2014 Second International Symposium on Computing and Networking, Shizouka, Japan 10-12 December 2014

Novelty Detection-Based Internal Fingerprint Segmentation in Optical Coherence Tomography Images

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Abstract

Biometric fingerprint scanners scan the external skin features onto a 2-D image. The performance of the automatic fingerprint identification system suffers if the finger skin is wet, worn out, fake fingerprint is used et cetera. In this paper, we present an automatic segmentation of the papillary layer method, in 3-D swept source optical coherence tomography (SS-OCT) images. The papillary contour represents the internal fingerprint, which does not suffer external skin problems. The slices composing the 3-D image are filtered by the regularized Perona and Malik partial differential equations filter to minimize the effect of speckle noise. Then the corneum stratum is detected; which in turn leads to the extraction of the epidermis using prior knowledge of the epidermis depth. The epidermis is used as the target of the novelty detection that is applied to the image slices. The contour of the papillary layer is segmented as the boundary between the target and rejection classes resulting from novelty detection. The papillary contours are consistent with those segmented manually; with the modified Williams index above 0.9400 on average. The 3-D papillary contour represents an internal fingerprint.