Mobile Wrist Vein Authentication Using SIFT Features

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Abstract. Biometrics have become important for authentication on modern mobile devices. Thereby, different biometrics are differently hard to observe by attackers: for example, veins used in vein pattern authentication remain hidden when not using specialized hardware. In this paper we propose a low cost mobile vein authentication system based on SIFT features. We implement our approach as vein recording and authentication prototype, evaluate it using a self recorded vein database, and compare results to other vein recognition approaches applied on the same data.

Keywords: mobile authentication, NIR, SIFT features, wrist veins

1 Introduction

Modern mobile devices have access to, store, and process much private information, such as with messaging (email, SMS), contacts, access to private networks (VPN, WiFi), or even mobile banking. Thus, most mobile devices provide local access protection mechanisms, such as PIN, password, or fingerprint authentication. The used authentication information could thereby be observed and used in replay attacks by attackers. However, some biometrics are more difficult to observe by attackers, as they remain hidden without special sensing technology.

Vein pattern authentication has gained popularity for being contactless, while users' veins largely remain hidden within the visible spectrum of light. To discover vein patterns, near infrared (NIR) light and cameras with an optical NIR bandpass filter are usually used [2, 6]. As NIR light is not visible to neither humans nor regular cameras, capturing vein patterns is more difficult for attackers than e.g. observing face information used for face authentication. Most vein capturing approaches use finger, hand dorsal, palm, or wrist veins [1, 7]. For mobile users, wrist veins have the advantage of being easily accessible: in the future, wrist vein authentication could be done e.g. by smartwatches, which would not require any effort and/or changes in behavior for the user. Existing vein recognition approaches use e.g. fast spatial or 2D correlation [5, 3], or spectral minutiae [1]. In this paper we present another approach: we combine low cost mobile wrist vein recording with SIFT features for vein authentication.

2 Mobile Wrist Vein Authentication With SIFT Features

The aim of this paper is to advance mobile vein authentication by combining low cost mobile vein recording with SIFT features for authentication [4]. We record vein images from a NIR sensitive camera with NIR LEDs, then apply image filtering and segmentation with local thresholding to obtain vein pattern images. From obtained vein patterns we derive SIFT descriptors as reliable vein pattern keypoints. For two given vein patterns, those can be compared to decide if both patterns have been originated by the same person, which thereby enables vein authentication. We evaluate our approach using a self recorded wrist vein image database and compare it to other approaches, such as vein pattern image correlation.

3 Current Results

We have implemented a mobile vein pattern recording and authentication prototype using an external NIR sensitive USB camera with 24 NIR LEDs. Currently, the thereby recorded mobile wrist vein database contains 10 individuals, which we plan on extending to more than 30 individuals. First experimental results show a reliable recognition of individuals with well visible veins. From extracted SIFT features of two vein patters, we currently use the mean of the closest features across both patterns a basis for the authentication decision. Our approach thereby seems to only require 4 images per individual to correctly distinguish between vein pattern images originated by the same person and those originated by different people. Applying vein pattern 2D image correlation on the same dataset seem to lead to slightly worse results, thereby would be in favor of using SIFT features.

We plan on further improving and fine tuning our vein authentication, as well as deepening the underlying evaluation to obtain a more broad and representative basis for conclusions.

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