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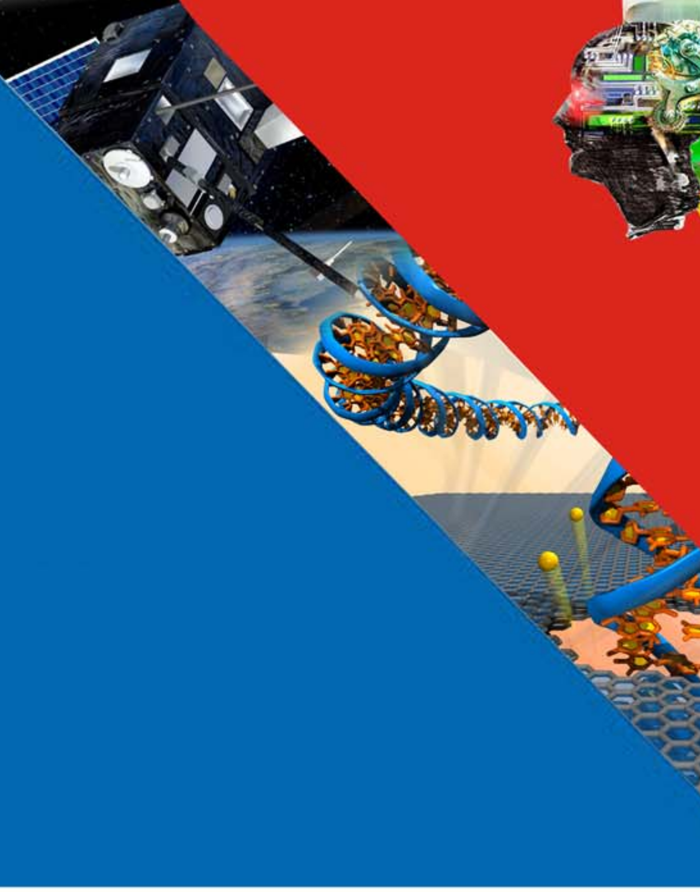

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Research Paper

IRIS RECOGNITION USING DAISY DESCRIPTOR

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Iris recognition is the most promising technologies for reliable human identification. Iris recognition has gained importance in the field of bio-metric authentication and data security. To improve accuracy of the iris recognition for face images of distantly acquired faces, effective strategies are required. In our proposed method, the face image is read and the iris is enhanced by Adaptive histogram equalization and is segmented using mean thresholding method. These coarsely segmented iris images are post processed using a sequence of operations that can effectively improve the segmentation accuracy. Then the parameters of the segmented iris are acquired using Daisy descriptor. Finally the person is recognized from the captured iris image with the help of match features.

Keywords: Biometrics, Iris Recognition, Daisy Descriptor

INTRODUCTION

Biometrics is the science and technology of measuring and analyzing biological data. In information technology, biometrics refers to technologies that measure and analyze human body characteristics, such as DNA, fingerprints, eye retinas and irises, voice patterns, facial patterns and hand measurements, for authentication purposes.

This paper aims to analyze the iris feature parameter for Human Identification. Iris Recognition plays the important role. For example, Aadhar card project which is being used by Indian Government. The popularity of the iris biometric has grown considerably over the past decade. Most research has been focused on the development of new iris processing and recognition algorithms for iris. The objective of this project was to produce a working prototype program that functions as an iris recognition tool using the automatic preprocessing, feature analysis and feature matching techniques in order to implement in an accurate and useful way that is also user-friendly.

A variety of iris recognition approaches were proposed that can be broadly classified in three categories. These categories are: (1) texture based, (2) appearance based and (3) feature

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based extraction. This paper proposes feature-based extraction techniques that use local variations, which are characterized by the appearance and disappearance of an important image structure. DAISY descriptor is a local image descriptor, which is used to convolve the different directional diagram of original image with Gaussian filtering function with different size. Due to the separability of Gaussian filtering function, the method has high efficiency. Compared to the finger print, iris is protected from the external environment behind the cornea and the eyelid. The small scale redial features of the iris remain stable and fixed from about 1 year of age throughout the life.

