Fingerprint Recognition: Contributions to Latent Matching and 3D Fingerprint Target Generation

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Abstract:
Automatic fingerprint capture and comparison methods have led to the ubiquitous use of fingerprint-based person recognition in applications ranging from law enforcement and border control to national identification and smartphone unlock. However, despite tremendous advancements in the state-of-the-art, improvements are still needed to recognize noisy and distorted fingerprints acquired from uncooperative users, improve fingerprint reader fidelity, and determine anti-spoofing capability of different fingerprint readers. We address two such impending challenges: (i) comparison of latent prints found at crime scenes to large collections of reference prints (rolled tenprints or slap fingerprints) in law enforcement databases, and (ii) operational evaluation of fingerprint recognition systems prior to large scale deployment. We develop a feedback paradigm that uses reference fingerprint features to dynamically select latent features during matching. This paradigm when used in conjunction with a state-of-the-art latent matcher demonstrates marked improvement (0.5-3.5%) in latent matching accuracy. Another contribution of this thesis in latent matching demonstrates a significant recognition performance improvement (2.5-11.5%) using crowdsourced latent markups. Finally, we design and fabricate wearable single-finger and whole hand 3D targets for operational evaluation of several commercially available contact-based and contactless optical readers as well as capacitive readers.