Afternoon Tutorial 1: Contactless 3D Fingerprint Acquisition and Matching

Abstract

Contact-based 2D fingerprint identification is widely employed for the civilian and law-enforcement applications around the world. Such traditional acquisition of fingerprint images by pressing or rolling of fingers against the hard surface (glass, silicon, polymer) or paper often results in partial or degraded images due to improper finger placement, skin deformation, slippages, smearing or due to sensor noise. As a result full potential from the fingerprints is not realized. Therefore, touchless 3D finger imaging systems have emerged to address above intrinsic problems. Such 3D approaches can also provide more accurate personal identification as rich information is available from 3D fingerprint images.

Emerging solutions for the contactless 3D fingerprint acquisition are largely based on shape from silhouette, structured lighting or photometric stereo based imaging. However widely accepted standards or the representation of 3D fingerprint features is yet to emerge. The minutiae features are widely considered to be most reliable and widely employed by law enforcement experts and commercial 2D fingerprint systems available today. Accurate recovery, representation, selection, registration and matching of 3D fingerprints is essentially a biometrics recovery/alignment, and matching problem. This half-day tutorial will provide algorithmic details relating to 3D fingerprint recovery, matching and interoperability of 3D fingerprints.

Presenters

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Topics

(i) Introduction to Contactless Fingerprint Identification
(ii) Contactless Live 3D Fingerprint Imaging
   a. Structured Lighting
   b. Multiple Cameras
   c. Photometric Stereo
(iii) Preprocessing 3D Fingerprint Data
(iv) Recovering 3D Minutiae (also other features)
(v) Matching two 3D Fingerprint Templates
   a. Registering two 3D fingerprints
b. Selection/Evaluation of 3D Minutiae  
c. Generating Matching Score  
(vi) Individuality of 3D Fingerprints  
(vii) Interoperability of 3D Fingerprints with Legacy Fingerprint Databases  
(viii) Matching 3D Fingerprints with Legacy Fingerprint Databases  
(ix) Conclusions and Further Work  
a. Sharing of 3D Fingerprint Database and Codes  
b. Theoretical Problems  
c. A List of Unanswered Questions  

References  