IRIS Recognition Using Neural Network

Leila Fallah Araghi, Hamed Shahhosseini, Farbod Setoudeh

Abstract— this paper proposed Iris Recognition based on covariance of discrete wavelet using Competitive Neural Network (LVQ). A set of Edge of Iris profiles are used to build a covariance matrix by discrete wavelet transform using Neural Network.
It is found that this method for Iris Recognition design offers good class discriminacy. This method can discriminate noisy Image very well. Simulation results are very promising.

Index Terms— covariance matrix, wavelet transform, Competitive Neural Network.

I. INTRODUCTION

Iris recognition is a method of biometric authentication that uses pattern-recognition techniques based on high-resolution images of the irises of an individual's eyes. Not to be confused with another, less prevalent, ocular-based technology, retina scanning, and iris recognition uses camera technology, with subtle infrared illumination reducing specular reflection from the convex cornea, to create images of the detail-rich, intricate structures of the iris. Converted into digital templates, these images provide mathematical representations of the iris that yield unambiguous positive identification of an individual. Iris recognition efficacy is rarely impeded by glasses or contact lenses. Iris technology has the smallest outlier (those who cannot use/enroll) group of all biometric technologies. The only biometric authentication technology designed for use in a one-to-many search environment, a key advantage of iris recognition is its stability, or template longevity, as, barring trauma, a single enrollment can last a lifetime. Plemmons proposed different optimization methods for designing the optics and the image processing algorithms, and provide laboratory and simulation results from applying these systems and results on restoring the intermediate phase encoded images using both direct Wiener filter and iterative conjugate gradient methods [1].

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Christel-Loïc Tisse *et al* examined a new iris recognition system that implements (i) gradient decomposed Hough transform / integral-differential operators combination for iris localization and (ii) the "analytic image" concept (2D Hilbert transform) to extract pertinent information from iris texture [2] Li Ma *et al* proposed A new approach for personal identification based on iris recognition. The body of their papers details the steps of iris recognition, including image preprocessing, feature extraction and classifier design. The proposed algorithm uses a bank of Gabor filters to capture both local and global iris characteristics to form a fixed length feature vector. Iris matching is based on the weighted Euclidean distance between the two corresponding iris vectors and is therefore very fast [3]. Narayanswamy *et al* employs an especially designed Wave front Coded lens customized for iris recognition. They presented experimental results that show the benefits of this technology for biometric identification [4]. Zhuoshi Wei *et al* presented a framework to synthesize large realistic iris databases, providing an alternative to iris database collection. Firstly, iris patch is used as a basic element to characterize visual primitive of iris texture, and patch-based sampling is applied to create an iris prototype [5]. Czajka *et al* presents an original, independent of typical cryptographic techniques, method of biometric replay attack prevention for iris biometrics. The proposed solution takes advantage of appropriate enhancements of iris templates and relies on appropriate data alteration within the image space resulting in significant changes of the resulting code in the iris feature space [6].

II. IRIS RECOGNITION

The iris is a membrane in the eye, responsible for controlling the amount of light reaching the retina. The iris consists of pigmented fibro vascular tissue known as a stoma. It is the most forward portion of the eye and the only one seen on superficial inspection. The stroma connects a sphincter muscle (sphincter pupillae), which contracts the pupil, and a set of dilator muscles (dilator papillae) which open it. The back surface is covered by a heavily pigmented epithelial layer that is two-cells-thick (the iris pigment epithelium), but the front surface has no epithelium. The high pigment content block light from passing through the iris and restricts it to the pupil. The outer edge of the iris, known as the root, is attached to the sclera and the anterior ciliary body. The iris and ciliary body together are known as the anterior uvea. Just in front of the root of the iris is the region through which the aqueous humour constantly drains out of the eye, with the result that diseases of the iris often have important effects on intraocular pressure, and

indirectly on vision. Depending on the amount of light, the iris makes the pupil larger or smaller. The plural form of iris, in this context, is irises.

An iris-recognition algorithm first has to identify the approximately concentric circular outer boundaries of the iris and the pupil in a photo of an eye. The set of pixels covering only the iris is then transformed into a bit pattern that preserves the information that is essential for a statistically meaningful comparison between two iris images. The mathematical methods used resemble those of modern lossy compression algorithms for photographic images. A discrete wavelet transform is used in order to extract the spatial frequency range that contains a good best signal-to-noise ratio considering the focus quality of available cameras. The result is a set of complex numbers that carry local amplitude and phase information for the iris image.

In this paper the covariance matrix of discrete wavelet transform of Edge of iris images has been used for Iris Recognition using Probabilistic neural networks following figure shows the structure of Iris Recognition system that has been design in this paper. The output of neural network is the class of ship. This system can classify the noisy ship image very well.

In this paper covariance matrix of discrete wavelet transform of Edge of Iris image has been used as input of probabilistic neural network. This method for ship classifier design offers good class discriminacy. This method can classify noisy ship image. Following figure shows the structure of this method.

