luminance (Y), chrominance blue (Cb) and chrominancered (Cr).

A . Spatiotemporal local binary pattern

Divide the examine window into cells ,for each pixel compare to its neighbors. Follow where the pixels value is greater than neighbors. Compute histogram over the cell, of frequency of each number occurring [15,17]. The histogram can be seen as 256 dimensional vector.

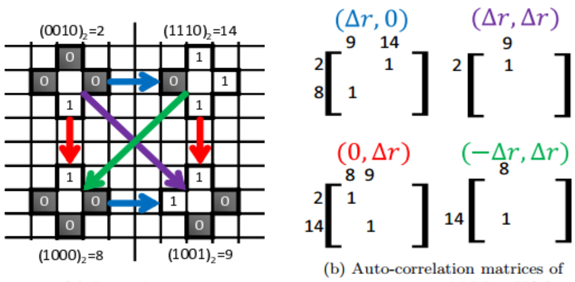
Example for LBP :



Output : 59 row Descriptor vector

B .Adjacent local binary pattern.

Since in LBPs all the information are packed in single histogram can discard important information, Hence we measure the co- occurance among multiple LBPs.[17]



(a) Example image (b) Auto-correlation matrices of co-occurrence of LBPs, $H(a)$

C. Image Feature binarization

BSIF descriptor computes a binary code string for each pixel in an image where each bit is obtained by first convolving the image with a linear filter and then binarizing the filter responses[8,12]. The number of the used filters determines the length of the binary code. In order to obtainstatistically meaningful representation of the image data and efficient encoding using simple element-wise quantization, the fixed set linear filters are learnt from a set of image patches by maximizing the statistical independence of the filter responses using independent component analysis (ICA).[20] In our experiments, we used the set of filters provided by the authors of that were learnt from a set of natural image patches.

D. Phase Quantization

It is based on Blur invariance property of fourier phase spectrum.It uses the local phase information using 2-D short-term Fourier transform (STFT).[13,14] In this we use the original code shared by the inventor of LPQ.

E. Invariant feature

An object is recognized in a new image by individually comparing each feature from the new image to this database and finding candidate matching features based on Euclidean distance of their feature vectors. By HASH table implementation the probability that a particular set of features indicates the presence of an object is computed, given the accuracy of fit and number of probable false matches [10,18]. Object matches that pass all these tests can be identified as correct with high confidence.

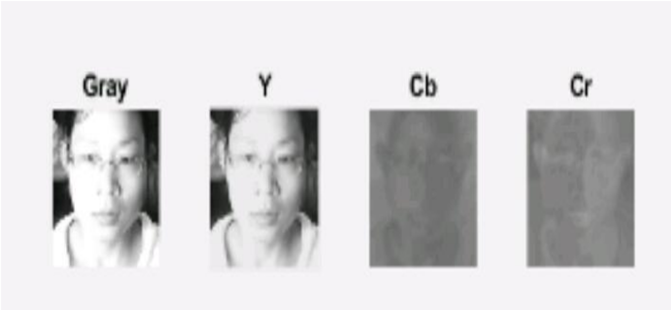
3. RESULTS AND DISCUSSIONS

This section illustrates the experimental outcomes and its deliberations. The main aim of this paper is to increase the vulnerability of the face detection system. Texture descriptors originally designed for gray-scale images can be applied on colour images by combining the features extracted from different colour channels [4,13]. Colour texture of the face images is analyzed using five descriptors: Spatiotemporal Local Binary

Patterns, Adjacent Local Binary Patterns , Phase Quantization, Image Feature binarization and Invariant Descriptor.

Proposed algorithm is Multi Low level feature descriptor for different color space. A novel and appealing approach for detecting face spoofing using colour texture analysis[17,20]. We exploit the joint colour-texture information from the luminance and the chrominance channels by extracting complementary low-level feature descriptions from different colour spaces.

FIG 1 : COLOUR CONVERSION



The colour local binary patterns (LBP) descriptor, explore the facial colour texture content using four other descriptors: the Spatiotemporal local phase quantization the adjacent local binary patterns the image feature binarization and the-invariant descriptor that have shown to be effective in gray-scale texture based face anti-spoofing[19].

