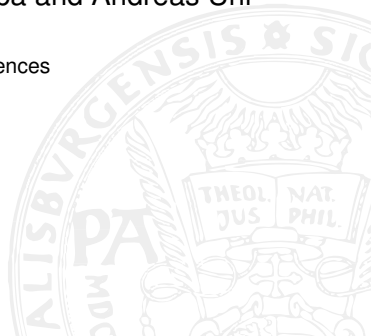


Multi-Perspective Finger-Vein Biometrics

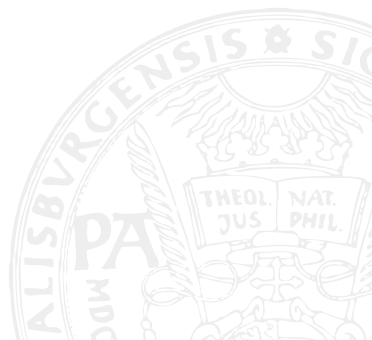
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University of Salzburg

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- 1 Finger-Vein Biometrics
- 2 PLUSVein-Finger Rotation Data Set
- 3 Experiments and Results
- 4 Conclusion and Future Work



General

- The networks of blood vessel under the skin of the finger are unique
- Therefore, finger-veins are suitable for biometric applications
- Similar to fingerprints also images of the blood vessels can be used for authentication

Advantages

- Resistant to forgery (inside finger, NIR light)
- Liveness detection is possible
- No abrasion as with fingerprints
- Insensitive to finger surface conditions

Disadvantages

- Comparatively large capturing device
- Images have in general lower contrast and lower quality than fingerprint images
- Vein structures are influenced by temperature, physical activity, certain diseases or injuries

PLUSVein-Finger Rotation Data Set I

- Up to now only palmar (and one dorsal) data sets
- No evaluation of other perspectives possible
- New finger-vein data set providing images all around the finger (360°-view)
- Acquired using our custom build sensor

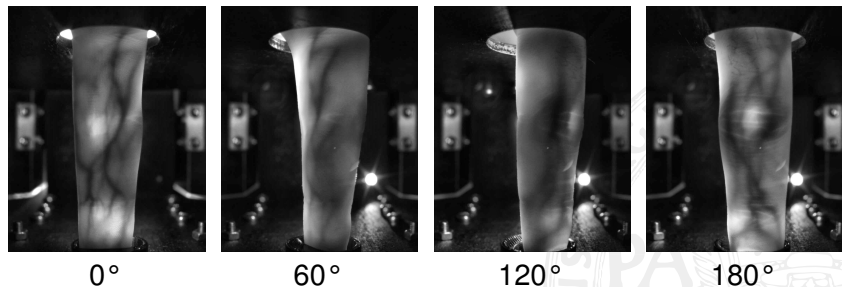


Figure: Example images of the data set acquired from 0° to 180° in 60° steps

PLUSVein-Finger Rotation Data Set II

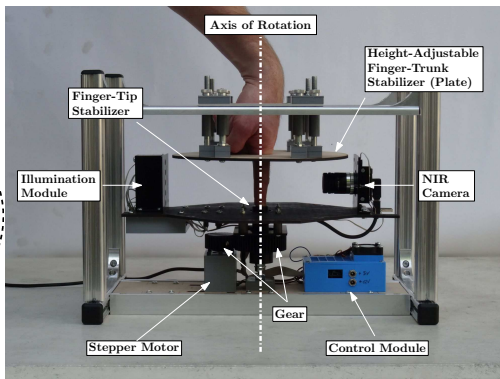
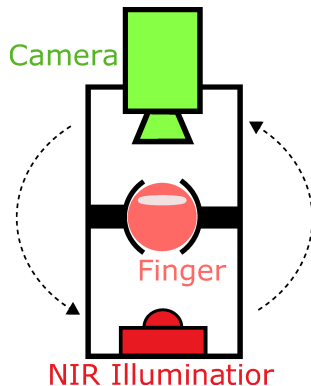
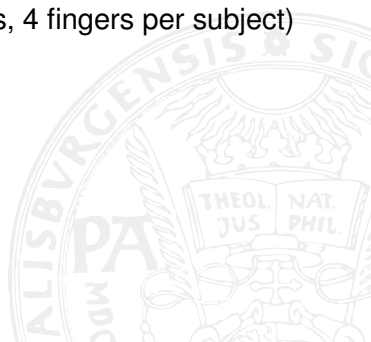


Figure: Left: Principle of the multi-perspective finger vein scanner, right: the scanner itself

Statistical data

- 63 subjects (27 female, 36 men)
- 11 nations (Austria, Brazil, China, Ethiopia, Germany, Hungary, Iran, Italy, Russia, Slovenia, USA), but mainly white Europeans (73%)
- Age: 18 (limited by national law) to 79 years
- 252 unique fingers (63 different subjects, 4 fingers per subject)
- 5 samples per finger
- 1.260 images per view
- Step-size: 1°
- 361 different views ($0^\circ + 360^\circ$)
- 454.860 images in total.