The canny edge detection has been used in this paper. Following figure shows Edge of Iris Image using canny method.

Neural network that has been used in this paper is LVQ.

LVQ, or Learning Vector Quantization, is a prototype-based supervised classification algorithm.LVQ can be understood as a special case of an artificial neural network.LVQ is one of the competitive neural networks. Following figure shows the structure of neural network:
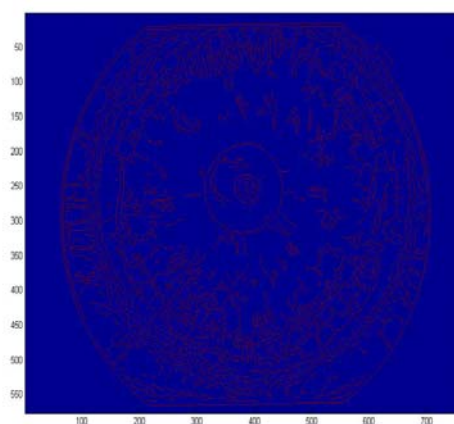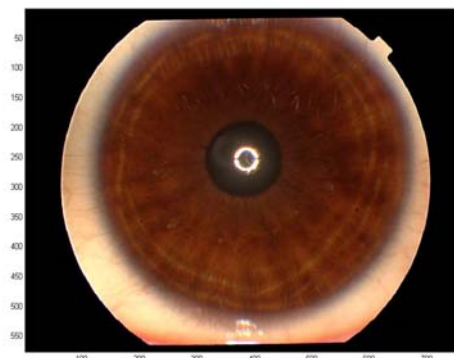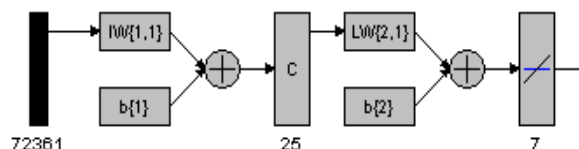

Fig. 1: Edge detection by canny method

Fig. 2: Structure of neural network

III. SIMULATION RESULT

In this paper covariance matrix of discrete wavelet transform of Edge of Iris has been used as input of LVQ neural network. This method for Iris recognition design offers good class discriminacy. This method can classify noisy image.

For example following figure shows Neural Network output The neural network can classify ship image very well.
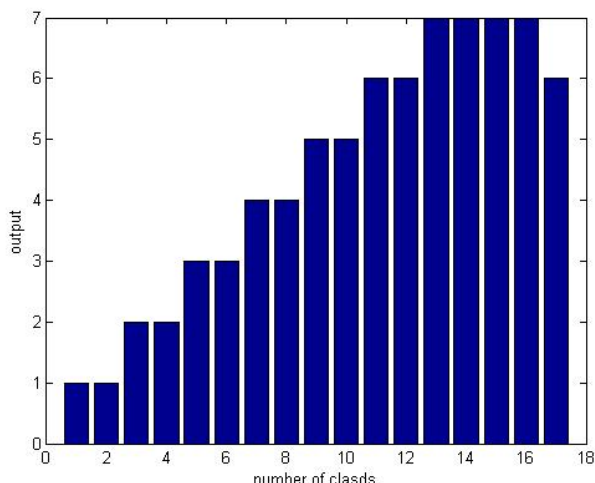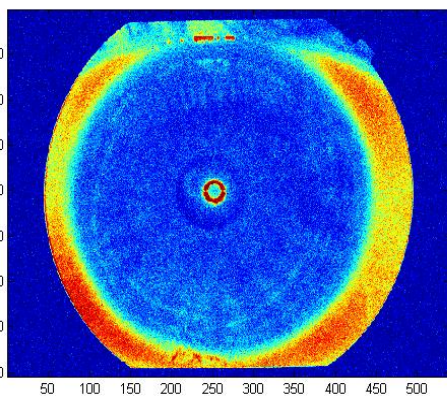

Fig. 3: Neural Network output

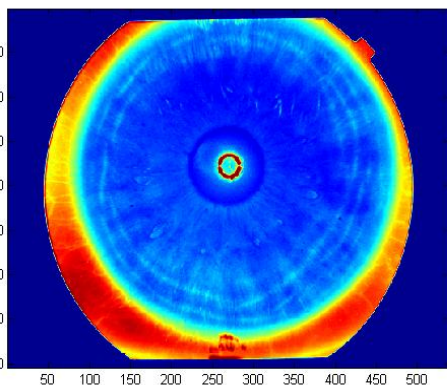Fig. 4 (a): Noisy image, input of system classifier

Fig. 4 (b): Output of system Iris classifier

IV. CONCLUSION

This paper proposed Iris Recognition based on covariance of discrete wavelet using Competitive Neural Network (LVQ). A set of Edge of Iris profiles are used to build a covariance matrix by discrete wavelet transform using Neural Network.

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