(REVIEW ARTICLE)

A review of human iris identification and recognition using soft computing techniques

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Abstract

Computer vision and iris recognition are fields that are constantly evolving. During the past ten years, there has been a significant increase in the level of interest in computer vision, Iris recognition, soft computing techniques, neural networks, etc. This paper reviews different research papers on iris recognition. Lastly, it focuses on the international status of iris recognition.

Keywords: Iris recognition; Computer vision; Faces; AI; Soft computing

1. Introduction

With the development of artificial intelligence (AI) algorithms, human iris identification and recognition systems may gain speed, hardware simplicity, accuracy, and learning ability. Biometrics technology plays an important role in the public security and information security domains. Using various physiological characteristics of humans, such as iris, retina, 2D and 3D faces, facial thermography, fingerprints, hand geometry, etc., biometrics accurately identify each individual and distinguish one from another. Iris recognition entails capturing, preprocessing, and recognizing the iris in a digital eye image. Iris image pre-processing includes iris localization, normalization, and enhancement. Each of these steps uses different algorithms. In the iris localization step, the inner and outer circles of the iris and the upper and lower bounds of the eyelids are determined. The inner circle is located between the iris and pupil boundaries, and the outer circle is located between the sclera and iris boundaries.

The most recent analysis space in the Human Iris Image Process is Human Iris Identification and Recognition, and this can be a difficult task due to matching in the presence of outliers and noise. Recognition of geometrically remodeled Iris images, reading purposeful modification and looking at images in guide information.

2. Review of Literatures

It focuses on iris recognition algorithms and presents the results of 9.1 million comparisons among eye images from trials in Britain, the USA, Japan, and Korea in the present paper [1]. It designed an iris recognition system by using neural networks. The paper contains a study of the average time for iris recognition and the achievement of 98.62% segmentation accuracy. By using vector as the input signal to recognize the iris pattern, the accuracy is 99.25% [2]. The concept of the presented preprocessing method is very efficient, and he has recommended it for further enhancement studies. The study also includes a hardware implementation of a weightless neural network that was successfully developed for an iris recognition system. The performance of the system has been evaluated by the author and found effective and suitable [3]. The core of this paper is a study of the comparative performance of four different approaches

to iris identification. The author has also investigated the possibility of performance improvement using score level combinations. The author has placed an emphasis on the user authentication and extension of this work for further study [4]. It studied different recognition techniques. It has been found that many business applications in the future will rely more on biometric recognition systems. It has been proven very effective in protecting information and resources in a vast area of application. The paper consists of the study of a biometric iris recognition system via wavelength transform and edge recognition techniques [5]. It aimed for a Daugman's algorithm. It is a study of the use of highly classified and secure applications for reliable security systems to prevent unauthorised trespassing. In this work, the iris localization has been performed using Daugman's algorithm, and this system has been found capable of effective segmentation of regular shapes [6]. This paper presents two soft computing techniques within the realm of neural networks, specifically applied to pattern matching in iris recognition. The study introduces Competitive Neural Network Learning Vector Quantization (LVQ) and Adaptive Resonance Associative Map (ARAM) as approaches, offering a fundamental redefinition of pattern similarity. Additionally, the paper introduces a novel mixture model of ARAM for precise measurements of patterns[7]. Iris recognition stands out as the most dependable biometric system, owing to the richness and stability inherent in iris texture. In this study, they introduce a cumulative sum-based change analysis in conjunction with a neural network. Performance evaluation is conducted, with a focus on measuring false rejection rate and false acceptance rate. The experimental results showcase a comparative analysis of various methods, highlighting the effectiveness and promise of neural networks in iris recognition[8]. The study computes various features, including Contrast, Correlation, Energy, Homogeneity, Mean, Standard Deviation, Entropy, RMS, Variance, Smoothness, Kurtosis, and Skewness. These features exhibit distinct behaviors across different iris images, although some overlapping values may occur. Subsequently, the extracted features are inputted into a neural network, and the Levenberg-Marquardt back propagation training rule is employed for training. Following the training phase with feature values from authorized images, the next stage involves testing the neural network to assess its impressive accuracy which is 99.7%[9]. The personal identification system comprises several stages, including iris region localization, normalization, enhancement, and subsequent iris pattern recognition using a neural network. Through the obtained results, they demonstrated the uniqueness of an individual's left and right eyes. Furthermore, highlight the sensitivity of the network to initial weights and the adverse effects of over-training. Additionally, they introduce a rapid algorithm for localizing the inner and outer boundaries of the iris region. Simulation results underscore the effectiveness of the neural system in personal identification. Finally, they propose a hardware iris recognition model and discuss implementation considerations[10]. In this study, Iris Recognition is proposed based on the covariance of discrete wavelets utilizing Competitive Neural Network (LVQ). A series of Edge of Iris profiles is employed to construct a covariance matrix through discrete wavelet transform using Neural Network techniques. It has been observed that this approach to Iris Recognition design provides commendable class discriminability[11]. This paper emphasizes the utilization of Neural Networks in iris recognition, concentrating on recent research endeavors in the realm of bioinformatics aimed at individual identity verification. The discussed methodologies encompass various techniques such as localization, normalization, comparison, and encoding. The application of iris recognition extends to numerous practical and research domains[12].

3. International status

Over the last twenty-five years, human iris identification and recognition has become a popular area of research in computer vision, and one of the most successful applications of Aadhaar began operation in 2011 in India, whose government is enrolling the iris patterns (and other biometrics) of more than ten billion residents for the Aadhaar scheme for entitlement distribution, run by the Unique Identification Authority of India. Because of the nature of the problem, not only computer science researchers are interested in it but also neuroscientists and psychologists. It is widely assumed that advances in computer vision research will provide neuroscientists and psychologists with useful insights into how the human brain works, and vice versa.

Significance of the study

- A lot of research work is carried in the area of Human Iris Identification and Recognition
- In India we find that very few people are contributing in the area of Human Iris Identification & Recognition
- Human Iris Identification & Recognition is still not 100% achieve, so there is scope for contribution in this area.

4. Conclusion

It is our opinion that research on Iris recognition is an exciting area for many years to come and will keep many researchers busy. The present paper can provide the readers with a better understanding of Iris recognition and also highlights the literature review, international status of Iris recognition, and significance of the study. The topic is also open to further research.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

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