A. Related Work

Commercial iris recognition systems are available that implement Daisy descriptor because here both public image and data set CASIA images are feature matched and tested. Thus this paper provides a fast, usable program that can easily be implemented. The existing state-of-the-art iris recognition algorithms on the iris images acquired using near infrared (NIR) and visible imaging from controlled environment [1]–[7]. Such algorithms are used in large scale applications. Recent NIR-based imaging technologies allow the farther reachable acquisition range (3 m–8 m) while controlling the NIR irradiance levels within the safety metrics [8]–[12], such systems are still not ideal to be practically considered for the forensic and surveillance applications. In contrast, visible imaging offers some advantages over the conventional NIR-based acquisition systems. NIR-based long range acquisition system must be cautiously designed and rigorously tested in order to ensure the irradiance levels meeting the specifications [11], [12].

The acquired images are considerably noisier primarily due to the influence of multiple noisy artifacts, such as motion/defocus blur, occlusions from eyelashes, hair and eyeglasses, reflections, off-angle and partial eye images [13], [14], [15]. Therefore, development of robust and efficient iris recognition approaches which can work under such relaxed imaging constraints is highly desirable.

B. Proposed Work

To achieve automated iris recognition, there are three main tasks: first the iris in a given face image is identified. Secondly, it is necessary to encode the iris information into a format which is amenable to calculation and computation, for example Zernikefeature extraction, Gobar Filter and Daisy Feature Descriptor. Finally, the parameters must be storable, to load and compare these format.

The decision was made to use Matlab for this project. Matlab is the high-level language and interactive environment used by millions of engineers and scientists worldwide. It lets to explore and visualize ideas and to collaborate across disciplines including signal and image processing. Matlab has effective tools, so the application will run on Linux, Windows, and Mac desktops, adopting the operating system's native tools and giving it an integrated feel on all platforms.

Efficient and robust segmentation algorithm is vital for any successful iris recognition strategy that can be deployed for online applications. The block diagram of the proposed iris matching strategy based on the Daisy Descriptor is shown in fig.1. The first scheme is referred as the *global* periocular region, which is the entire eye region without performing segmentation and normalization. The second scheme is referred as *local* periocular region, which a localized region is extracted and normalized with respect to the segmented iris information.

IRIS AND PERIOCULAR SEGMENTATION FROM LESS CONSTRAINED ACQUIRED FACE IMAGES

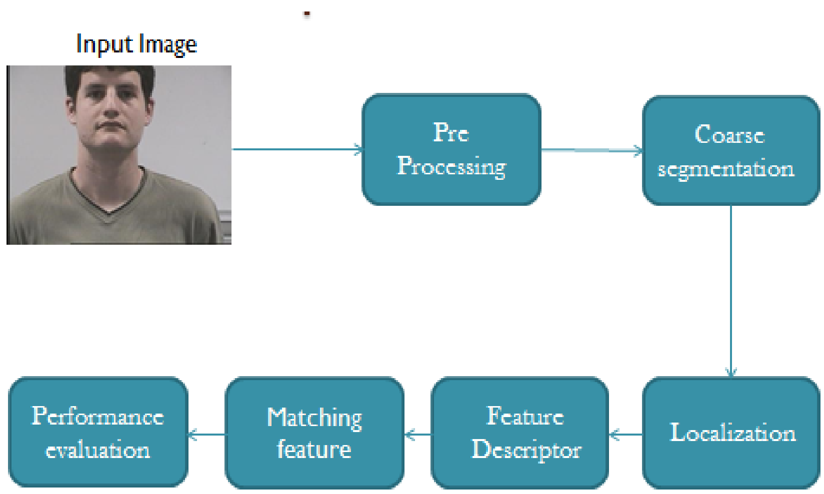
The proposed framework can be broadly categorized into two parts: part (a) is focusing on the segmentation of iris and periocular regions; while part (b) is concentrating on the human recognition utilizing the segmented information from part (a). In part (a), we employ the Viola Jones Object Detection Algorithm. The features employed by the detection algorithm universally involve the sums of image pixels within rectangular areas. Eye region is cropped from the face image. Iris images are coarsely segmented using mean threshold method. Given the localized iris, the information such as iris center and radius can be approximated. Such information is employed to extract the iris and pupil region for further feature extraction.

A. Preprocessing

Initially the face image is loaded using imread or uigetfile function. Illumination variation is a common problem for imaging in real environment. Illumination variation not only poses difficulty in iris segmentation but affects the recognition performance.

