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# Recognition of Face using Spatio-Temporal Texture Descriptors

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***Abstract***
*Recognition of face has been an important topic in image processing for the past few decades. As a result, a huge progress is done in this area. This paper focuses on the face recognition for the blur images. To recognize the face the method used in this is the kernel fusion of two spatial and temporal texture descriptors.*

***Keywords**: Kernel fusion, Spatial, Temporal, Texture descriptors.*

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## 1. Introduction

Although recognition of face has been achieved a significant progress in the past few decades, it is challenged by the spoofing assaults, related to artificial biometric traits. A spoofing attack [1] is one such attack where an imposter attempts to get access to a service by entering the artificial biometric information of some other data to the authentication system. But in a recent study, it has been revealed that the face recognition techniques are exposed to such spoofing attacks, which successfully clearances the authentication stage. In order to overcome such attacks there must be a necessity to check for authenticity earlier to the identification or verification of a biometric data. The spoofing assault is not limited only to the face recognition system, it is also present in other biometric systems like palm recognition, iris recognition, fingerprint system. The face spoofing attack problem is more common where the launching of face attack cost is relatively low. The media related to face spoofing system includes low high quality photographs, video streams, quality paper prints, 3D masks, blurred images etc. Face recognition related to blur and uncontrolled illumination is even more challenging. Therefore a fusion of texture descriptor is used in this paper to identify the correct person from the blur image.

## 2. Related Work

This includes the recent and relevant work done by different authors in the face recognition. It also includes the methods and techniques used in particular work. Pan et al. (2007) had suggested an approach for eye blink centered on anti-spoofing in the face detection system by a generic system. In their work, eye blink is a counter measure for the spoofing. This system successfully identifies the face with respect to eye blinking but this has a limitation that this system is not reliable, since spoofing attacks using the printed masks with eye positions cut out can pass the test. This limitation is overcome by the proposed system. Freitas (2014) suggested a face liveliness detection using dynamic texture [3] where the numerous methods to face liveliness detection has been classified according to the cues employed. These categories include methods detecting signs of liveliness, methods gauging difference in image quality. The authors in [4] had projected a face detection system by using visual dynamics. In this, the technique used for face detection is Dynamic Mode Decomposition (DMD) for exhibiting dynamic information of the video content like blinking eyes, moving lips, and facial dynamics. The authors recommended a classification pipeline consists of local binary patterns (LBP), support vector machine (SVM) filters and DMD. The DMD is used to characterize the temporal information of an image sequence as a single image. LBP operators are applied on a single mode and SVM is used for final decision making. Face liveliness detection from a single image with sparse low rank bilinear discriminative model has been proposed by the authors in [5]. In this work two techniques are used for face detection. One is variational Retinex based method and another is based on Gaussian filters. These two methods are used for the extension to the sparse logistic regression model which is developed recently. The work in [6] used a set of Gaussian filters for selecting a particular frequency band, used as features for discriminating real accesses from that of the spoofed attack. Gaussian filters reduce the noise but take more time for face detection. However in the proposed system BSIF filters are used which takes less time.

## 3. Architecture

The figure 1 indicates the system architecture of the proposed system. There are two modules in the work. They are training module and testing module. The training is done for about 200 images that are stored in dataset. The image is retrieved from the dataset. The face detection is done then MLPQ and MBSIF features are extracted separately. The kernel is constructed for MLPQ and is denoted as KL and the kernel for MBSIF is denoted by KB. The kernel fusion is applied for both the kernel vectors which is done by using the normal addition like K=KL + KB. This is done by using the KDA method. A single vector α is estimated. The projection is compared against the projection of mean of the positive training samples in the induced feature space (ω).

