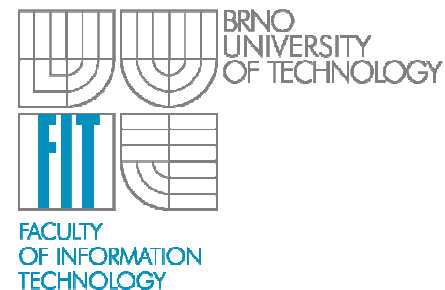
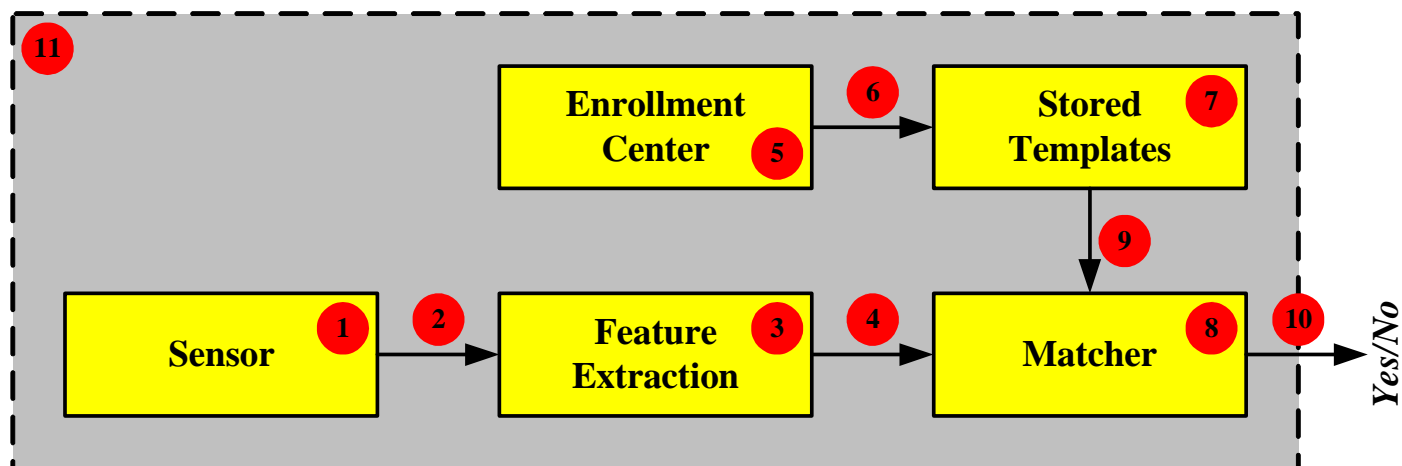


# Liveness detection on finger and recognition of eye characteristics

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Suprema SFM 3020  
(fake – rubber stamp)



Artificial fingerprints (SFinGe)

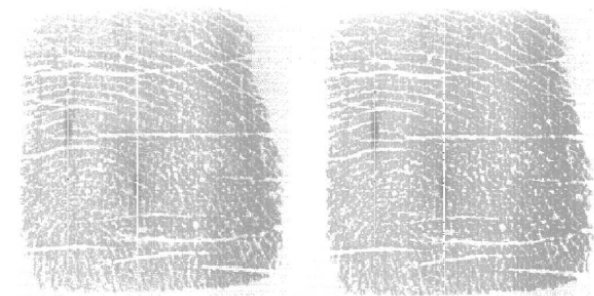


Artificial fingers

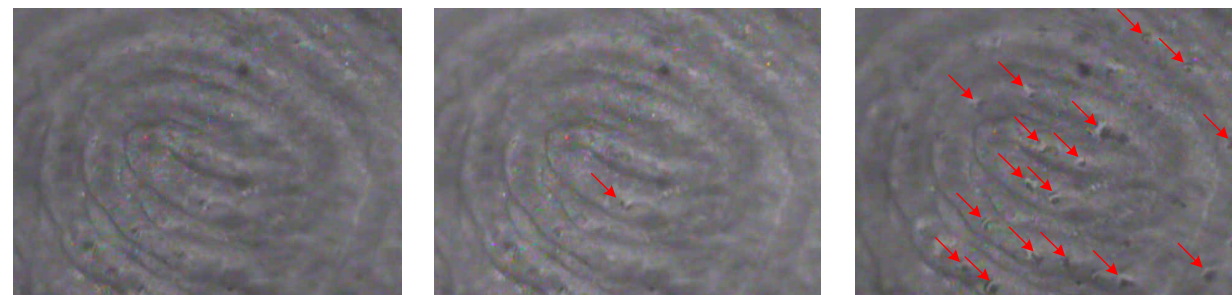


Fake fingerprints of different materials

- Clarkson/Virginia universities
- 600 sweat glands in 1 inch<sup>2</sup>
- Duration approx. 5 seconds
- High intra-class variability



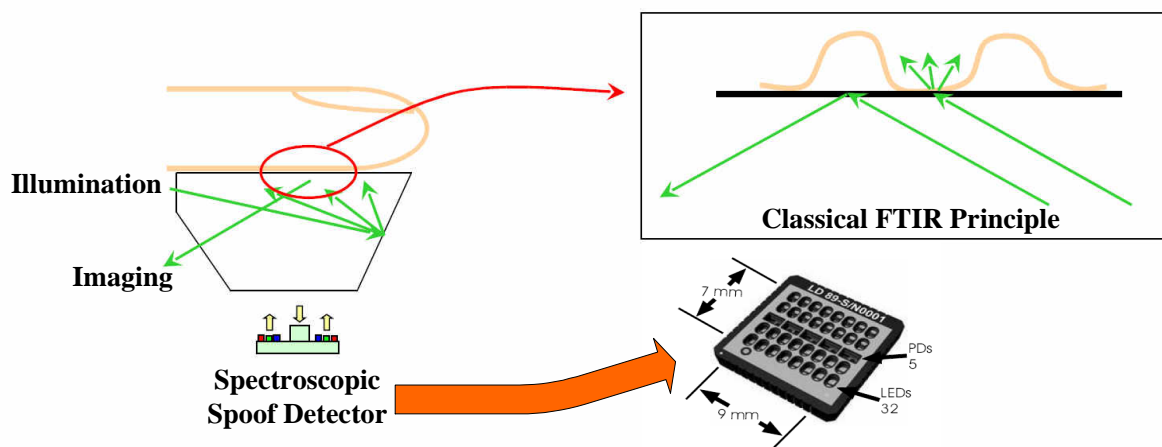
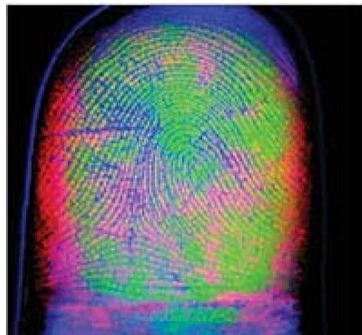
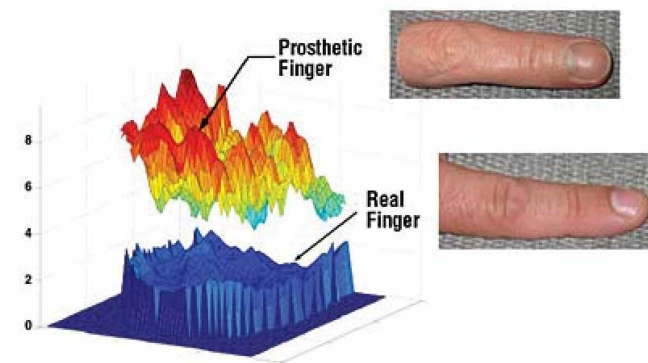
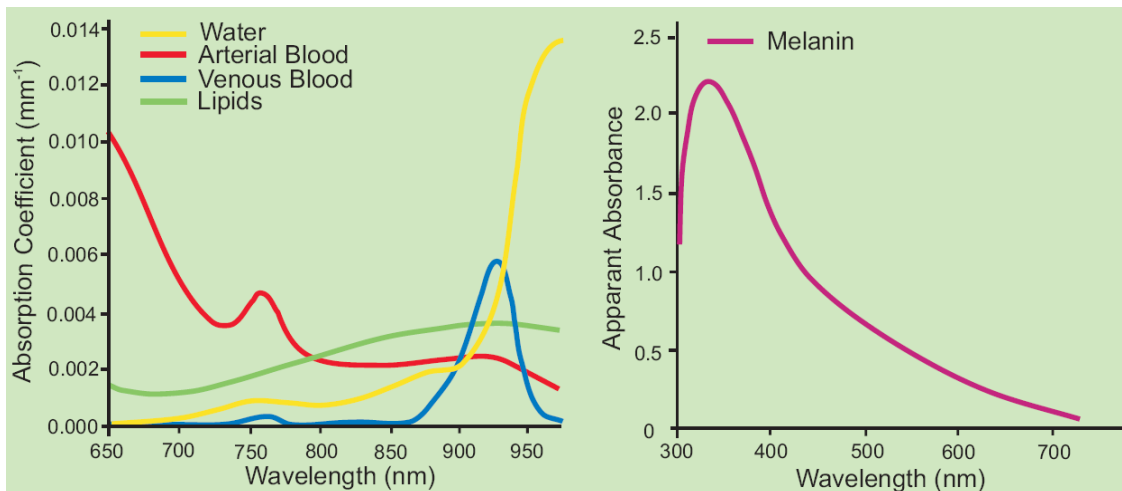
Time →



