

DETECTION AND EVALUATION OF FINGER VEIN SPOOFING IN MONOGENIC SCALE SPACE

Tirunagari et al.



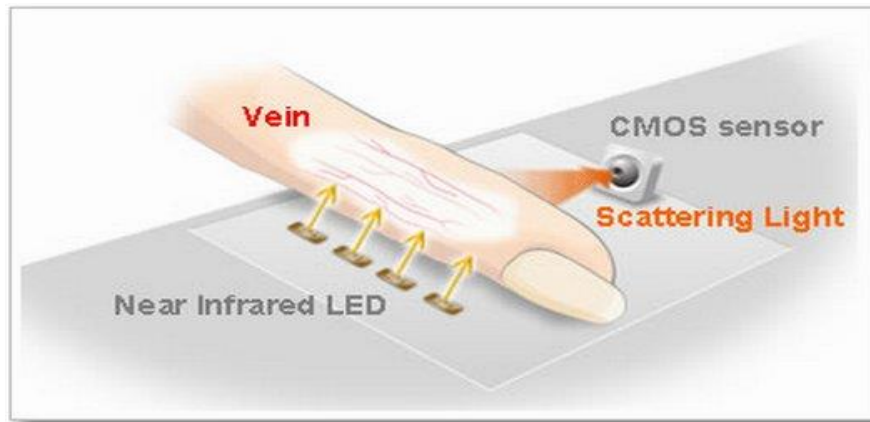
FINGER VEIN BIOMETRICS

- Authentication system that matches the vascular patterns in an individual's finger.
- Blood vessel patterns are unique to each individual, as are other biometric data such as fingerprints or the patterns of the iris



HOW IT WORKS ?

- An individual inserts a finger into an attester terminal containing a near-infrared LED (light-emitting diode) light and a monochrome CCD (charge-coupled device) camera.
- The hemoglobin in the blood absorbs near-infrared LED light, which makes the vein system appear as a dark pattern of lines.
- The camera records the image and the raw data is digitized, certified and sent to a database of registered images.



WHERE IT IS USED ?

- European biometric cards.
- Credit card authentications.
- Automobile security.
- Employee time and attendance tracking.
- Computer and network authentications.
- End point security and ATMS.
- <http://www.bbc.co.uk/news/business-29062901>

WHAT IS FINGER VEIN SPOOFING ?



IDIAP - Switzerland

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MONOGENIC SCALE SPACE

BACKGROUND ON ATTACKS

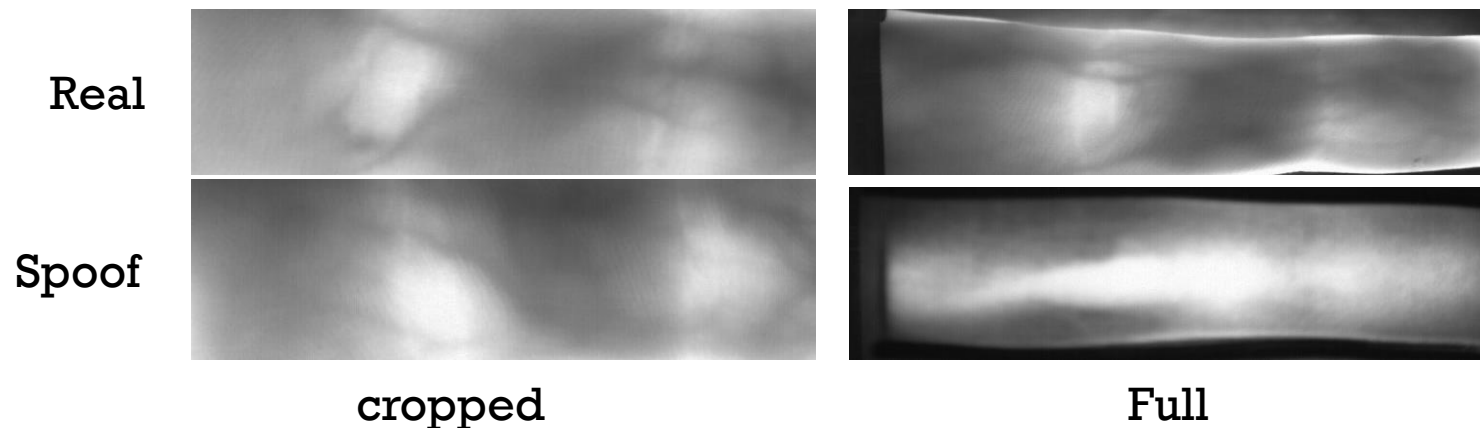
Print attack

Spooing finger vein:
the recipe

DATASET – 1ST COMPETITION ICB 2015

- Spooing-Attack finger vein database.

