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Contact-free and pose-invariant hand biometric based personal identification system using RGB and depth data

Key words: Hand biometric, Contact free, Pose invariant, Identification system

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Introduction

- Hand biometric feature based personal identification is considered to be an effective method for automatic recognition.
- A contactless personal identification system is proposed based on matching hand geometry features and color features.
- The hand is segmented from the background through depth images, which are insensitive to illumination and background.
- Finger orientations and landmark points like finger tips or finger valleys are then obtained by geodesic hand contour analysis.
- Geometric features and palm print features are extracted from depth images and intensity images, respectively.

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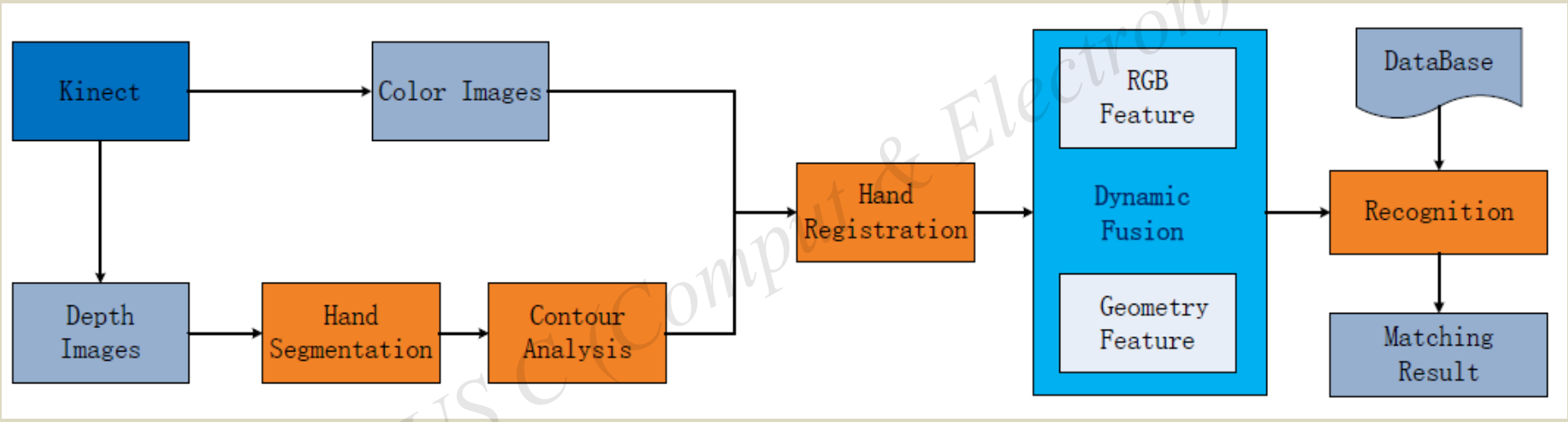
Design method (I)



A brief illustration of the proposed biometric-feature-based human hand identification system