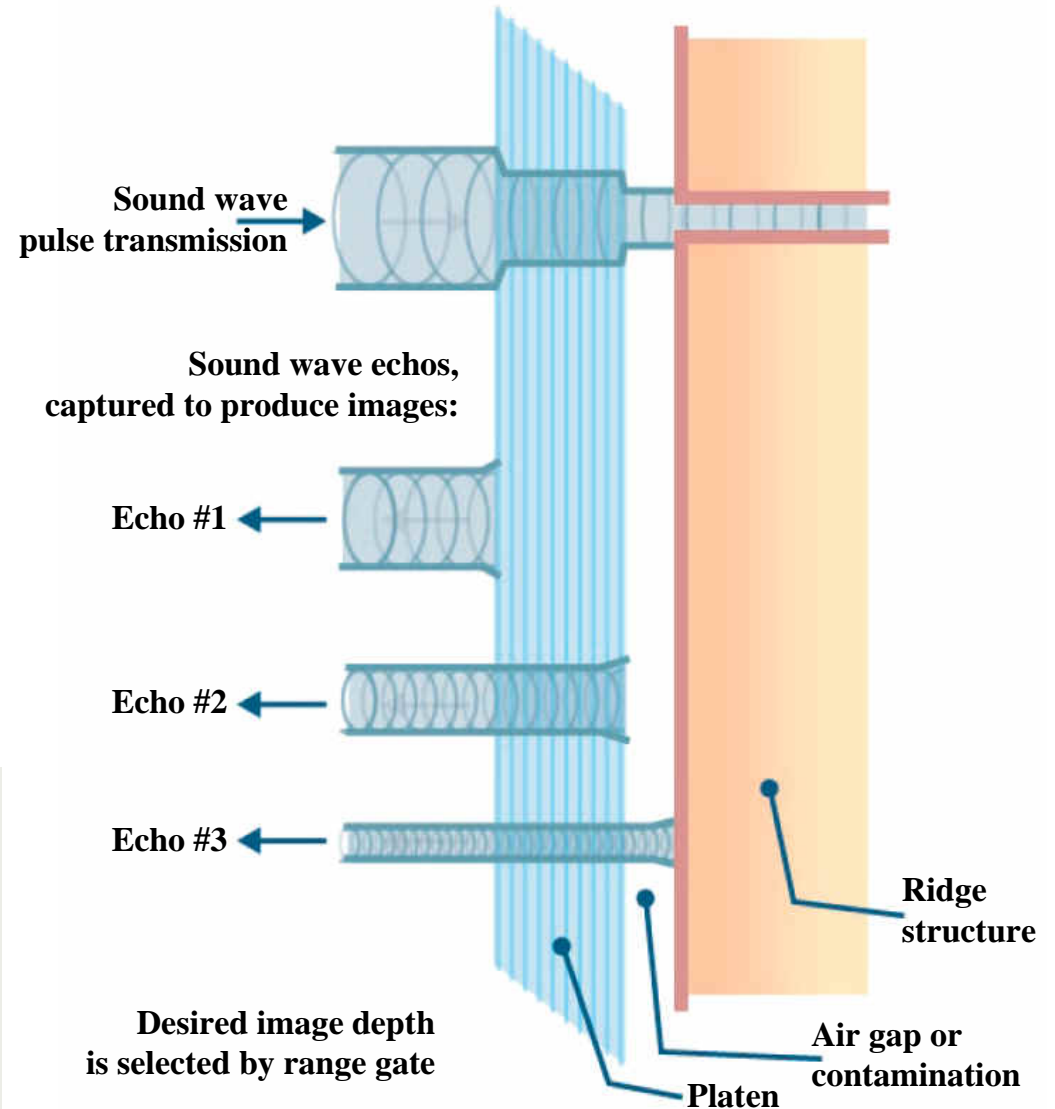
Time →

# Spectroscopic characteristics

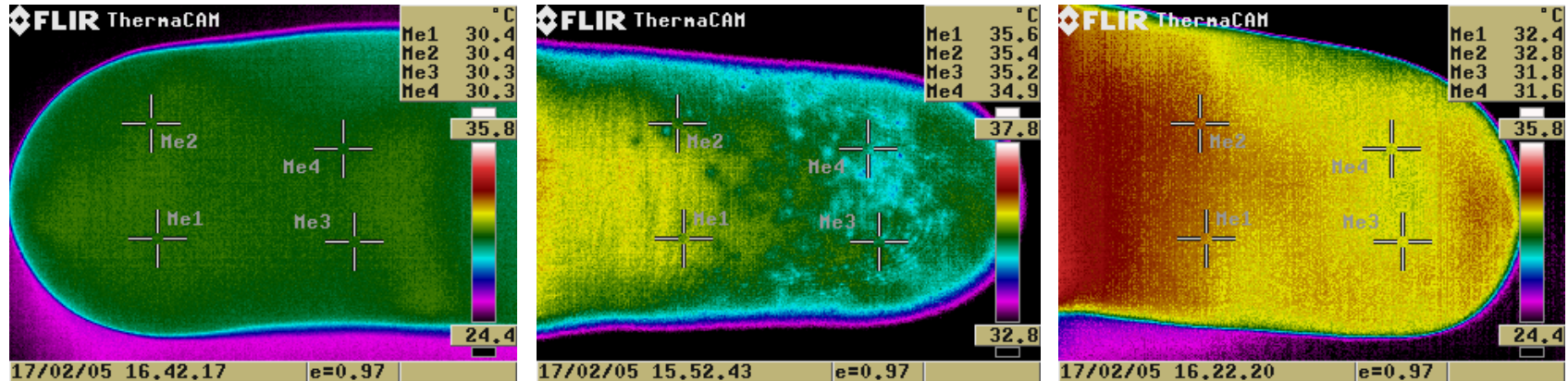
- Lumidigm Ltd.(Albuquerque)
  - Clones: TST Biometrics GmbH, Sagem Morpho etc.



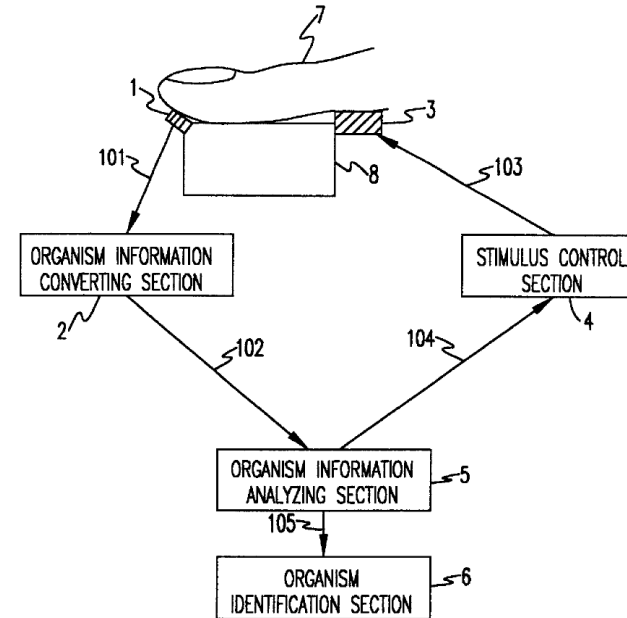
- Ultra-Scan / Optel



- Temperature

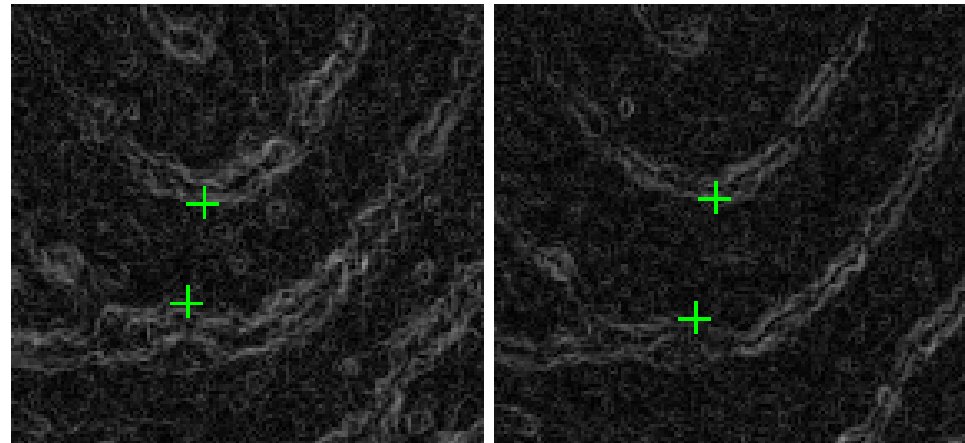


- Hot and cold stimulus



- National **utility model ÚPV-19364**

- Ridge elasticity
  - 20%

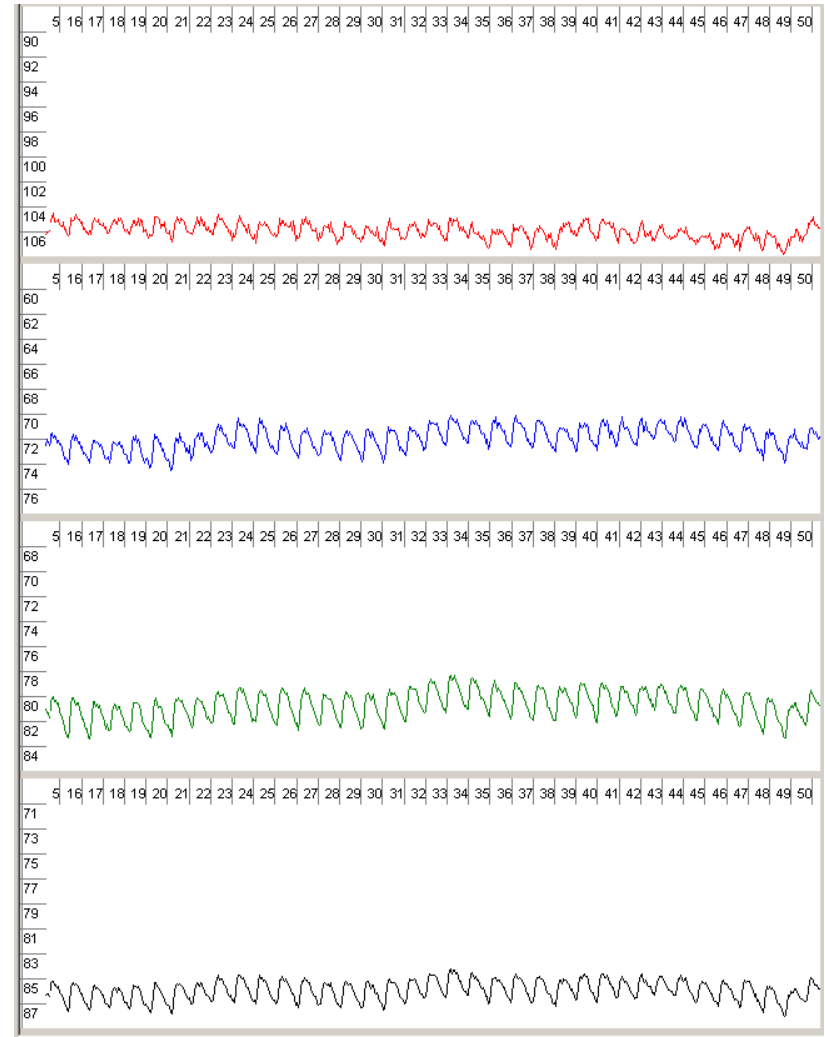
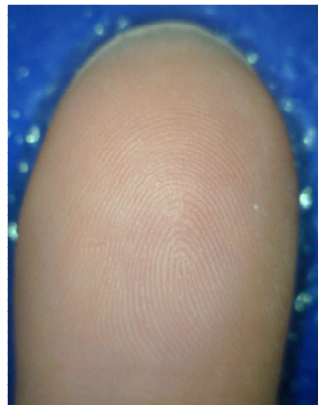


- Change of color (RGB)
  - $G \sim 42$

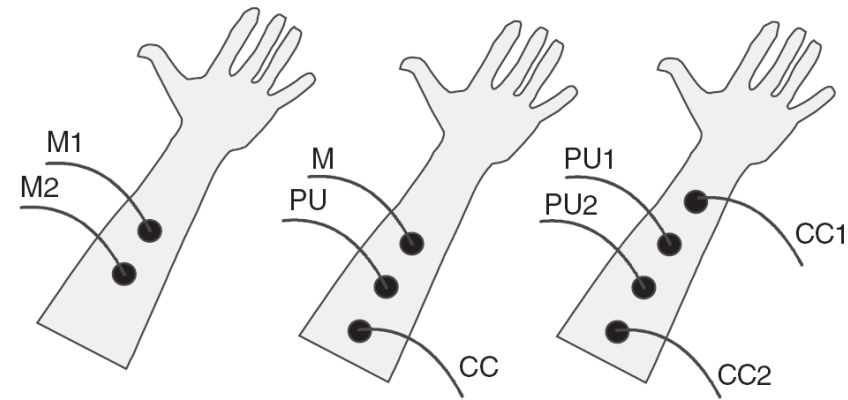
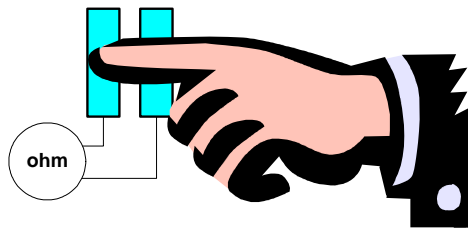