Protocol	Training set	Development set	Test set
full	120	120	200
cropped	120	120	200



TWO FOLD CROSS VALIDATION



MONOGENIC SCALE SPACE

- Global descriptors capturing appearance and shape within an image can be described by the distribution of local energy and local orientation.
- The monogenic signal is a representation derived from a generalization of the 1-D Hilbert transform to a higher dimensional signal space.
- Uses Poisson Kernel.
- Used for Edge detection.
- Our Contribution: Histogram descriptor representation.

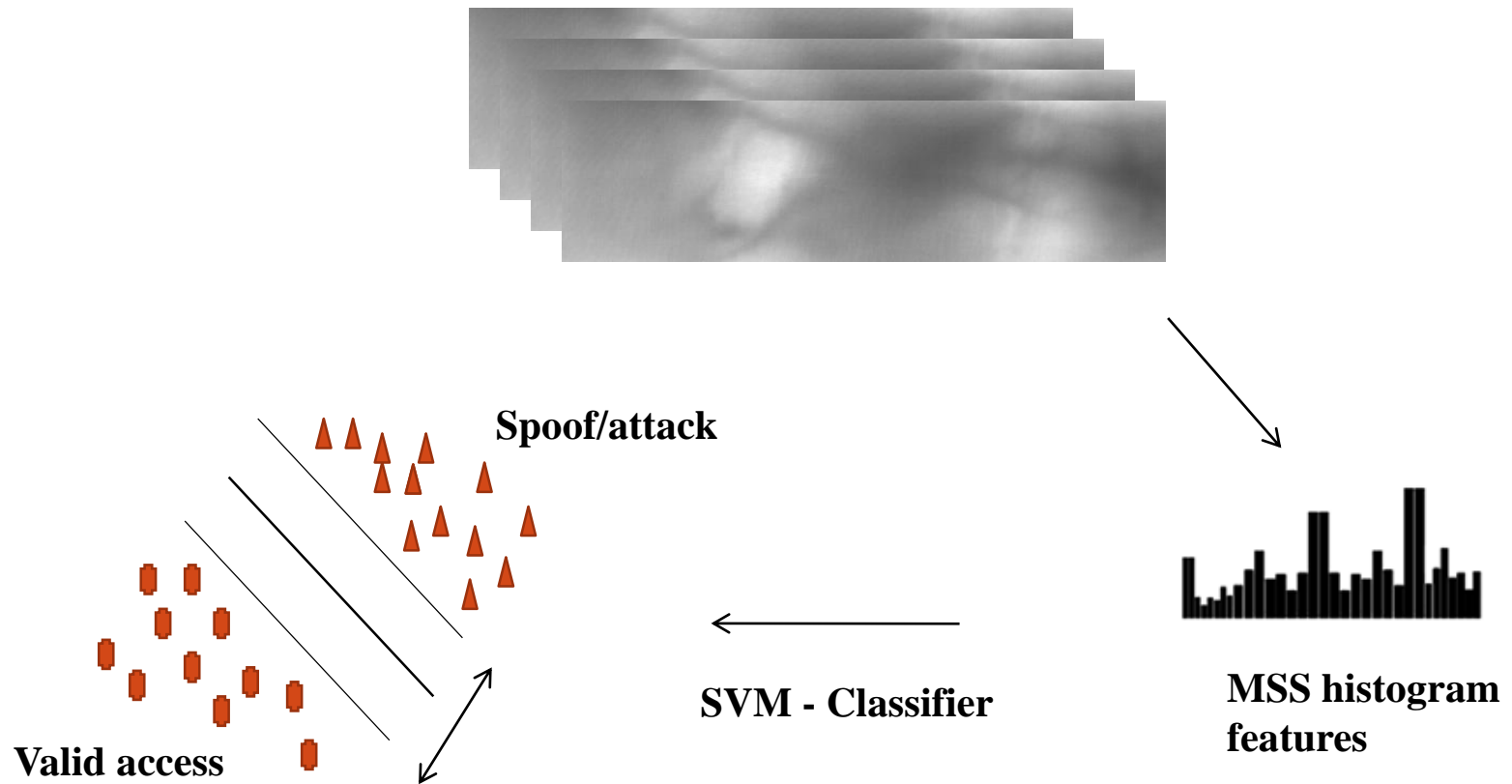
Felsberg, Michael, and Gerald Sommer. "The monogenic scale-space: A unifying approach to phase-based image processing in scale-space." *Journal of Mathematical Imaging and vision* 21.1-2 (2004): 5-26.