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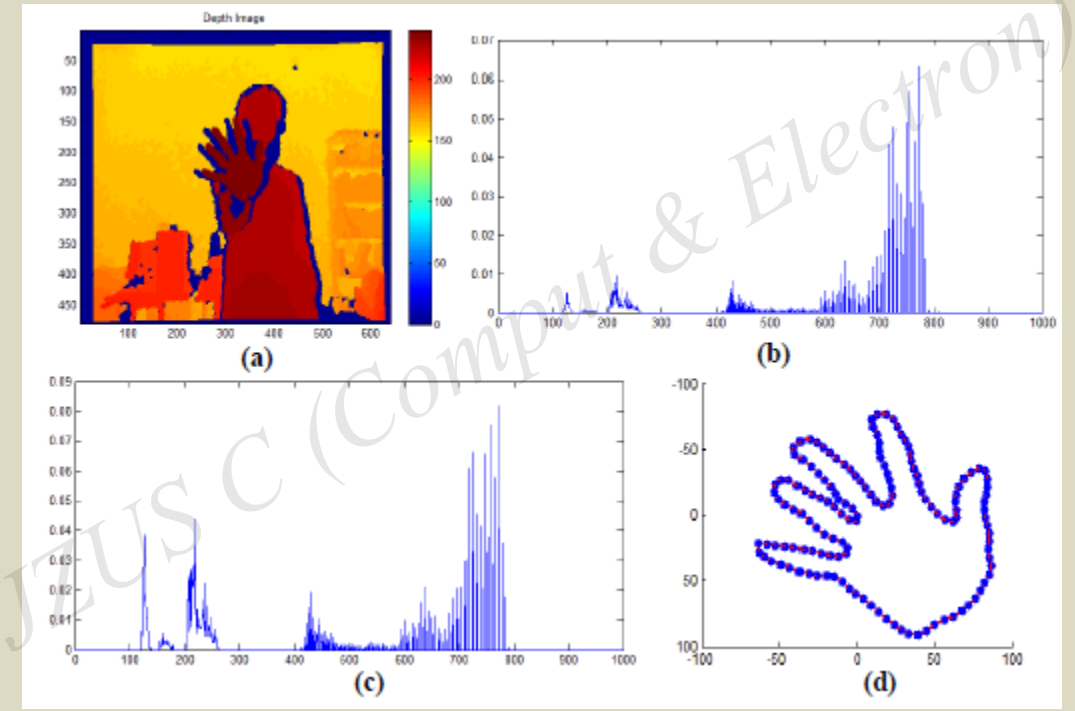
Design method (II)

Hand segmentation based on depth data:



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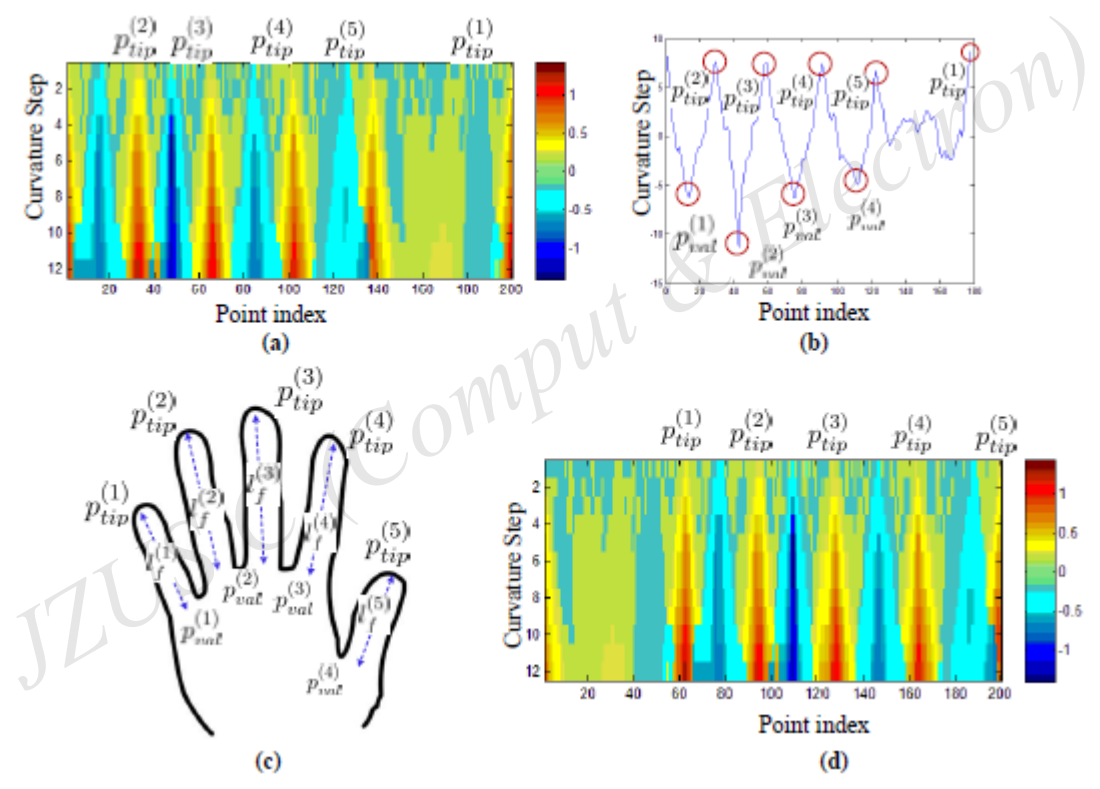
A brief illustration of a weighted-depth-histogram based first-peak hand segmentation method: (a) original depth map; (b) its depth histogram; (c) weighted depth histogram; (d) 3D hand contour transformed to the camera coordinates