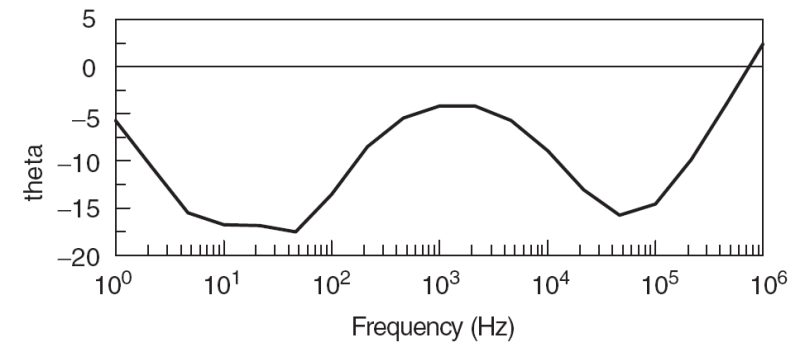
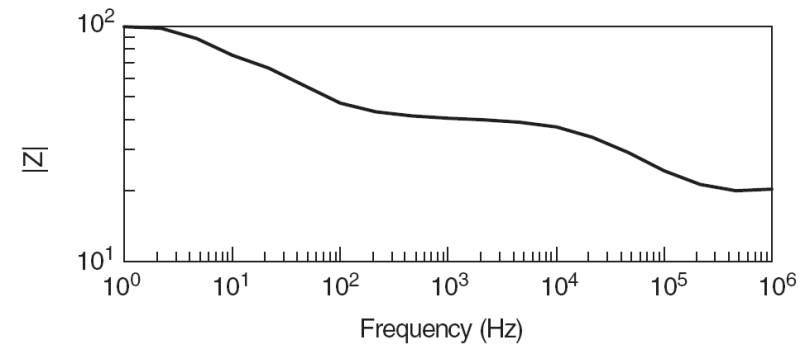
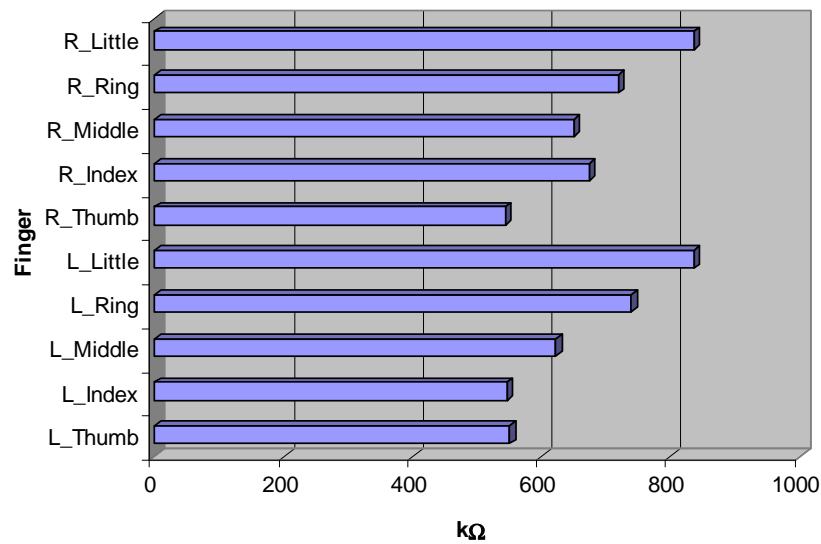
- Using RGB, each channel shown tiny pulsation
- Could be used for mobile devices
- Only transparent finger fakes could be used, all other do not work
- Our **patent**  
**ÚPV-304801**



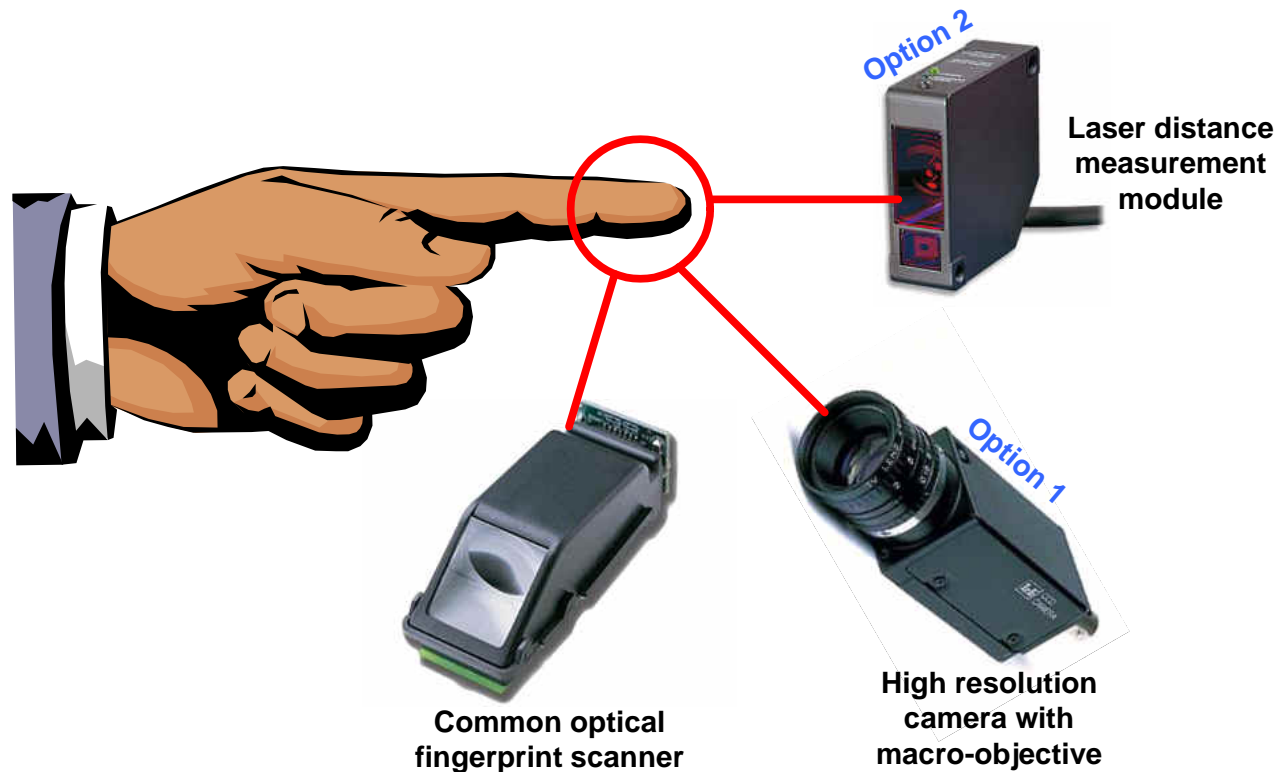
- Bio-impedance →
- Resistance / Conductivity



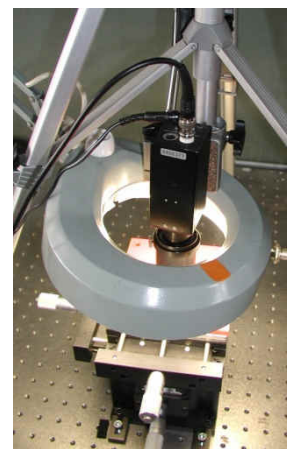
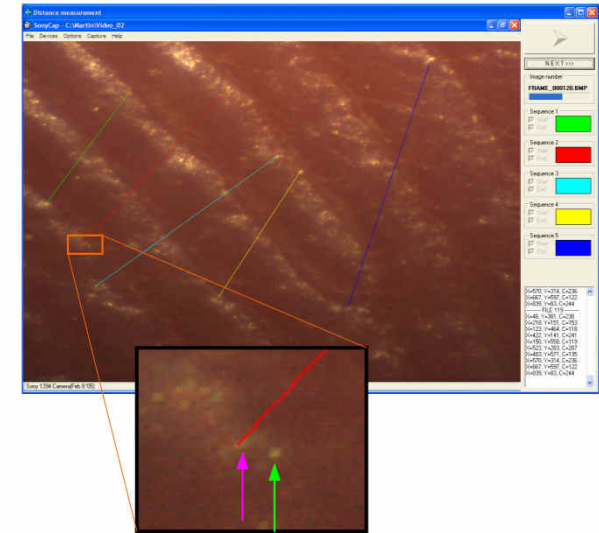
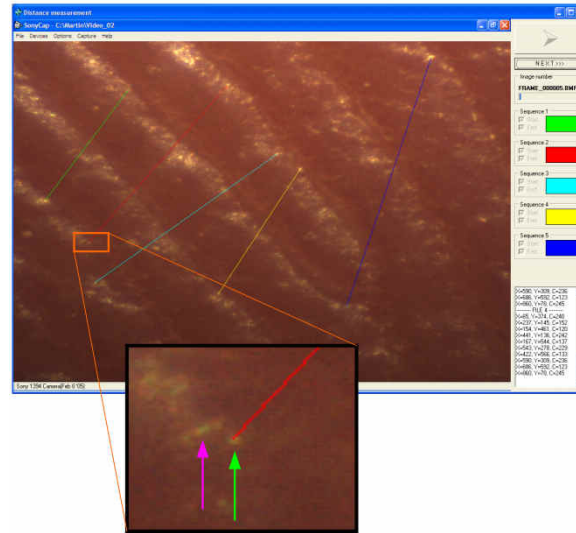
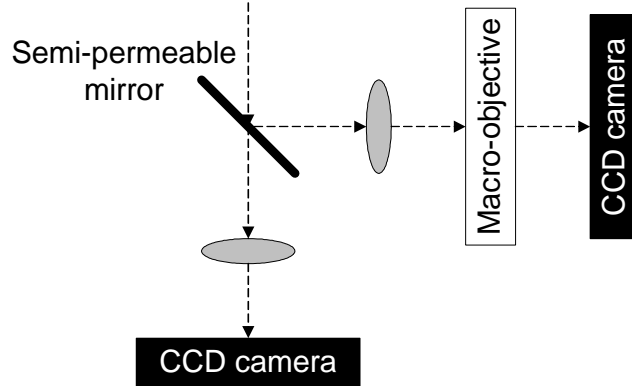
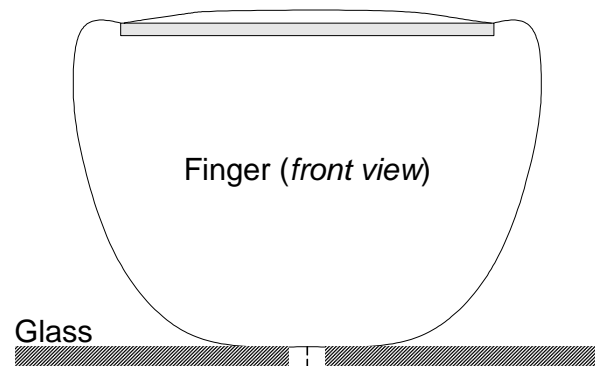
Measurement with DC low voltage