F-RATIO

- A large value of F-ratio implies higher separability; and this can be measured even when no error is observed. The F-ratio is defined as:
- $F\text{-ratio} = [\mu_C - \mu_I / \sigma_C + \sigma_I]$

Where C is real and I is spoof.

PIPEPILE: MSS + SVM

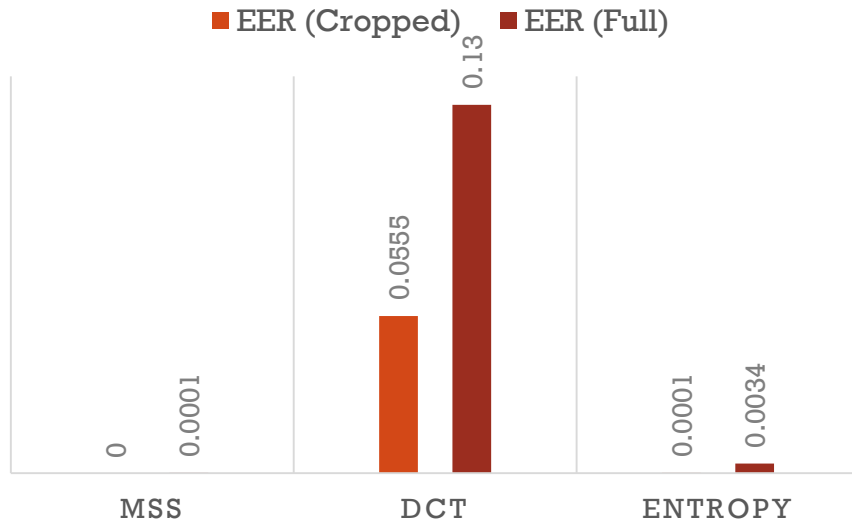


COMPARISON WITH OTHER METHODS

	Domain	Descriptor
MSS	Frequency	Global
DCT	Frequency	Global
Entropy Filter	Spatial	Local

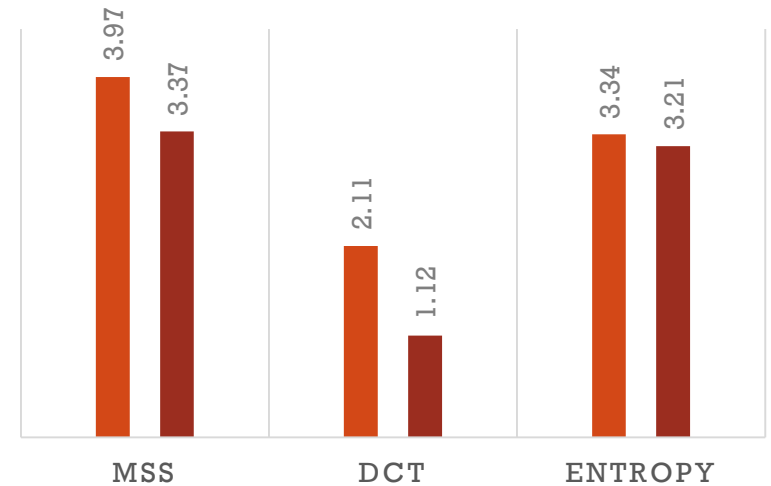
PERFORMANCE EVALUATION

EQUAL ERROR RATE (%)



F_RATIO

F_ratio (Cropped) F_ratio (Full)



METHOD+SVM pipeline

CONCLUSIONS

- This study shows the significance of the MSS + SVM pipeline to effectively detect the spoof samples.
- MSS + SVM pipeline applied on finger vein images for valid and print attacks from 110 clients (240 (training) + 240 (development)).
- The results were promising in tackling the print attack challenge.
- 2nd runner up in ICB 2015 - 1st Competition on Counter Measures to Finger Vein Spoofing Attacks.