Improvement on pattern matching method for hand-waving finger vein authentication

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1. Introduction

Recently, the application field of biometric authentication is expanding from small-scale service to wide-scale one such as big event venue, theme park, and so on. In these situations, high-speed calculation and smooth operation are required because of a large number of users. In order to apply finger vein authentication to above services, a walkthrough type finger vein authentication is effective. In our previous study, a hand waving finger vein authentication system was proposed [1]. However, it is hard for this system to achieve high-speed calculation and highly accurate authentication simultaneously. In this study, we propose an improved pattern matching method that make it possible to accelerate the calculation of the finger vein authentication by applying Scale-Invariant Feature Transform (SIFT).

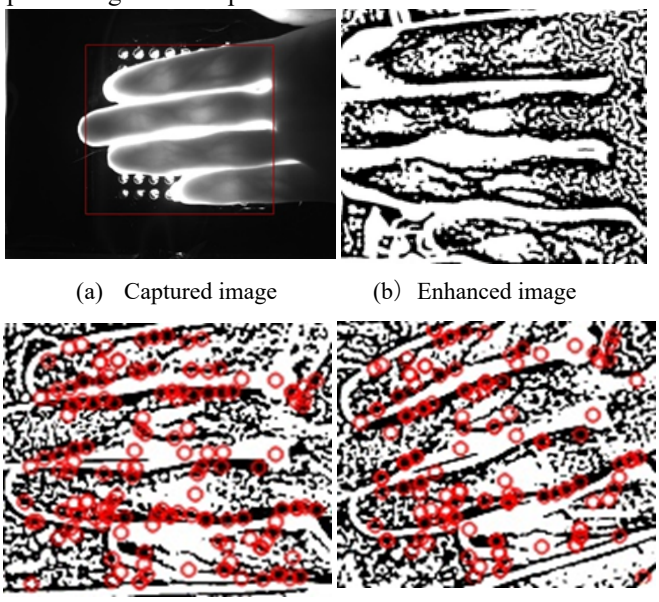
2. Verification based on SIFT

In the previous study [1], a similarity between enroll and verification finger vein patterns is calculated based on Normalized Cross Correlation (NCC). NCC-based method needs correction of the rotation and the shift of a finger vein image and it cannot employ multiple fingers for authentication because it is difficult to distinguish each finger from others. On the other hand, it is well known that SIFT is robust to rotation, shift and scale variation and the SIFT-based method can use multiple fingers for authentication. Therefore, we employ the SIFT-based method for the pattern matching of the finger vein authentication system.

In SIFT based method, we obtain some SIFT keypoints and corresponding feature vectors from a captured image and individually compare each feature vectors between the enrollment and verification finger vein image. If the number of matched feature vectors is more than a certain threshold level, that person is identified as a genuine. Because the SIFT-based method can be employed without extracting a finger vein region from a captured image and correcting the rotation and shift variation of the finger vein image, acceleration of the calculation speed can be expected. Moreover, improvement of the verification accuracy can be also expected because the SIFT-based method can use multiple fingers.

3. Experiments

We conducted experiments to evaluate the proposed pattern matching method. In Fig.1, the matched SIFT feature vectors are shown. The red circles indicate the matched vectors. This result shows that if the finger vein image between the enrollment and the verification is rotated, the SIFT feature vectors can be detected correctly. Table 1 shows the result of verification experiments, in which we used intentionally shifted and rotated finger vein images. The result in Table 1 shows that the SIFT based method could improve both of the verification accuracy and the processing time compared with the NCC.



(a) Captured image (b) Enhanced image

(c) Matched feature vectors in enrollment image (d) Matched feature vectors in verification image

Fig.1 Capturing system for hand-waving finger vein movie.

Table 1 Result of verification experiments

	EER[%]	Processing time[s]
NCC-based method	8.37	5.61
SIFT-based method	1.97	0.738

4. Conclusions

We proposed a SIFT-based pattern matching method for a hand-waving finger vein authentication system. With experiments, we also showed that the proposed system could improve both of the verification accuracy and the processing time when the finger vein image was rotated and shifted.

References

[1] H. Suzuki, et al., JSAP-OSA Joint Symposia 2016, 13a-C301-6 (2016).