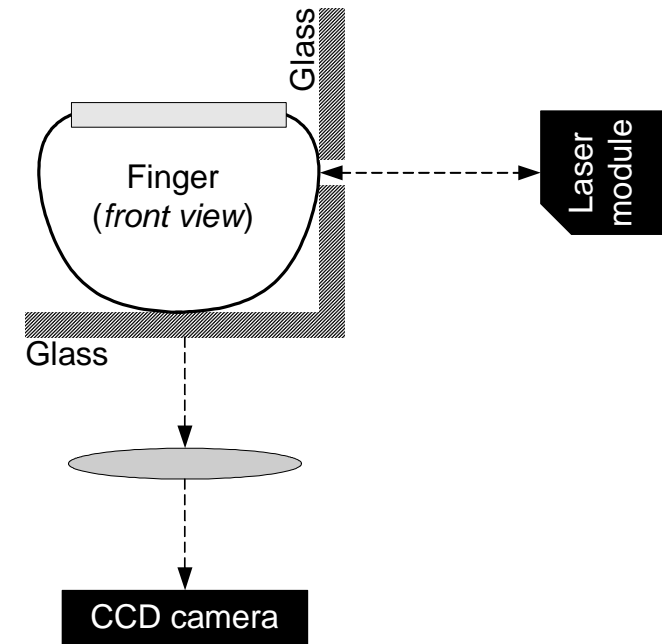
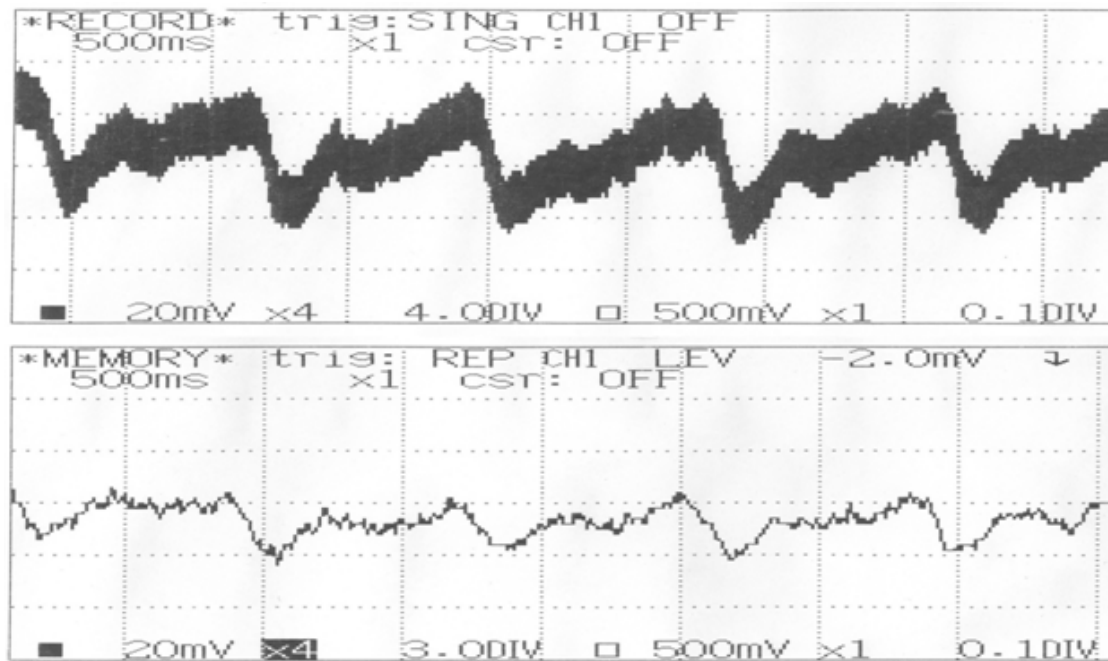
- International patent WO/2007/036370
- National patent pending; new approach in preparation



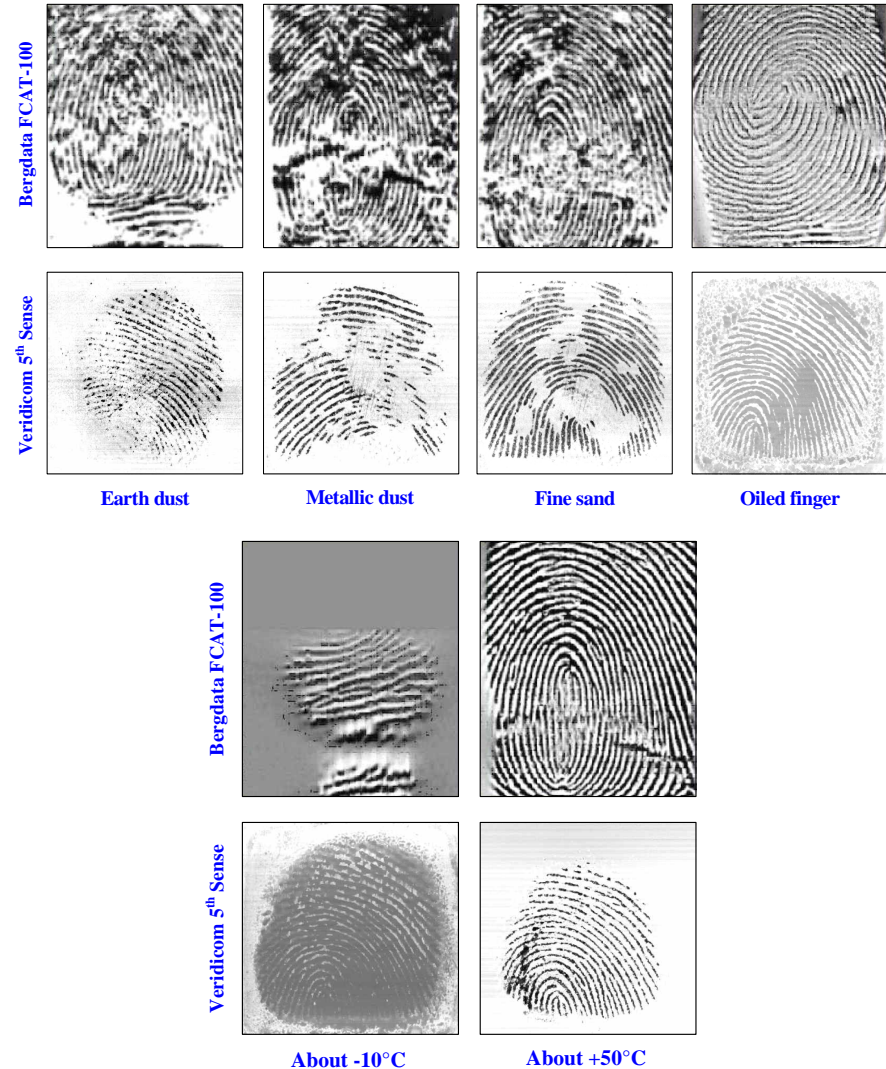
- Macroobjective I.

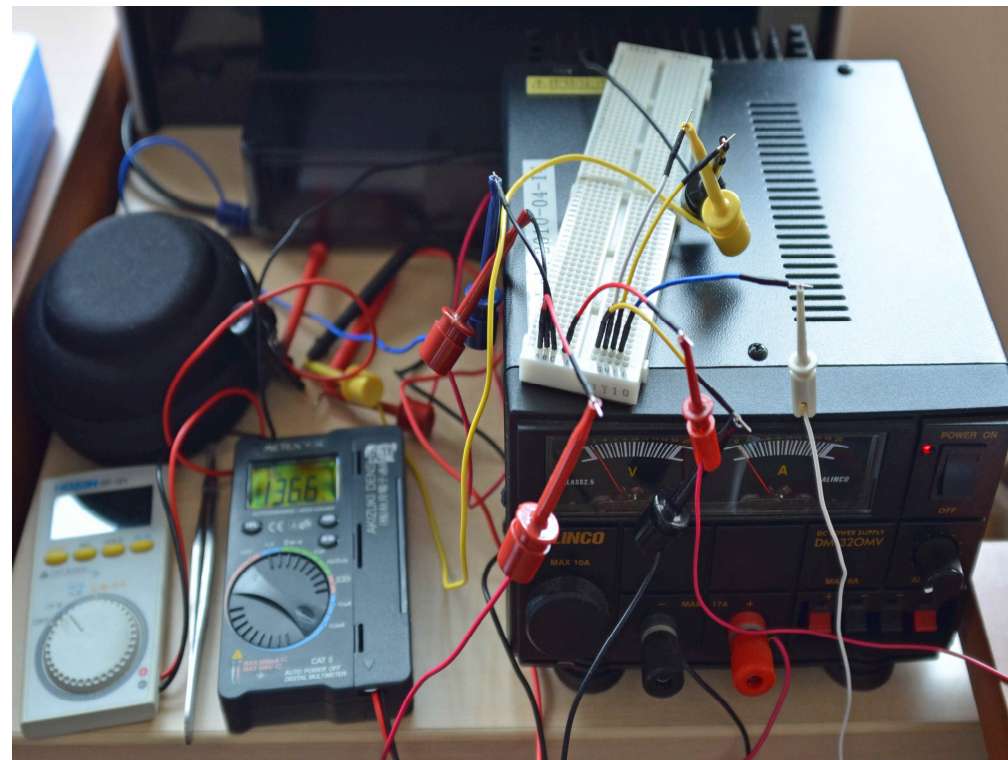
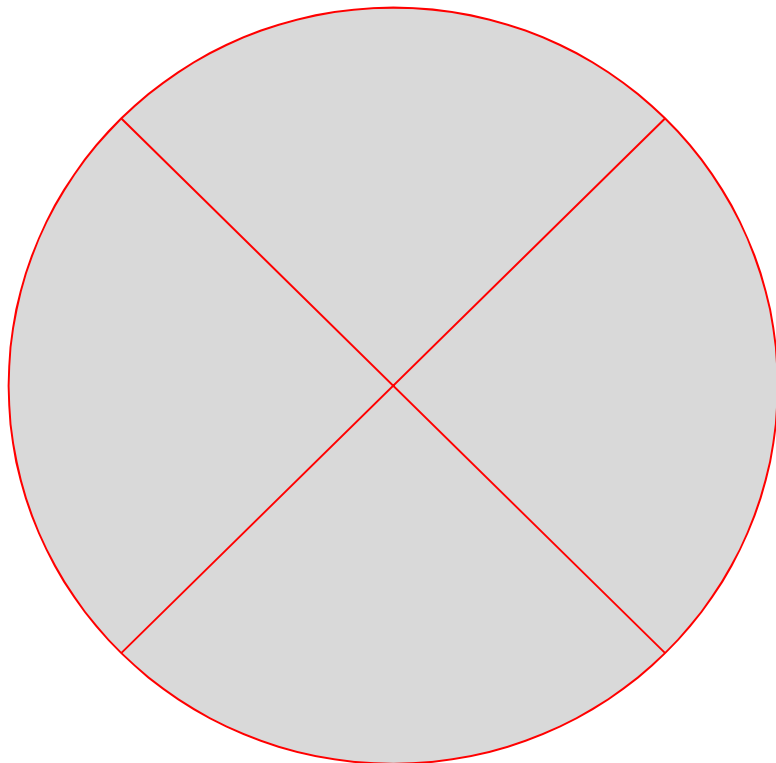