Design method (III)

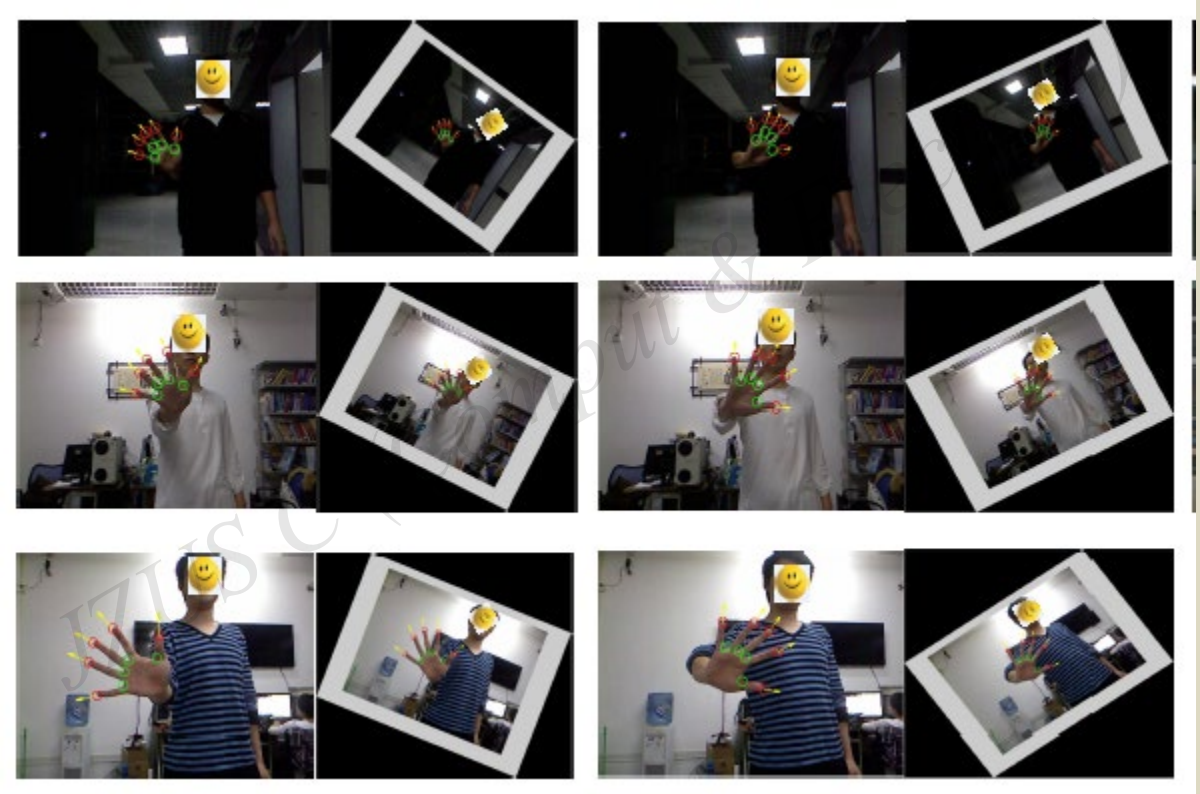
Geodesic contour analysis based on curvature calculation:



(a) Original curvature matrix. (b) Curvature hist with five peak points and four valley points marked by red circle. (c) Illustration of the found tips and valleys points on a hand and finger length. (d) The re-formulated curvature matrix.