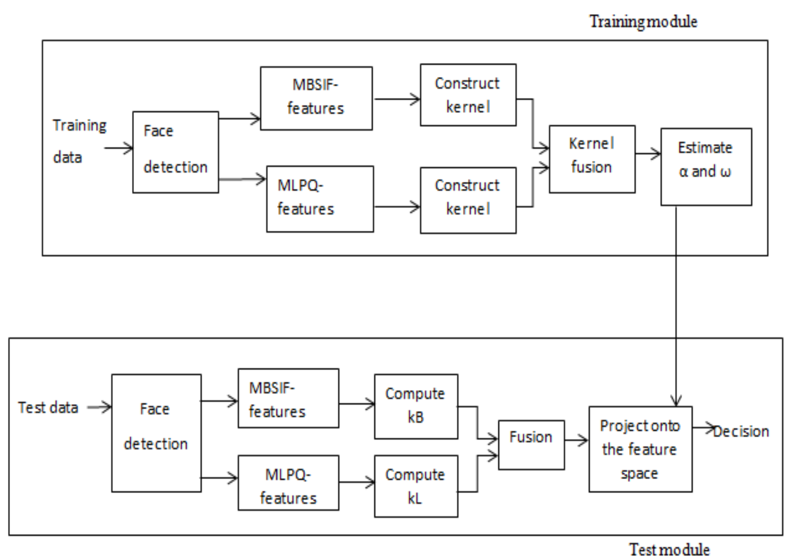


Fig. 1: System Architecture

In the testing module, a test data is used. The test data here is an image from the dataset. An image is taken from the dataset then face is detected. MLPQ and MBSIF algorithm is applied separately. After that, features are extracted respectively. Once the features are extracted, kernel is constructed for both descriptors, for MLPQ it is denoted by kL and for MBSIF it is denoted by kB these kernels are combined using kernel fusion based on KDA method by using the normal addition of vectors like k=kL+kB. The resultant kernel vector is projected onto the feature space.

It is compared with the feature space obtained from the training module. Finally the decision is made for the face recognition.

Fig. 2: The first image is a blur image, the second image is LPQ featured image and the third image is MLPQ featured image

## 4. Methodology

In the proposed system the spatial and temporal texture descriptors are utilized for the recognition of face. Firstly, a blur robust face image descriptor which is based on Local Phase Quantization (LPQ) and its extension to a multi-scale framework, multi-scale local phase quantization (MLPQ) is used to increase the effectiveness. The MLPQ descriptors are figured regionally to increase insensitivity to misalignment. Secondly, Binarized statistical image features and its extension to multi-scale framework, multi-scale binarized statistical image features (MBSIF) is applied on three orthogonal planes which displays a promising performance against spoofing attacks. Thirdly, the proposed MLPQ descriptor is combined with the MBSIF descriptor by using kernel fusion which is based on a method called Kernel Discriminant Analysis (KDA). The KDA is used with the spectral regression (SR-KDA) which solves the KDA problems and avoids the costly eigen-analysis computations.

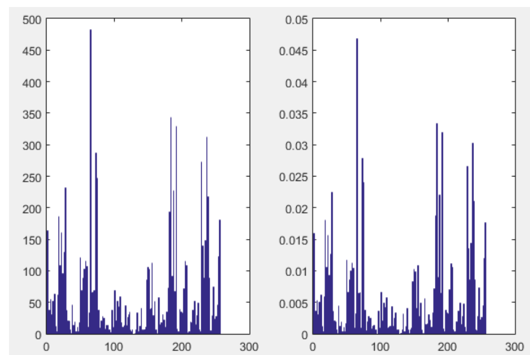


Fig. 3: Histograms obtained by MBSIF descriptor

## 5. Results

The MLPQ algorithm follows the steps like LPQ, de-correlation, image coding and MLPQ image. In LPQ, the feature extraction takes place and LPQ image is obtained. The extension of LPQ is MLPQ which extracts the multi scale features of an image. The steps involved in MLPQ are as shown in figure 2. In MBSIF algorithm, the face image is given as input. First information at multiple resolutions at each pixel level is captured and is achieved via three orthogonal planes. Distribution of codes in each plane is represented by plane specific histograms. Histograms of two image sequences are compared and finally the recognized image is displayed. It is shown in figure 3. The kernel fusion of both MLPQ and MBSIF descriptors are done and the kernel vector is obtained. This vector is compared with the dataset and the correct image is obtained, hence face recognition is done.

## 6. Conclusion

In this paper the techniques used for the face recognition based on the spatial and temporal descriptors has been proposed. The kernel fusion of MLPQ and MBSIF descriptors is an effective approach and it improves the performance when it is combined, instead of using these descriptors separately.

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