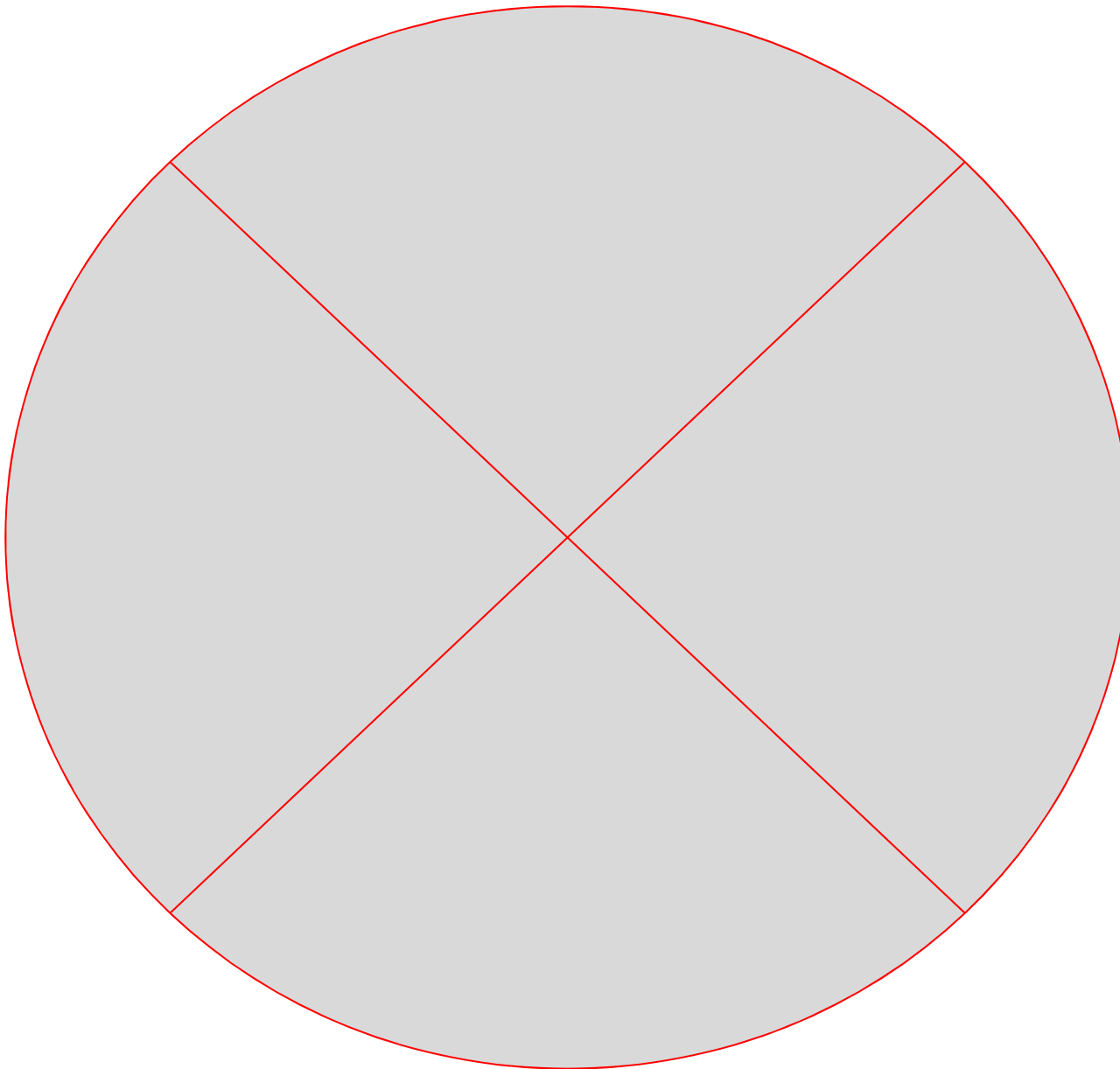
- Laser based solution



- Change of temperature and/or humidity
- Dry or wet fingers
- Dirt on sensor area
- Dirt on fingertip surface
- Blurred images
- Change of pressure
- Latent fingerprints etc.