FIG 2: SPATIOTEMPORAL LOCAL BINARY PATTERN

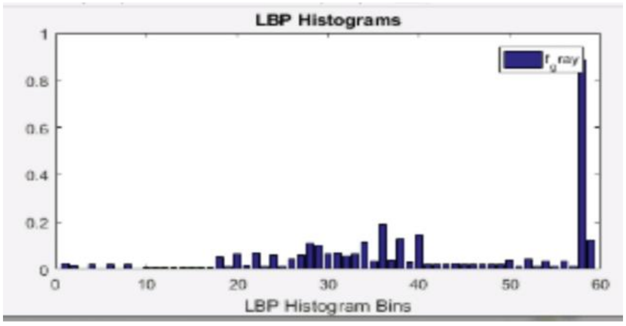


FIG 3: ADJACENT LOCAL BINARY PATTERN.

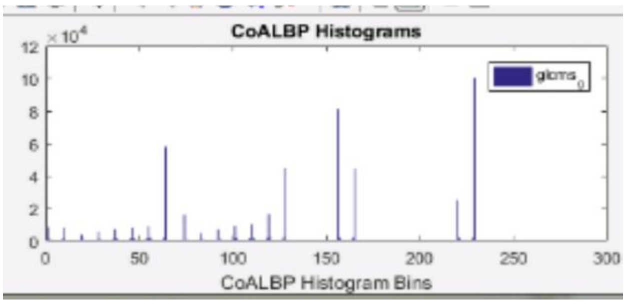


FIG 4: INVARIANCE FEATURE.

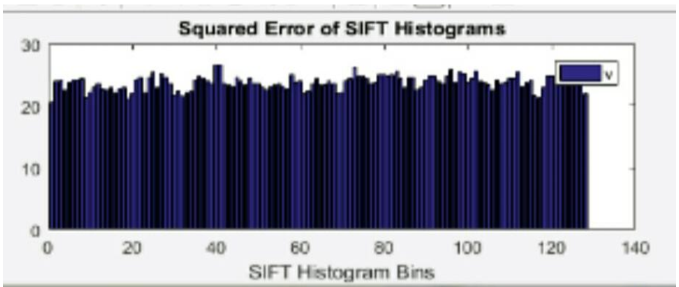
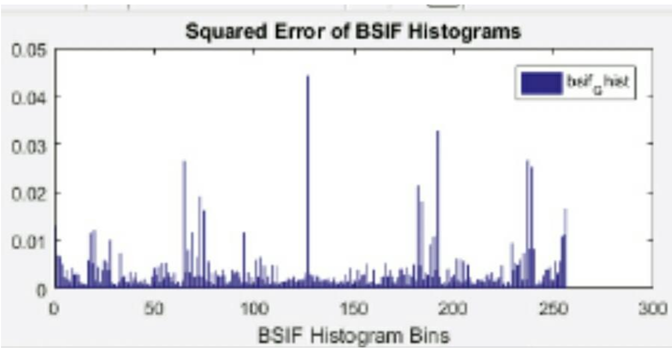


FIG 5: IMAGE FEATURE BINARIZATION



Here by using these features the colour texture is analyzed and extracted by face descriptors from different colour bands [14] .To gain insight into which colour spaces are most suitable for discriminating genuine faces from fake ones, considered three colour spaces, namely RGB, HSV and YCbCr

A new and appealing approach using colour texture analysis and demonstrate that the chroma component can be very useful in discriminating fake faces from genuine ones. First, the face is detected, cropped and normalised into an M×N pixel image[19].

4. Conclusion

In order to address the problem of face anti-spoofing from the colour texture analysis point of view. It is been investigated how the various colour image representations (RGB, HSV and YCbCr) can be used for describing the intrinsic disparities in the colour texture between genuine faces and fake ones and if they provide complementary representations[3]. The effectiveness of the different facial colour texture representations was studied by extracting different local descriptors from the individual image channels in the different colour spaces. The facial colour texture representation under undefined conditions are more stable than texture descriptions that have been extracted from gray-scale images[7,13]. Use of colour texture information provides a way to improve the unsatisfying generalization capabilities of texture based approaches. Benefit from the potential complementarity of the ALBP and the LPQ face descriptions, to fuse them by concatenating their resulting histograms[12,15]. Facial representations extracted from different colour spaces using different texture descriptors can also be concatenated in order to benefit from their complementarity. The effectiveness of different texture descriptors more closely in detecting various kinds of face spoofs by extracting holistic face representations from luminance and chrominance images in different colour spaces [18].

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