20 January 2023

Human retinal biometric recognition system based on multiple feature extraction

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Journal of Electronic Imaging, Vol. 32, Issue 1 (/journals/journal-of-electronic-imaging/volume-32/issue-1), 013008 (January 2023). https://doi.org/10.1117/1.JEI.32.1.013008 (https://doi.org/10.1117/1.JEI.32.1.013008)

Abstract

Retinal biometric trait is one of the safest and most secure biometric traits that can be used for personal identification and authentication. The poor contrast in captured retinal images initially requires the adoption of a preprocessing technique, especially when the vessel segmentation is required. As a result, an effective preprocessing technique is employed before the feature extraction process. The reliability of the segmentation depends on the consistency of the contrast across the images. Due to the complexity of the retinal vascular patterns, segmenting the vessels manually is a time-consuming task that also requires extensive training and abilities to distinguish the thinner blood vessel pixels from the background of the retinal images. We present a unique blood vessel segmentation technique based on Radial Chebyshev Moments (RCMs) shape descriptors. Moment-based shape descriptors are typically strong, concise, and simple to compute. They are also insensitive to the object's scale, rotation, and translation. Furthermore, to eliminate the eye movement and to overcome the various lighting problems, the following multiple features are extracted in the feature extraction stage to accurately authenticate a person: statistical (gray-level) features, shape-based (RCM) features, and structural features, such as minutiae, bifurcation points, optical disc, and enclosed regions. The principal components analysis methodology is used to optimize the feature vector, and the target image is identified using the support vector machine classifier. This step helps to determine whether the test image belongs to the authorized person or not. RIDB and VARIA are the two standard retinal authentication databases and DRIVE and STARE are the two general retinal databases that are used for evaluating the performance of the system. The system yielded a high identification rate of 98%, 97.5%, 97.2% and 94.4% with average processing time of 0.987 s, 0.40 s, 1.262 s and 0.65 s, respectively. From the results, it is evident that the proposed method is more effective and efficient for authenticating individuals.

Citation

Download Citation

Jothibasu Marappan, Karthik Murugesan, Malar Elangeeran, and Usha Subramanian "Human retinal biometric recognition system based on multiple feature extraction," *Journal of Electronic Imaging* 32(1), 013008 (20 January 2023). https://doi.org/10.1117/1.JEI.32.1.013008 (https://doi.org/10.1117/1.JEI.32.1.013008)

Received: 26 July 2022; Accepted: 4 January 2023; Published: 20 January 2023

KEYWORDS

Feature extraction

Blood vessels