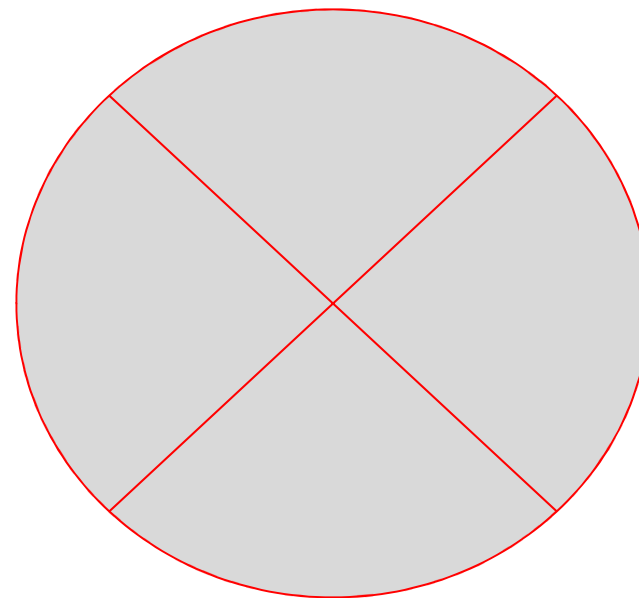


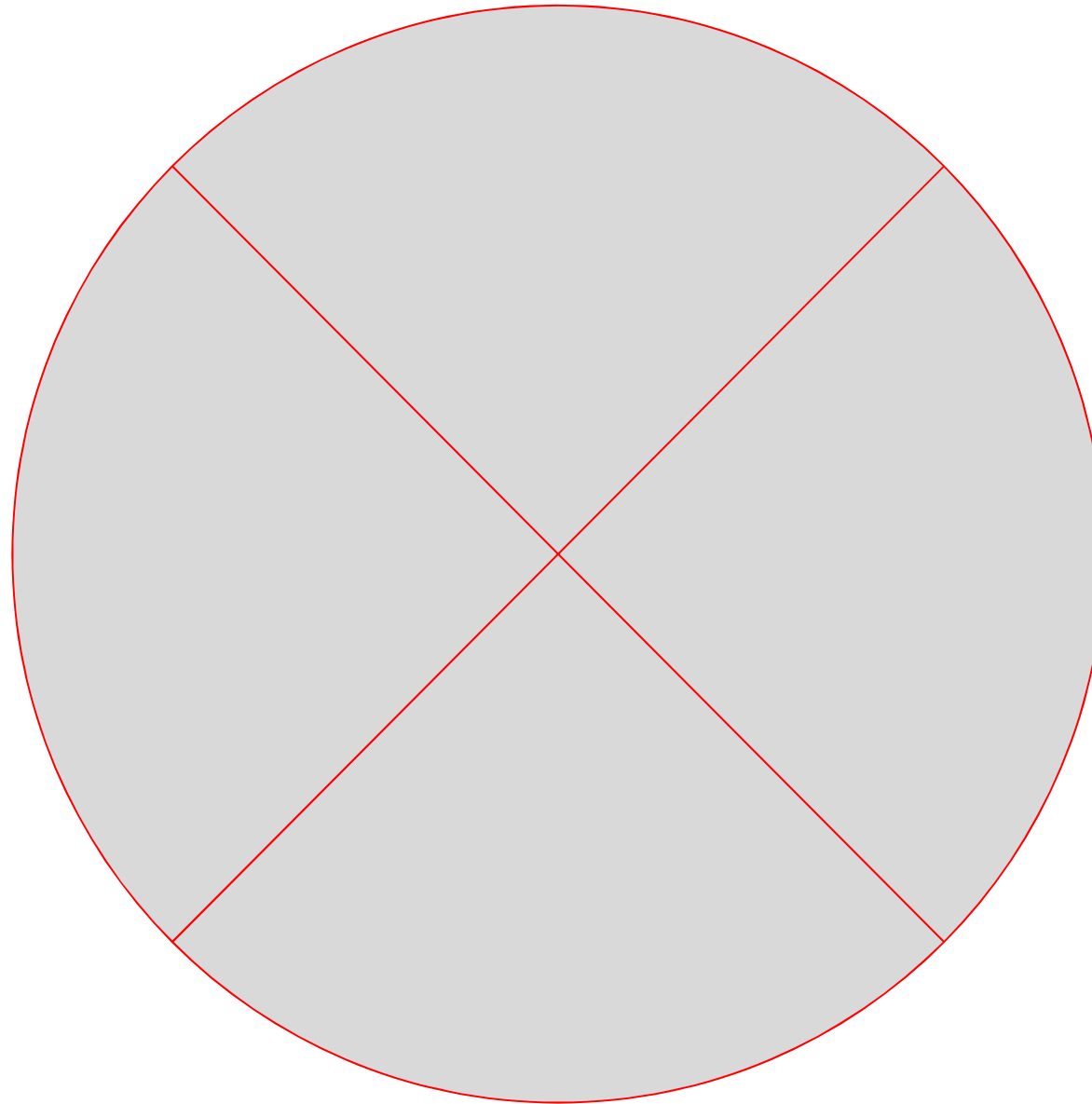


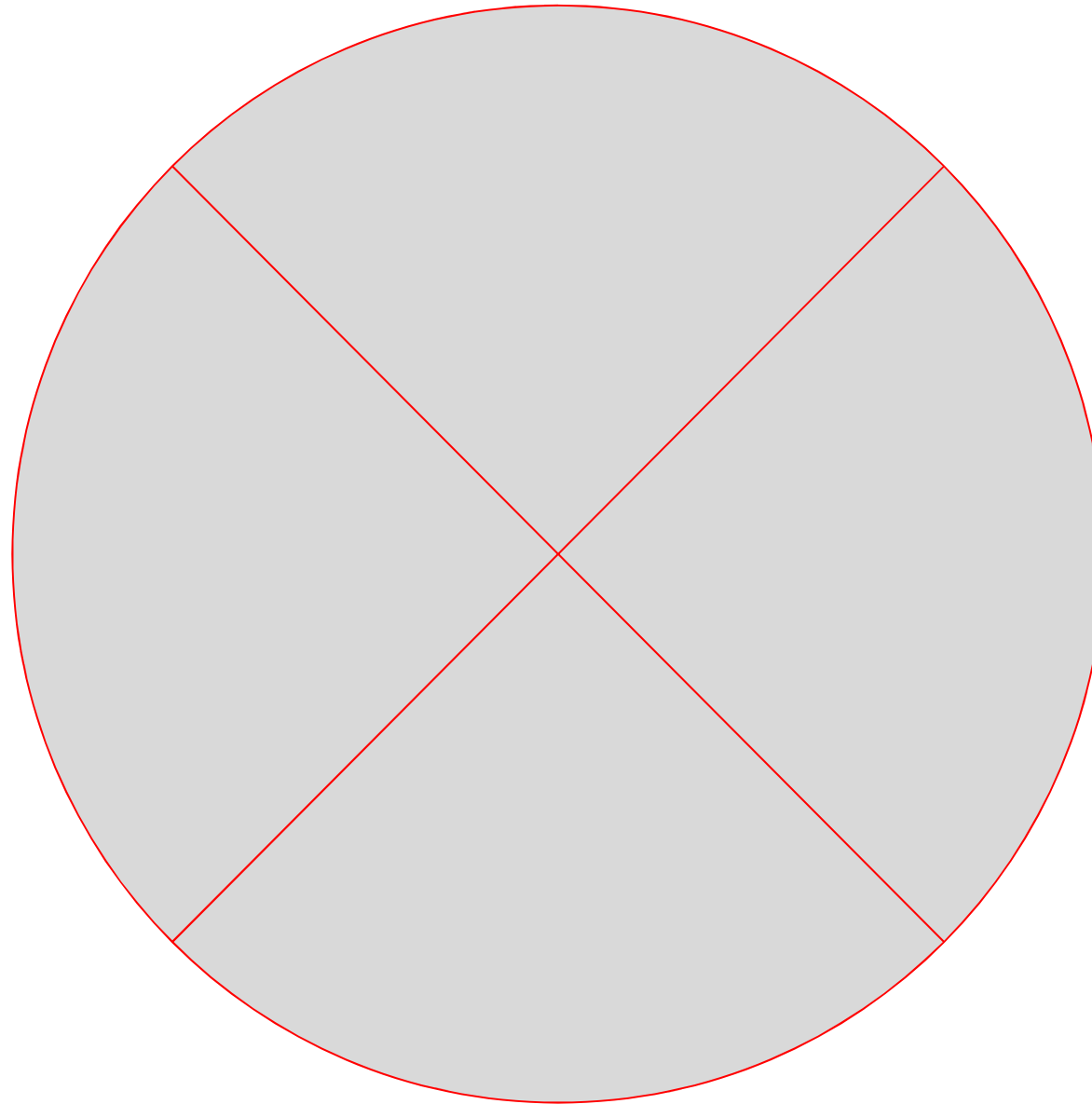


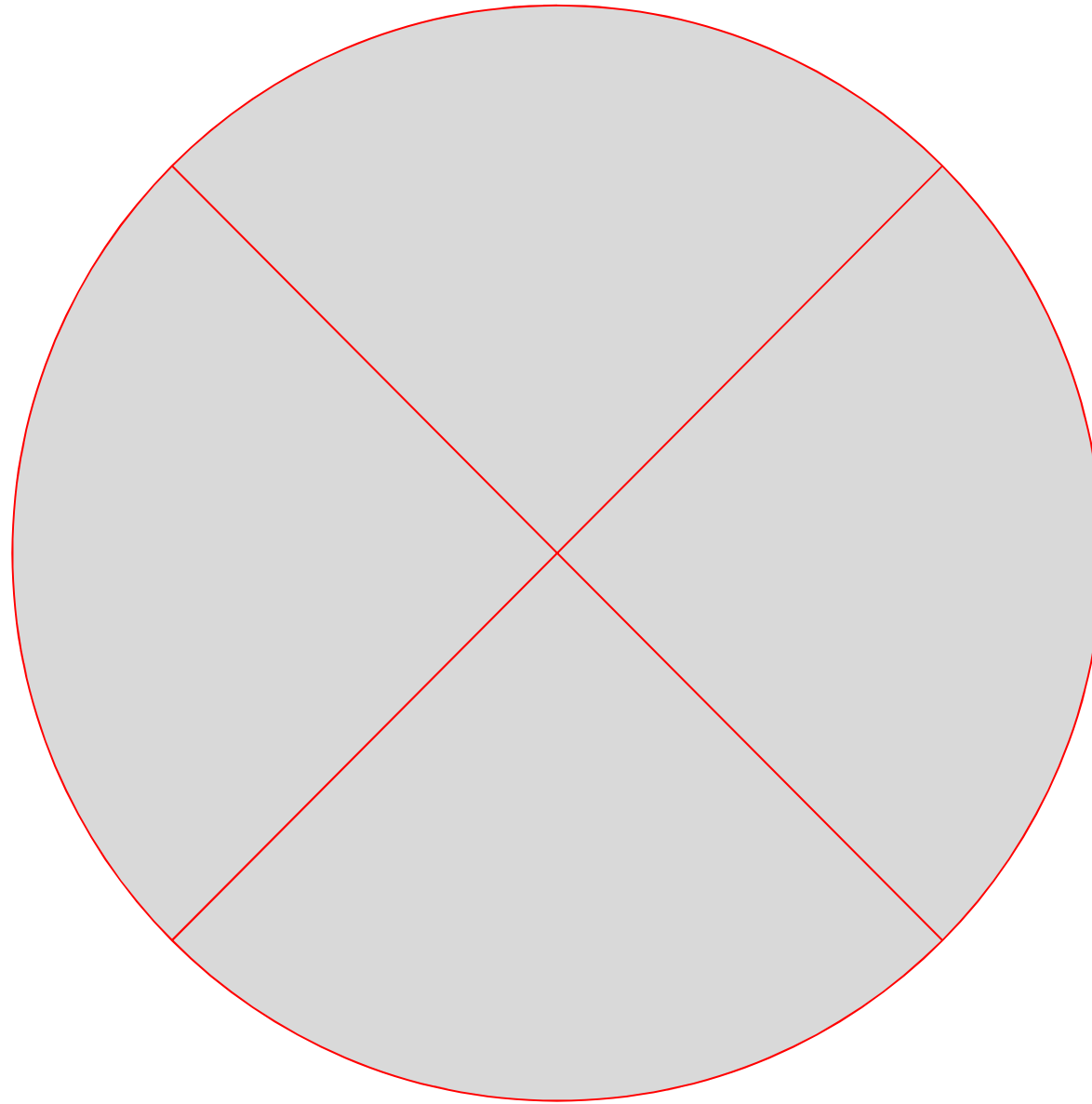
# Optic skin properties vs. finger fakes III.

III









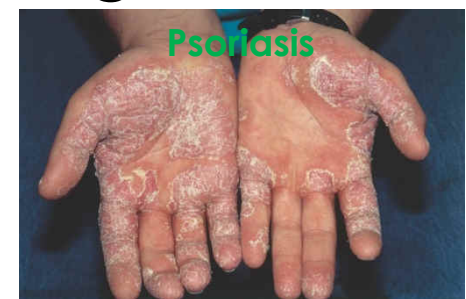
- Histopathological changes



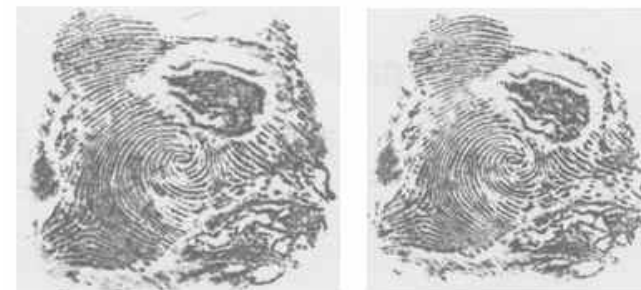
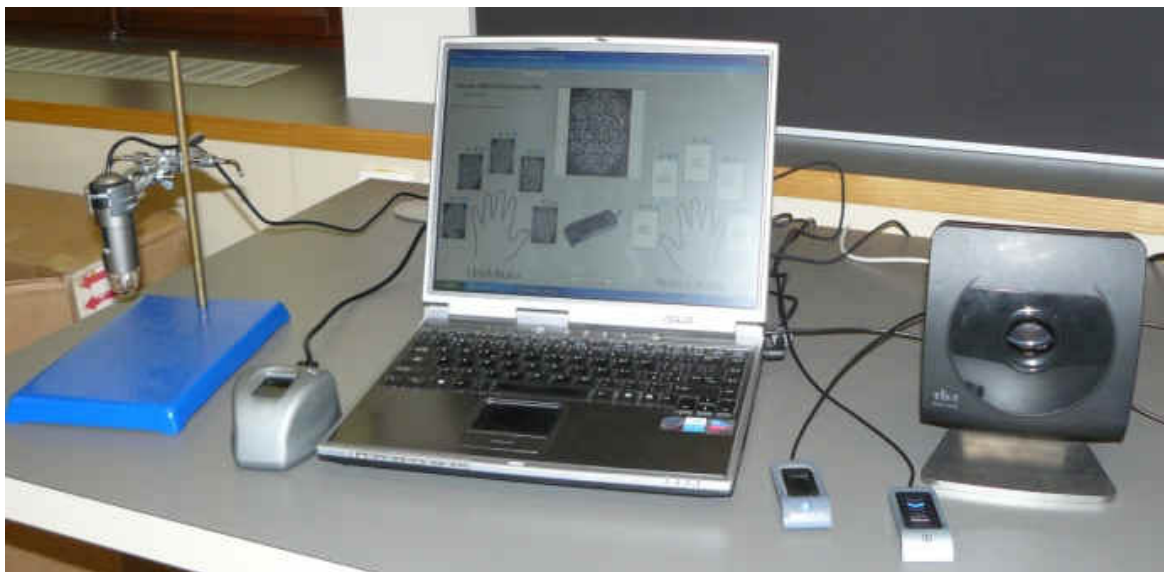
- Changes of skin color



- Histopathological and skin color changes



## Project COST\_LD14013



a) CRD

b) CRD



c) E500

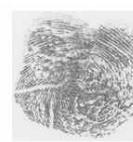


d) EII



a) MSO

b) MSO



a) CRD



b) CRD



a) CRD



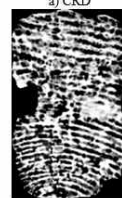
b) CRD



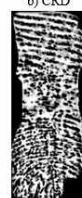
c) E500



d) EII



c) E500



d) EII



c) E500



d) EII



e) CRD



f) DIN

Fingertip eczema – a light form.



e) MSO



f) DIN

Dyshidrosis.



e) MSO



f) DIN

Verruca vulgaris.

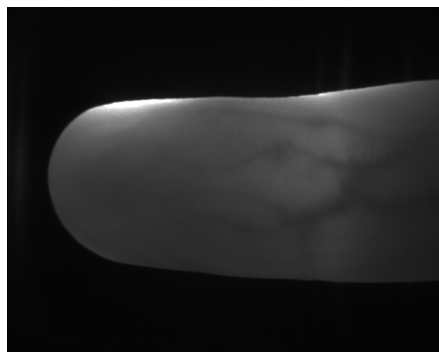


e) MSO

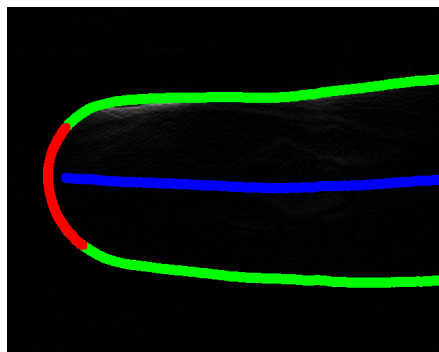


f) DIN

Psoriasis – a partial seizure.



