Iris Recognition for Personal Interconnection Using Lamstar NeuralNetwork

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Abstract: *One of the most promising biometric recognition methods is iris recognition. This is because the iris texture has many features such as freckles, wreaths, stripes, furrows, crypts, etc. These traits are unique and distinguishable to different people. Such unique features in the anatomical structure of the iris make it possible to distinguish between individuals. Therefore, in recent years, many people have tried to improve performance. This article first explains various general steps for the iris recognition system. Then a special type of neural network is used for the recognition part. Experimental results show that high accuracy can be achieved, especially if the first few steps are performed well.*

Keywords: *Iris recognition, biometric identification, pattern recognition, automatic segmentation.*

1. Introduction:

Biometric in general:

Biometrics is the identification of human identity based on special physiological characteristics. Therefore, scientists have tried to find a solution to the development of technologies that can analyze these characteristics and ultimately distinguish between different people. Some popular biometric features are features in fingerprint, language, DNA, face and different parts of it, and hand movement. Among these methods, face recognition and speaker recognition have been considered more than others in the past two decades. The idea of automated iris recognition was first proposed by Flom and Safir. They showed that the iris is an accurate and reliable code for biometric identification. First, the iris is an easily visible internal part of the body. Visible patterns are also unique to each individual. So it's really difficult to find two people with identical iris patterns.

Also, the iris pattern is different even for the left and right eyes. Furthermore, these patterns are almost immutable and will not change throughout life. Therefore, the patterns of the iris are almost constant throughout a person's life. This minimizes the likelihood of two people having the same traits when using traits that are very unique. Taking this uniqueness into account and proposing an algorithm to correctly extract the iris would result in a stable and accurate system to solve the human identification problem. Although some new research has revealed that there are some methods to hack these types of systems.

Background:

Alphonse Bertillon and Frank Burch, both ophthalmologists, suggested that iris patterns could be a reliable method for identification systems [2, 13], while John Daugman [3] was the first to invent an identification verification system based on iris patterns. Another valuable work by R. Wildes et al. Their method differed in both the algorithm used to extract the iris code and the pattern matching technique. Because the Daugman system has a proven record of high performance and a truly low failure rate, his systems are patented by Iriscan Inc. and are also used commercially by Iridian Technologies, British Telecom, the UK National Physical Lab, etc. So in our research the Daugman model is used to extract the iris pattern. In addition to using common steps used in other works, such as image acquisition and preprocessing, iris localization and normalization, our research uses powerful neural networks such as LAMSTAR [9] for the recognition part. Due to the availability of the Daugman model [6, 7] and the associated source code, a brief overview is given in each section to describe the theoretical approach and its results. The paper mainly focused on the neural network used and its implementation, as well as first experimental results and suggestions for performance improvement.

Image acquisition:

o get a reasonable result, this step should be done carefully. If you get a high-quality image with minimal noise, you reduce the necessary noise reduction process and promote the result of other steps. Especially when pictures are taken at close range, removing the reflection effect reduces errors originating from different steps. To focus on our method, which is actually a special type of classifier, the image provided by CASIA (Institute of Automation, Chinese Academy of Sciences) is used as the data set. These images were taken for the purpose of researching and implementing iris recognition software. Due to the use of infrared light to illuminate the eye, the effect of specular reflections was reduced in this dataset. Therefore, some initial steps to reduce errors caused by reflection are not required here. It is clear that real-time applications require a reflection removal process.

2. IRIS LOCALIZATION:

Method:

The part of the eye that contains information is only the iris region. As shown, the iris is located between the sclera and the pupil. Therefore, it is necessary to extract the iris from the eye image. Actually, a segmentation algorithm should be used to find the inner and outer boundaries. There are numerous studies on image segmentation such as [5] or those based on more sophisticated algorithms, but the most popular segmentation method is edge detection. The Cany edge detector has proven successful for this purpose. The Canny detector mainly consists of three main steps: finding the gradient, non-maximal suppression and hysteresis thresholding [8,11]. As suggested by Wildes, viewing the threshold in a vertical direction would diminish the effect of the eyelids.