

5. Conclusion and Future Work

While current automated a fingerprint identification system have achieved high accuracy in matching rolled/plain prints, latent fingerprint matching remains to be a challenging problem and requires much human intervention. The goal of this work is to achieve accurate latent segmentation, which is an essential step towards automatic latent identification. Existing fingerprint segmentation algorithms perform poorly on latent fingerprints, as they are mostly based on assumptions that are only applicable for rolled/plain fingerprints.

In this work, we proposed the Adaptive Directional Total Variation (ADTV) model as an image decomposition scheme that facilitates effective latent fingerprint segmentation and enhancement. Based on the classical Total-Variation model, the proposed ADTV model differentiates itself by integrating two unique features of fingerprints, scale and orientation, into the model formulation. The proposed model has the ability to decompose a single latent image into two layers and locate the essential latent area for feature matching. The proposed ADTV scheme can be viewed as a preprocessing technique in automatic latent fingerprint recognition. It also has a strong potential to be applied to other applications, especially for processing images with oriented textures. This study can be further extended along the following directions:

- 1) The effectiveness of the proposed scheme is related to the accuracy of orientation estimation. When the estimated orientation is unreliable, fingerprint patterns may not be fully extracted to texture layer, leading to poor segmentation and enhancement results. In addition, the positions of singular points were not taken into consideration by the proposed model. Additional detection and processing techniques can be introduced for handling regions surrounding the singular points.
- 2) Some structured noise may have very similar characteristics as fingerprint patterns and cannot be blocked from the texture layer. For example, parallel straight lines have high coherency similar to fingerprints and could be extracted to the texture layer as well. Adding a preprocessing step to remove this type of structure noise may be a possible solution.
- 3) The proposed ADTV method is incapable of handling regions with overlapped fingerprints, as our model formulation is designed to identify regions with coherent orientations along one single direction. To handle images with overlapped fingerprints, some sophisticated local analysis has to be conducted and integrated into the model formulation.

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