Therefore, we adopt Viola jones object detection algorithm to address such problem. The algorithm provides high dynamic range compression which has been shown to be effective in improving the overall image quality, especially for those cropped eye images. Left and right eye of the face is cropped separately and kept for processing as in fig. b. The de-noised image is enhanced using Adaptive Histogram Equalization for image enhancement as in fig.c. Adaptive Histogram Equalization has a tendency to over amplify noise in relatively homogeneous regions of an image and improve the contrast.

Figure: (a) Block diagram of the proposed iris recognition strategy using Daisy Feature Descriptor



B. Coarse Segmentation and Localization of Iris

The objective of the coarse iris segmentation is to provide a simplistic model to "*classify*" each image pixel into either iris or non-iris category. The coarse segmentation is applied with a suitable threshold value for the eye image. Although it is expected that such simplistic model may not produce classification result as good, which provide robust solution to further refine the coarsely segmented iris images as in fig. d.

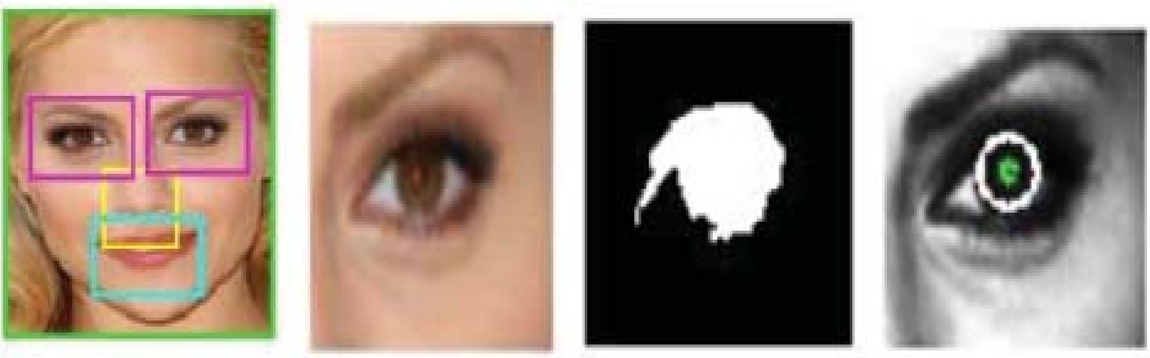
The localization of limbic and pupillary boundaries is then approximated from the coarsely segmented iris region based on circular model. Localization is done using Adaptive Eyelid Model. (*xir , yir , rir)* should be obtained and are employed to approximate the pupillary boundary *(x pu, ypu, r pu)*. The (*xir , yir*) serves as the initial center and the predefined offset ±10. The search radius is calculated using *rir* with the weight ϕ. For localizing the limbic boundary of NIR acquired iris images, we adopted different strategy for calculating the each radius, i.e. min$(\phi$ *rir*, ϕ max*(hB,wB)*/2) $\leq r \leq \phi$ max*(hB,wB)* as in fig. e.

DAISY FEATURE DESCRIPTOR

DAISY descriptor [16] is a local invariant feature descriptor which is used in dense stereo matching. In addition, its matching performance and operation speed are relatively good. Although DAISY descriptor does not have rotational invariance, the calculation of descriptor is very convenient because it has a central-symmetrical structure. On the basis of these features, such as simple and low complication, the method has a higher matching accuracy. In a word, DAISY descriptor has a greater advantage than the previous descriptors in the process of image matching, which is more suitable for the image matching. Our proposed algorithm can not only keep the merits of the original DAISY descriptor in computation speed, but also improve the matching accuracy on rotation invariance.

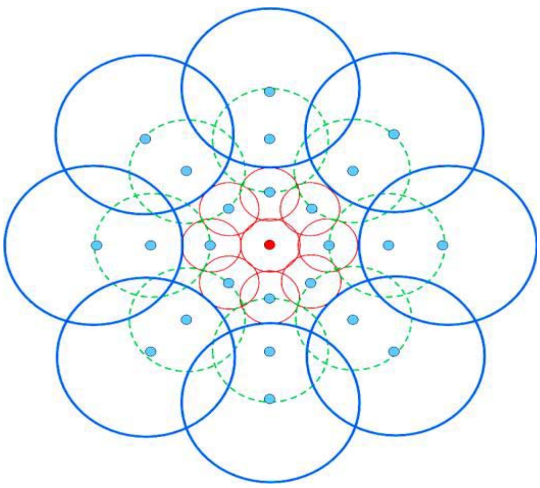
DAISY descriptor is a local image descriptor, which is very efficient to compute densely as in fig f. Its core idea is to convolve the different directional diagram of original image with Gaussian filtering function with different size. Due to the separability of Gaussian filtering function,

Figure: (b) face image partitioned using viola jones object detection algorithm, fig (c) cropped left eye, fig (d) segmented right eye, fig (e), Localized pupil and iris region of left eye by green and white concentric circle



the method has high efficiency, which is often used in the process of stereo vision dense matching.