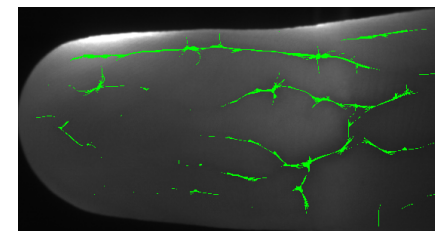
(1) acquired image



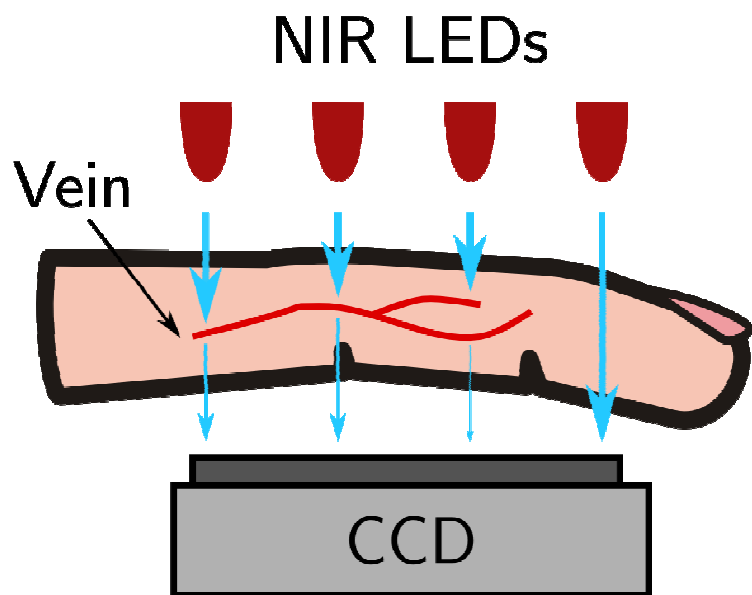
(2) contours and rotation estimation



(3) enhanced ROI

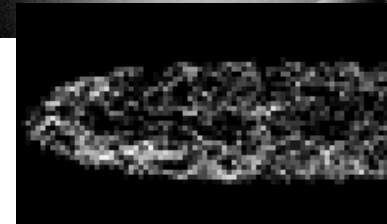
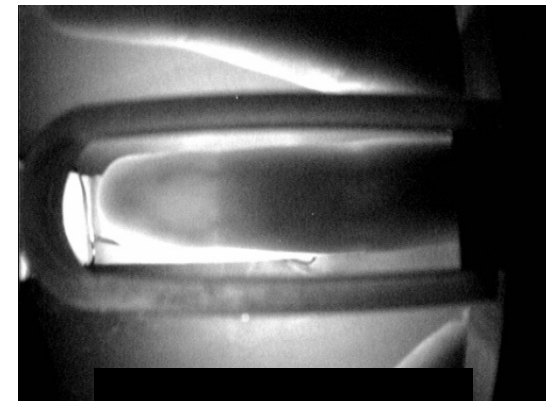
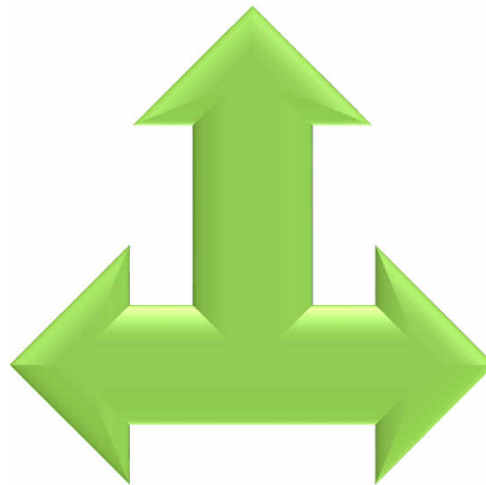
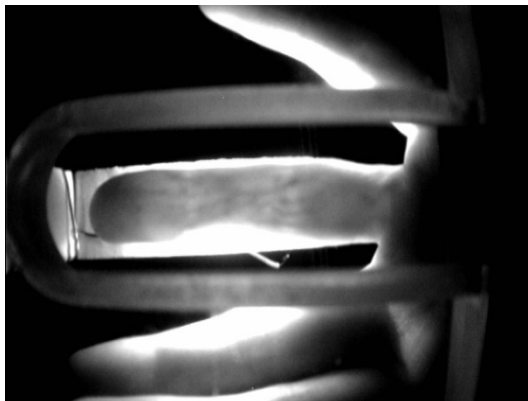
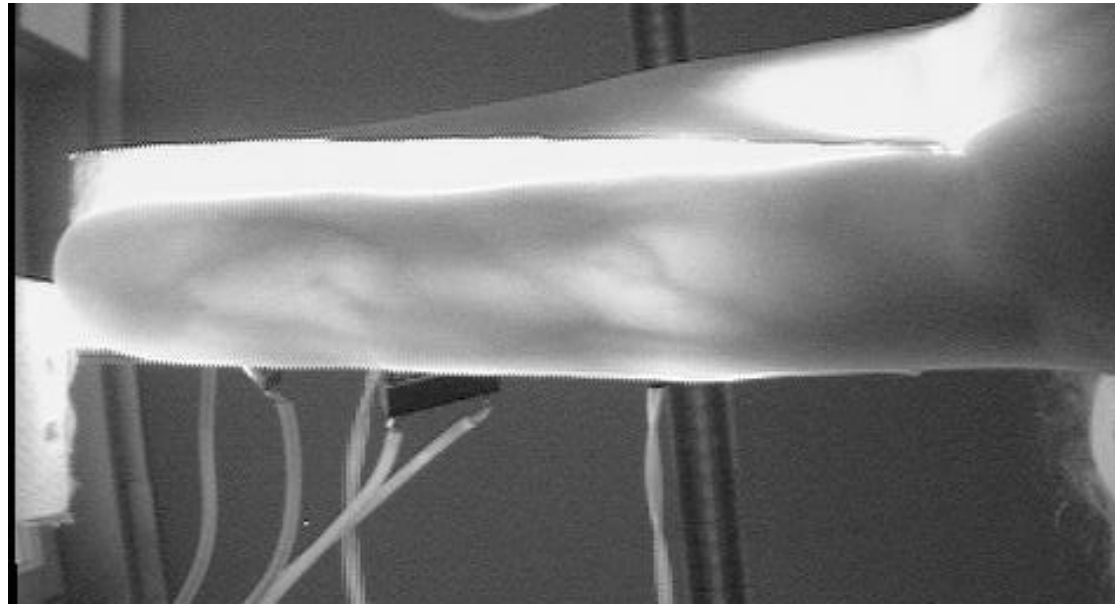


(4) detected veins



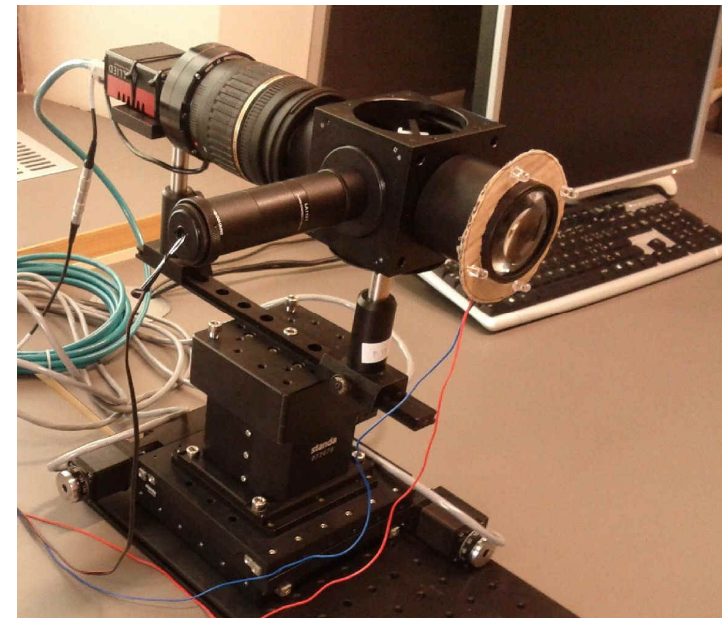
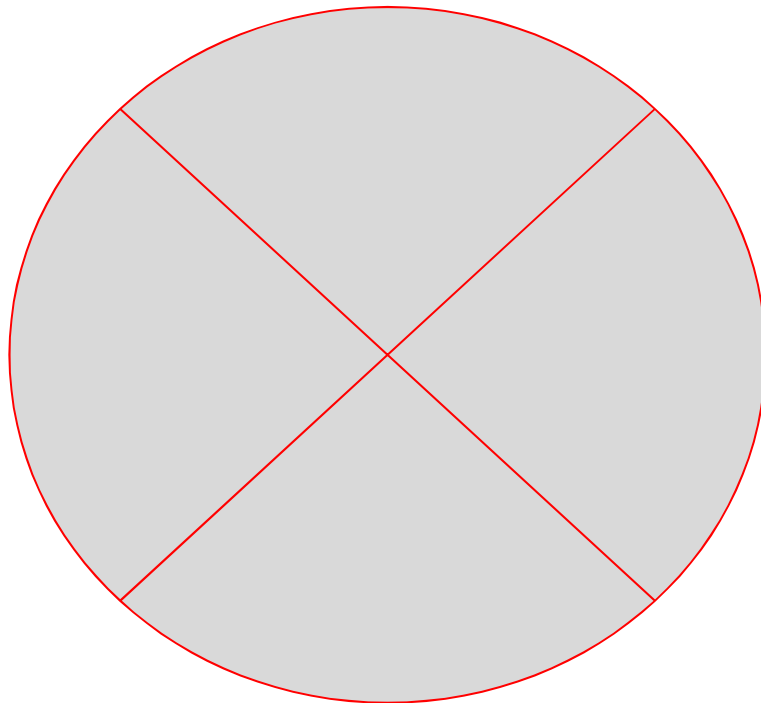
- Cheap infrared LEDs and camera
- Same or better performance than fingerprint recognition
- Suited as a multibiometric characteristic

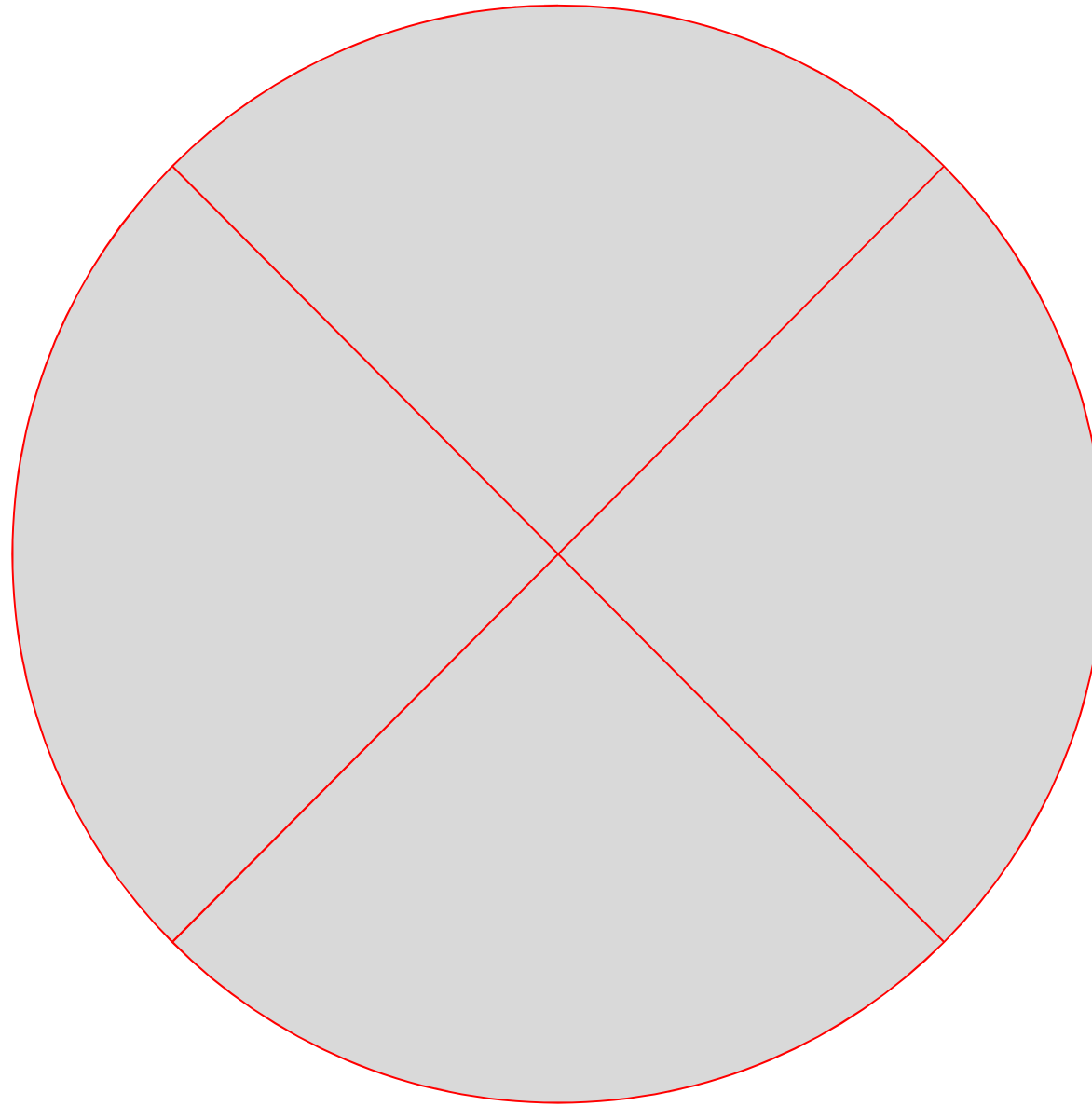
# | Finger veins – Acquired and processed images | III



