Slap Fingerprint Segmentation

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Abstract
This poster presents a novel approach in segmenting multiple fingertips from an image. Such an image is taken by a scanner capable of recording several fingers simultaneously. A combination of two-staged mean shift and ellipse-fitting algorithms as well as an elaborate subsequent set of rules is used to segment the single fingerprint images. First, the mean shift as a well-established feature-space analysis technique is used to identify the different components of the fingers. Then the orientation and size of each component is determined by the application of a robust ellipse-fitting algorithm. Finally the rules locate the fingertips. Extensive experimental evaluations demonstrate the success of the approach.

Goals
- Correct segmentation of the fingertips (size, orientation)
- Assignment and classification of the fingers
- Left or right hand detection
- Performance (real time capability)

Segmentation Approach

1. Mean shift
- Use two-staged mean shift [1] to identify components of the fingers.
- 1st run detects components.
- 2nd run merges modes.

2. Ellipse fitting
- Calculate size and orientation of potential fingertips using properties of the covariance matrix [2].
- Re-estimation using elliptical search window turned into direction of average angle for more accurate results.

3. Finger logic
- Use of orientation normalized image.
- Select topmost modes.

Results
- Segmentation results measured with Overlap Score and Precision/Recall
- 150 Images (3 simulated scenarios)
- Overlap Score: 71%
- Precision: 76%
- Recall: 86%

Conclusion
- Combination of mean shift and ellipse fitting algorithm
- Robust and accurate detection
- Very good results
- Real time capable

References
In IEEE Transactions on Pattern Analysis and Machine Intelligence, volume 24, 2002.