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Separate the overlapping latent fingerprints using Fourier Optics (FO)

One of the evidence left in the crime scene, which is important in finding the person who committed the crime, is latent fingerprints. Fingerprints are both unique and permanent, making it an ideal biometric trait for the person identification by extracting and comparing characteristic points (minutiae) of ridges. The cases of overlapping fingerprints are frequently encountered in a crime scene and they can cause difficulty of interpretation for an investigator. To lessen the problem, in this study, a method for separating the overlapping latent fingerprints is proposed. The method is based on the 4F imaging system normally found in Fourier Optics (FO). The principle of the 4F system is to convert spatial domain patterns into the frequency domain patterns, filter out the unwanted components from the pattern, and convert the modified pattern back to the spatial domain patterns again. Therefore, the final image is improved from its original form. The object under investigation here is the overlapping fingerprints. The key point that allows us to implement FO to the overlapping fingerprints is the periodic patterns of ridges of fingerprints. The overlapping fingerprints can create perpendicularly periodic patterns in the frequency domain and one of the patterns can be systematically removed by an appropriate filter. Subsequently, only one fingerprint pattern in the spatial domain still remains and is recovered. In addition, the simulation is also conducted to supplement the experimental results by using a freely available software: ImageJ. The technique based on FO shows a potential for the recovery of an individual fingerprint from overlapping fingerprints.

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