Improvement on finger region extraction for hand-waving finger vein authentication

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1. Introduction

Recently, a walkthrough type vein authentication system has been attracting extensive attention, which is effective for wide-scale events such as big event venue, theme park, and so on. In our previous study, a hand waving finger vein authentication system was proposed, in which a similarity between enroll and verification finger vein patterns was calculated based on Normalized Cross Correlation [1] and Scale-Invariant Feature Transform [2]. These methods perform worse in case that the background of the captured frame has significant noises such as the bright light sources. In order to eliminate such noises and extract a finger region correctly, we apply a machine learning method. In this study, we employ U-Net [3] as a machine learning method and evaluate it compared to conventional image processing techniques.

2. Method

U-Net is well known as a convolutional neural network architecture for image segmentation and it is reported that U-Net can perform segmentation for medical images effectively. Fig.1 shows a training flow of this work. We take movies of finger vein patterns and extract finger regions manually from the captured images using Adobe Photoshop. The extracted finger regions are used as ground truth of machine learning. A function to extract a finger region from a captured finger vein image is generated by using the captured images and corresponding finger region ones as input data and output data of U-Net respectively.

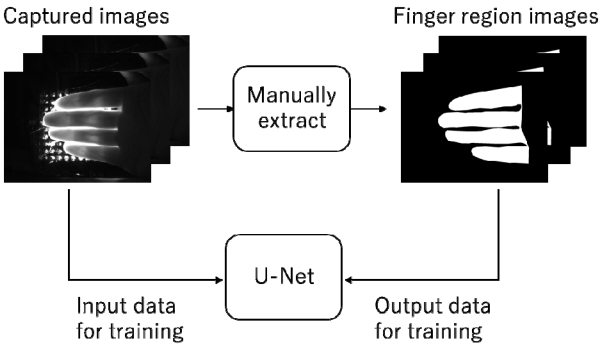
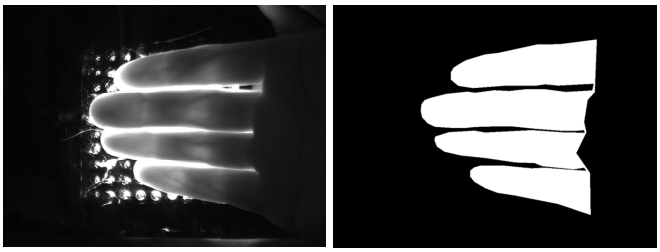


Fig.1 Training flow of U-Net based machine learning.

3. Experiments

We took moving images of hand-waving finger vein with a transmitted-type imaging system. The size of the captured image is 1024 x 768 [pixel]. Fig.2 shows a pair of a captured finger vein image and a corresponding finger region one, which are used for training of U-Net. For the training, we used 24 captured images from three subjects. Under these conditions, we generated a function to extract a finger region from a captured finger vein image. Fig.3 shows an example result of finger region extraction. The experimental results show that the generated function contributes to a good performance of the finger region extraction in terms of accuracy as well as computational time.



(a) Captured image (b) Finger region of (a)

Fig.2 Example of training data.

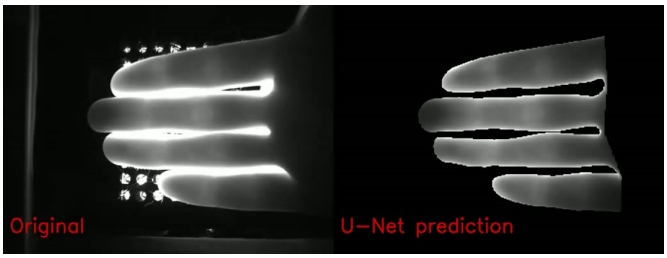


Fig.3 Resultant image of finger region extraction.

4. Conclusions

We generated a U-Net-based finger region extraction function and showed that it could perform the finger region extraction effectively. We also confirmed that U-Net could make implementation with less trial-and-error for adjusting parameters compared to conventional image processing techniques.

References

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[3] J. Redmon, et al., CVPR2016, pp. 779-788 (2016).

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