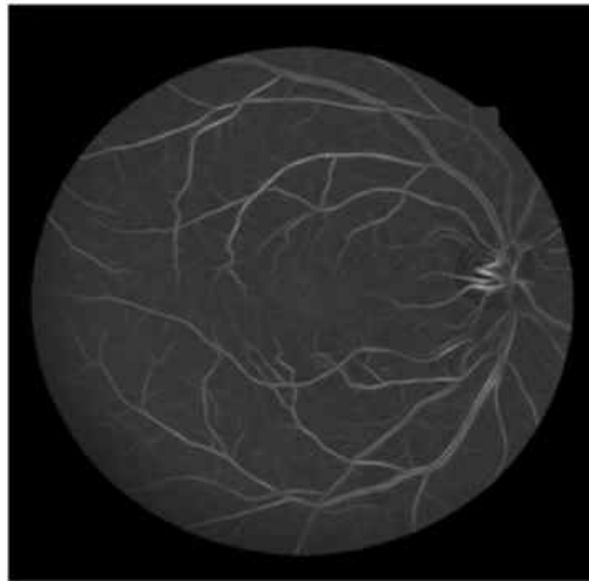
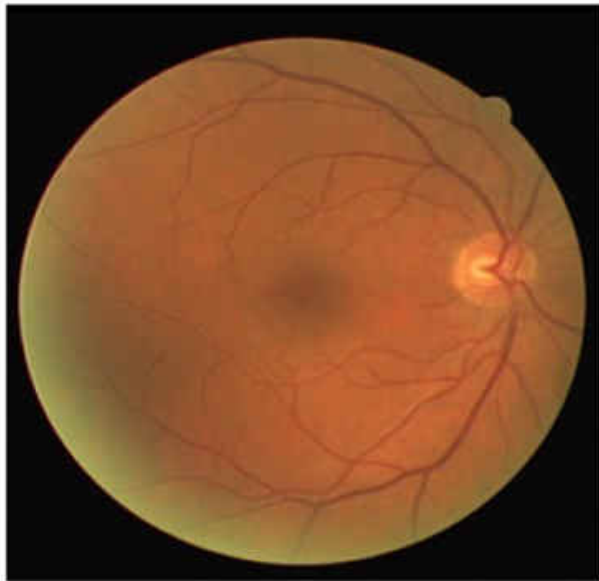


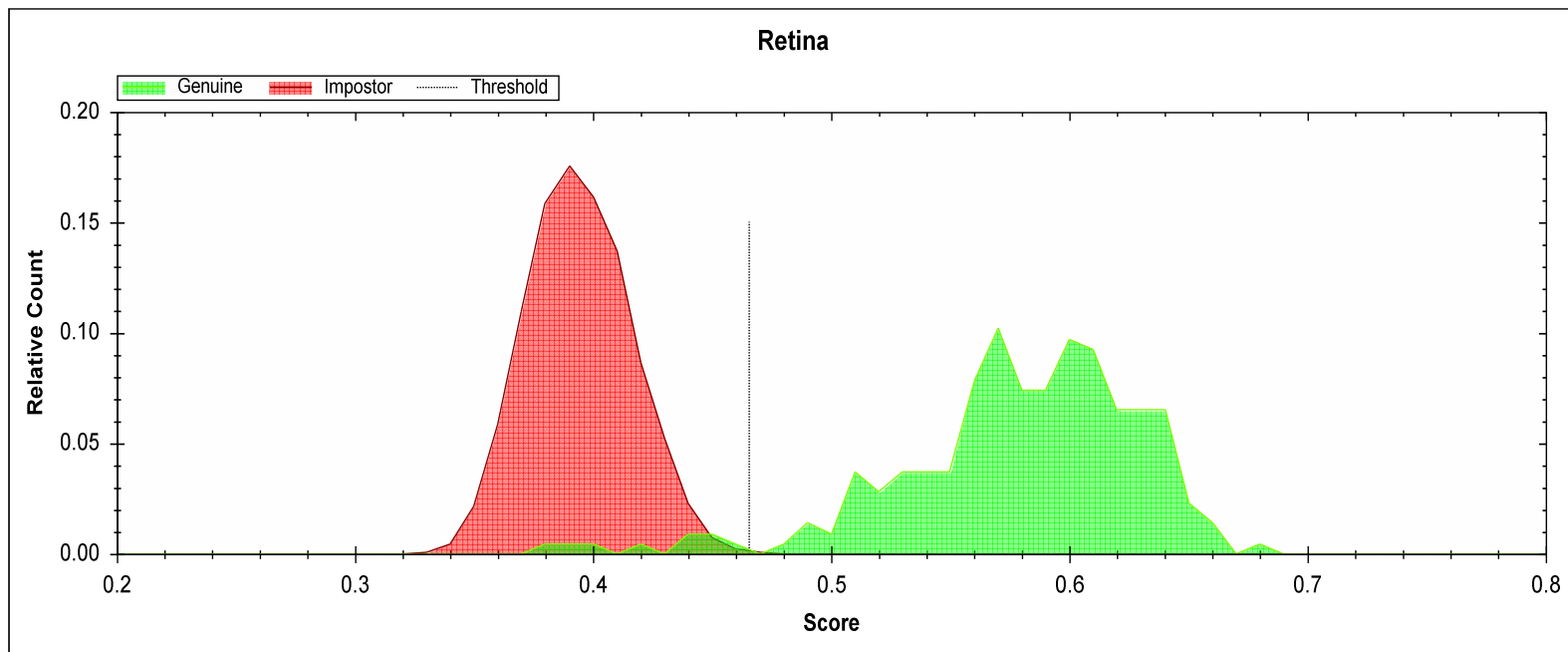
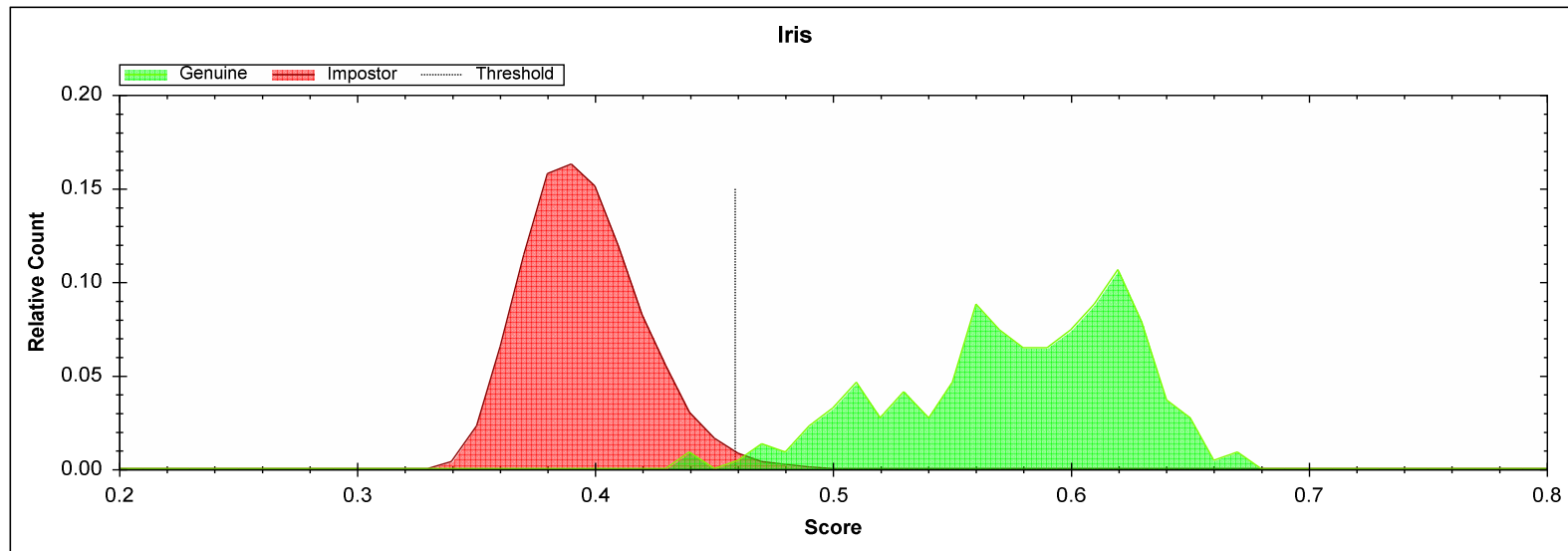
- One device for acquirement of eye iris and eye retina → possible ways of use are for biometrics and ophthalmology

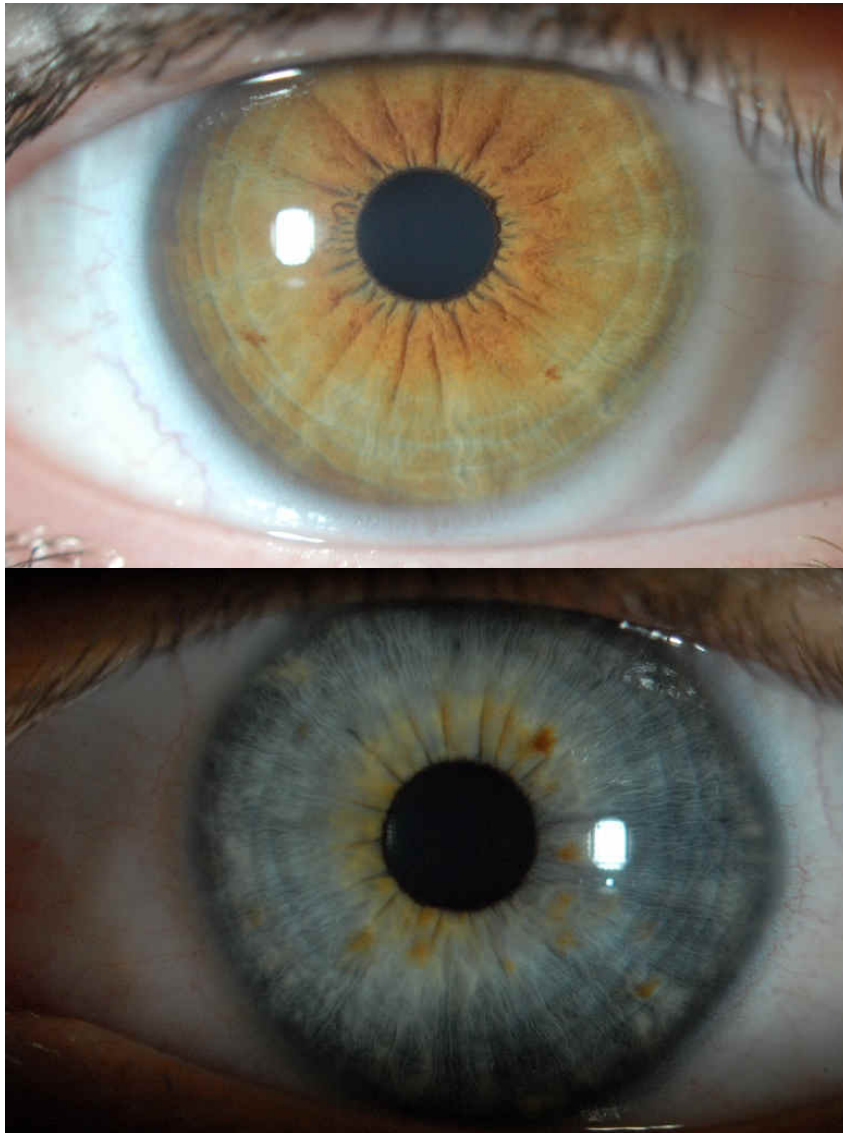












Thank you for your attention.