INTISARI

A FUSION METHODOLOGY OF AKAZE AND NEURAL NETWORK FOR PARTIAL FINGERPRINT RECOGNITION

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Dalam beberapa tahun terakhir, perangkat seluler seperti *laptop*, *smartphone*, dan *tablet* telah menjadi bagian dari aktivitas manusia. Diperlukan suatu metode untuk menjamin kerahasiaan data pada perangkat mobile. Sidik jari adalah salah satu ciri biometrik unik yang digunakan untuk mengotentikasi individu. Sidik jari dapat digunakan untuk masalah keamanan, termasuk pembayaran, perbankan, kehadiran, dan mengamankan barang-barang. Mengenali citra sidik jari pada perangkat seluler sulit dilakukan karena sensor sidik jari hanya berukuran 10 x 10 mm^2. Sensor hanya menangkap beberapa bagian dari keseluruhan sidik jari.

Penelitian ini mengusulkan metodologi untuk pengenalan sidik jari parsial. Fitur sidik jari direpresentasikan menggunakan AKAZE. Fitur-fitur ini dipilih karena dapat mempertahankan noise, skala, dan orientasi citra sidik jari. Selain itu, kami merumuskan tahapan pencocokan menggunakan *sliding window*. *Sliding window* bertujuan untuk membandingkan citra penuh dan citra sebagian secara menyeluruh. Sebagai tambahan dari penelitian ini, kami juga mengganti metode heuristik untuk menghitung presentase hasil dengan *neural network*. *Neural network* telah terbukti mampu membedakan berbagai data tanpa perlu melakukan banyak *tuning parameter*.

Sebagai validasi, kami bereksperimen menggunakan modifikasi dari FVC2002 *database*. Metode kami mencapai hasil yang memadai dalam hal evaluasi biometrik. Nilai EER dan FRR@FAR 1/5000 berhasil mencapai presentase kurang dari 9%. Tingkat keberhasilan tertinggi tercatat di DB1, EER mencapai 4,95%, dan FRR@FAR 1/50000 mencapai 6,06%. Namun, metode ini hanya optimal pada citra berukuran 184x184 piksel. Kami belum bisa mengenali sidik jari saat resolusinya diperkecil. Sebagai penelitian masa depan, kami harus memastikan metode kami bekerja dalam berbagai resolusi citra. *Deep learning* dapat membantu mempertahankan kinerja di seluruh resolusi. *Deep learning* telah terbukti berhasil dalam memecahkan masalah yang kompleks.

Kata Kunci: AKAZE, *sliding window*, penentuan presentase hasil, pengenalan sidik jari parsial

ABSTRACT

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In recent years, mobile devices such as laptops, smartphones, and tablets have become an integral part of human activities. Accordingly, we need a method to ensure data confidentiality on mobile devices. The fingerprint is one of the unique biometric traits used to authenticate individuals. It is widely used for security issues, including payments, banking, attendance, and securing belongings. However, recognizing the fingerprint image on a mobile device is difficult since the fingerprint reader is only 10 x 10 mm^2 in size. The reader captures only some parts of a whole fingerprint. This result contains only a small amount of information, such as ridges, minutiae, and pores.

We proposed a novel methodology for partial fingerprint recognition. The fingerprint feature was represented using the local feature-based AKAZE. These features were selected because they could maintain the fingerprint image's noise, scale, and orientation. Moreover, we formulated the standard of matching tasks using a sliding window. This sliding window made it possible to compare full images and partial queries comprehensively. As part of this approach, we also replaced the heuristic method of calculating the matching rate with neural networks. A neural network had proven to be able to distinguish between a variety of data without the need for a lot of rules.

As validation, we experimented with our method using an instance of the FVC2002 database. Our method achieves adequate results in terms of biometric evaluation. These values of EER and FRR@FAR 1/5000 are both less than 9%. The highest success rate was recorded in DB1, EER reached 4.95%, and FRR@FAR 1/50000 reached 6.06%. However, these methods only optimize for images of 184x184 pixels. We cannot yet recognize fingerprints when the resolution is reduced. As future research, we must ensure our method work in various image resolutions. Deep learning can help sustain performance across resolutions. As far as computer vision is concerned, deep learning has been proven to be successful in solving complex problems.

Keywords: *AKAZE feature representation, sliding window, decision scoring, partial fingerprint recognition*