Figure: (f) DAISY Descriptor Construction



Local features are well known to recover scale, rotation and translation invariance features and have been employed in many image processing applications, including in iris segmentation, image reconstruction, etc. However, prior attempts only exploited the magnitude information of the Daisy Feature values in order to benefit from the rotation invariance property. The coarse phase information (iris code) has been successfully employed to characterize the iris texture. Such an approach for iris matching has shown to achieve accurate iris matching for large-scale iris recognition applications but under constrained and NIR-based image acquisition. However, image variations such as scale changes, illumination changes, geometric transformation, etc., are often embedded in the eye images acquired at-a-distance and under the less constrained environments, which further increase the difficulty in performing the iris encoding and matching for such noisy iris images.

Therefore we propose a new iris encoding and matching strategy by exploiting the phase information of the feature extracted from the partially overlapping local iris region pixels. The motivations for using Daisy feature phase-only information to encode such localized iris texture information are as follows: (1) The phase information has been demonstrated to provide better discriminative power than the magnitude information, while retaining the scale invariant properties of the feature parameters to accommodate inherent image variations from less constrained imaging. (2) the local pixel variations can be better recovered from the localized iris region rather than those accumulated globally from the phase difference in conventional iris encoding. Such *phase* encoding information of the Daisy parameters from the local region pixels is expected to be more tolerant to the feature distortions than the global encoding scheme, and therefore can be used to complement the local iris features matching for achieving more accurate performance.

MATCH FEATURES

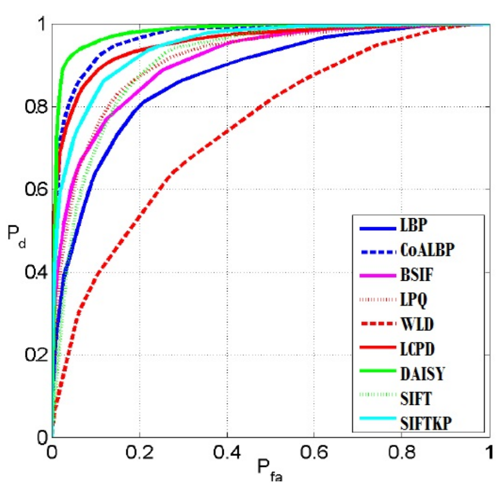
In match features, the parameters of Daisy descriptor for an input image are taken as test features. In database, the test feature is compared with all stored images. When test feature is same as that of parameters in the saved trained database image, the person is recognized.

The parameter of the test features are around 200 values from the orientation. This value is checked with parameters of saved images of 400 orientations. When the feature value matches, the person recognized is displayed in the monitor. In our proposed work, the some images from database CASIA is taken and public images are also taken for processing. Hence this descriptor provides better efficiency and robustness even for public images.

RESULT

In this case, DAISY is the best descriptor, ranking often first, and proving hence to work well with different biometric traits. The LCPD, however, keeps providing a good performance, probably because of deep structural similarities between the discriminative micro-textures found in iris images. In general, it seems that printed irises can be reliably recognized as fakes by DAISY and some other descriptors. Cosmetic contact lenses, as expected, pose more serious problems. In Fig.g we show the ROC curves for the CASIA dataset, with DAISY consistently superior to all other descriptors.

Figure: (g) ROC curve for CASIA data set



CONCLUSION

This paper has presented a promising approach for automated human recognition by exploiting iris and DAISY features to provide improved recognition performance. The main advantage of this paper is the person could be auto detected as soon as the iris is detected. However, further efforts are still required to improve the efficiency of the iris segmentation algorithm in order to make it feasible for any possible online deployment in applications like remote surveillance. The Space invariant Descriptor could also be implemented for further study.

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