Qualitative results

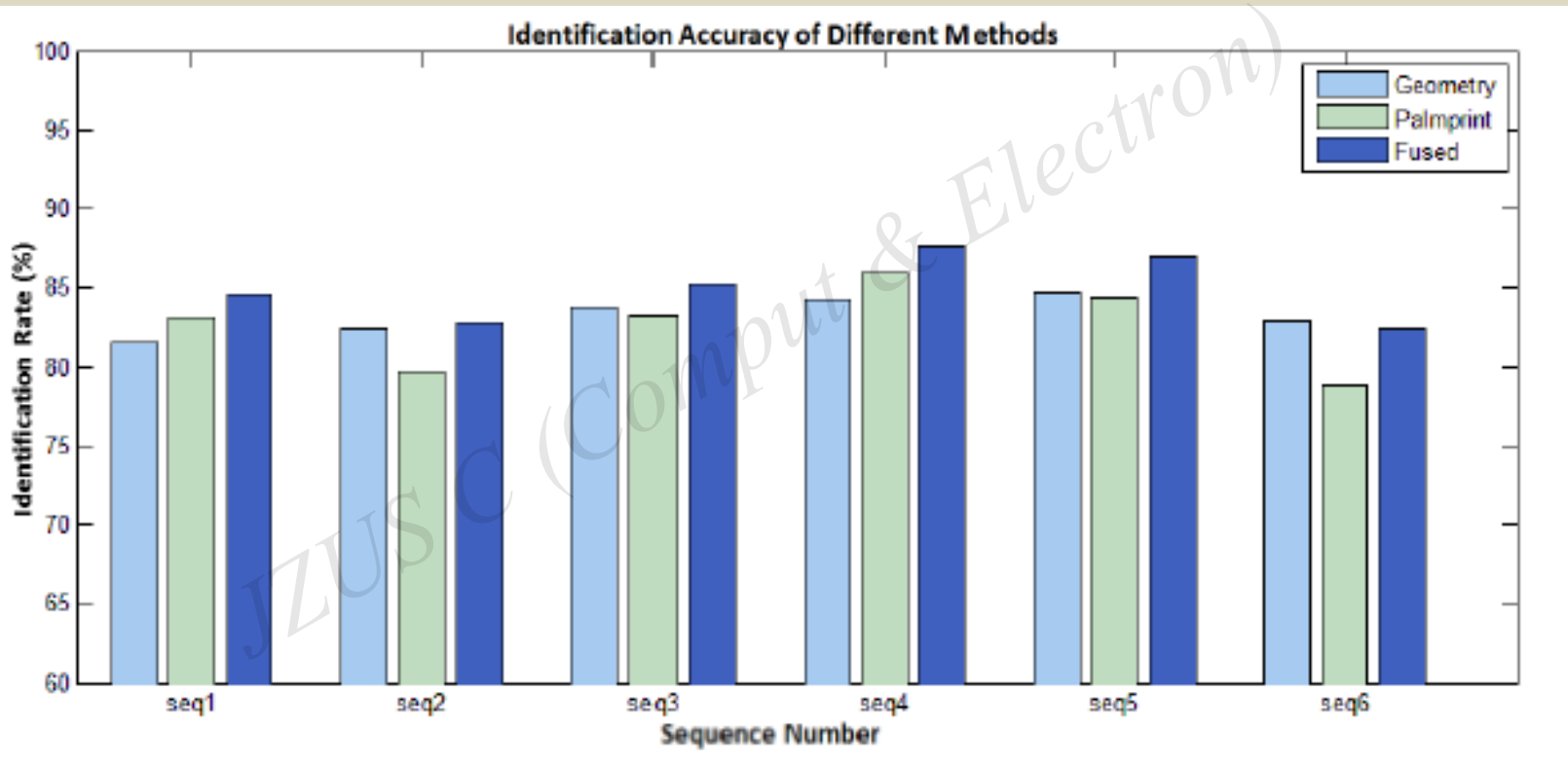
Hand segmentation and registration results:



Hand registration based on finger orientation. Six real registration examples are given, with hands being rotated to face the camera and point upwards

Quantitative results

Identification accuracy of different methods:



Performance of the hand-biometric-based person identification system. Geometric features, RGB features, and fused features are used to identify people in six sequences, respectively

Conclusions

- In this paper, a contactless personal identification system is proposed based on matching hand geometry features and color features. An inexpensive Kinect sensor is used to acquire depth and color images of the hand.
- Hand geometry features and color features used in our system show good discrimination ability. More robust features will be extracted to better discriminate hands in future work.

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