PLUSVein-Finger Rotation Data Set IV

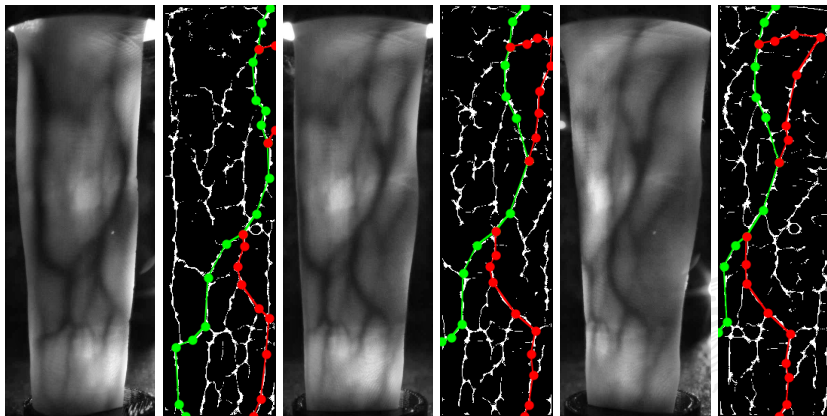


Figure: Examples of finger vein images and extracted MC features acquired at different longitudinal rotation angles. Left: -30° , middle: 0° (palmar view), right: 30°

Experiments

Performance evaluation of different perspectives all around the finger

- Step-size 5°

Fusion of selected perspectives

- Multiple perspectives (2-72)
- One against all other

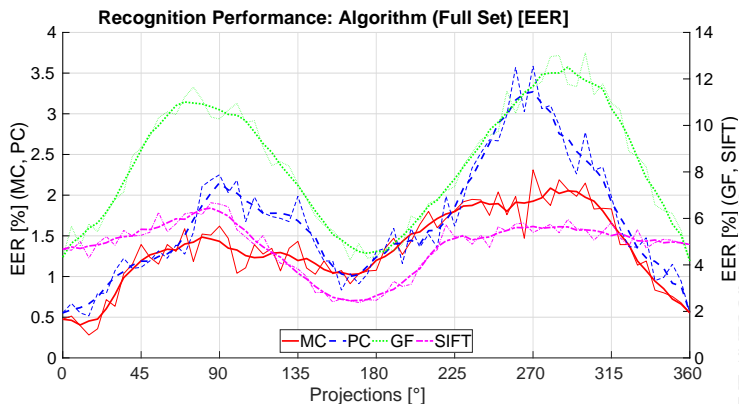
Used recognition schemes

- Vein pattern based methods (binarization)
 - Maximum Curvature (MC)
 - Principal Curvature (PC)
 - Gabor Filter (GF)
- Key-point based methods
 - SIFT

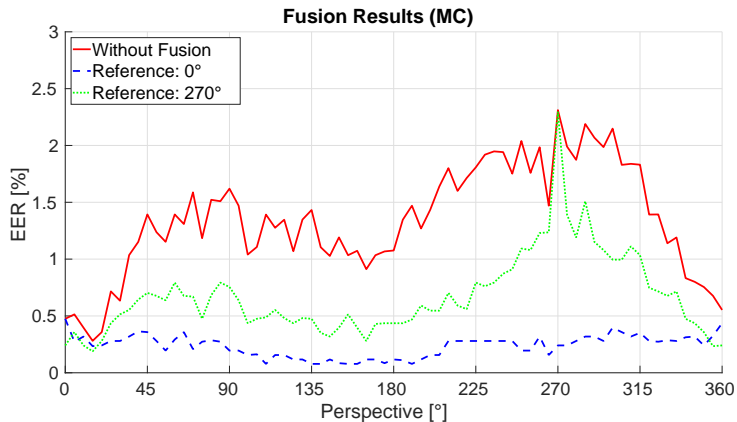
Used performance indicators

- EER
- FMR100
- FMR1000
- ZeroFMR

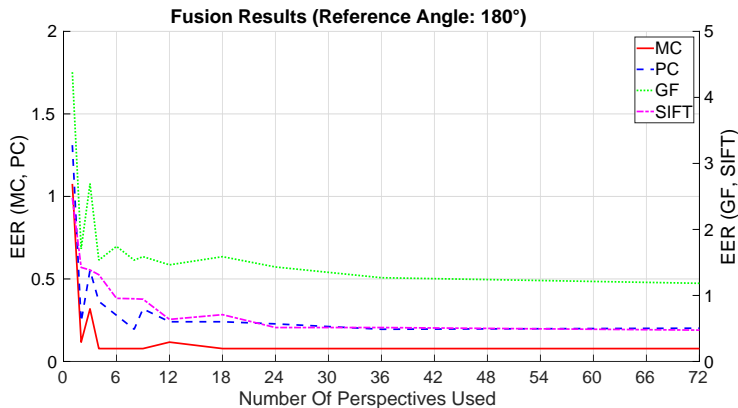
Recognition performance for different projections



Two-Perspective Fusion

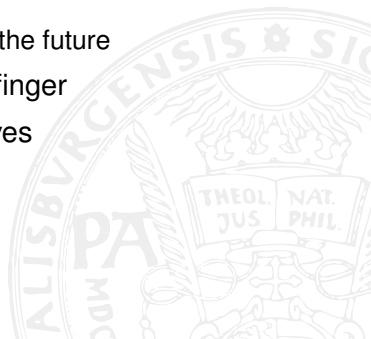


Multi-Perspective Fusion



Contribution

- Designed a custom rotating multi-perspective finger vein scanner device
- Established the first multi-perspective finger vein data set (360°-view)
 - Will be made available to the public in the future
- Analysis of perspectives all around the finger
- Preliminary fusion of selected perspectives



Conclusion

- Best performance at 0° (palmar) and 180° (dorsal) region
- Inbetween the performance is inferior
- Opposite perspectives are independent from each other
- Fusion increases recognition performance

Future Work

- Improvements on scanner hardware
- More detailed evaluation on fusion
- Problems and Effects from longitudinal finger rotation (already published at BIOSIG'18)
- 3D reconstruction of finger vein structure

Thank you!

