

# Hanno Coetzer

## RESEARCH PROJECTS / STUDENT SUPERVISION

### BIOMETRIC AUTHENTICATION / RECOGNITION

- **BEHAVIOURAL**

- Offline and online handwritten signatures (MSc, PhD)

- **PHYSICAL**

- Hand veins (MSc, PhD), Fingerprints (MSc), Ears (MSc)
- Multimodal (Hons, MSc), Iris (Hons)

### OTHER PROJECTS

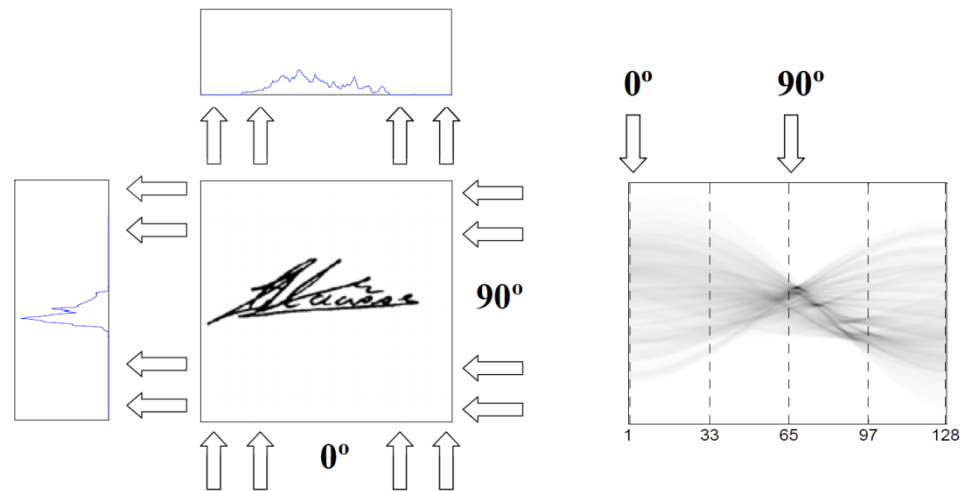
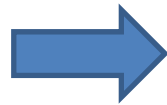
- Cost-sensitive human-machine collaboration (ETS, Montreal)
- Dental implant recognition (Leuven/PhD)
- Identification of dicentric chromosomes (MSc)

# Hanno Coetzer

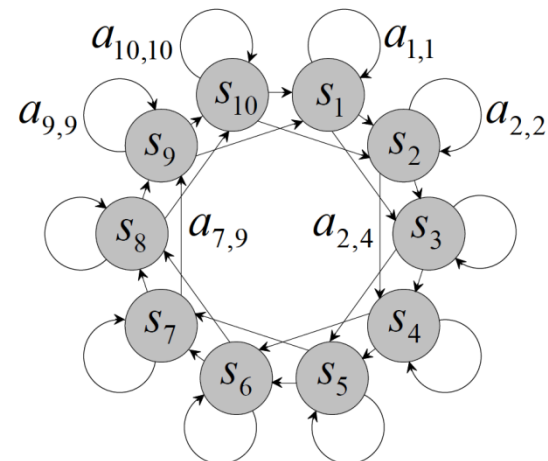
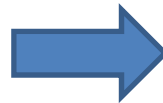
## Offline signature verification (PhD, 2005)

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Discrete  
Radon transform



Ring-structured HMM



# Hanno Coetzer

## Offline signature verification (PhD, 2005)

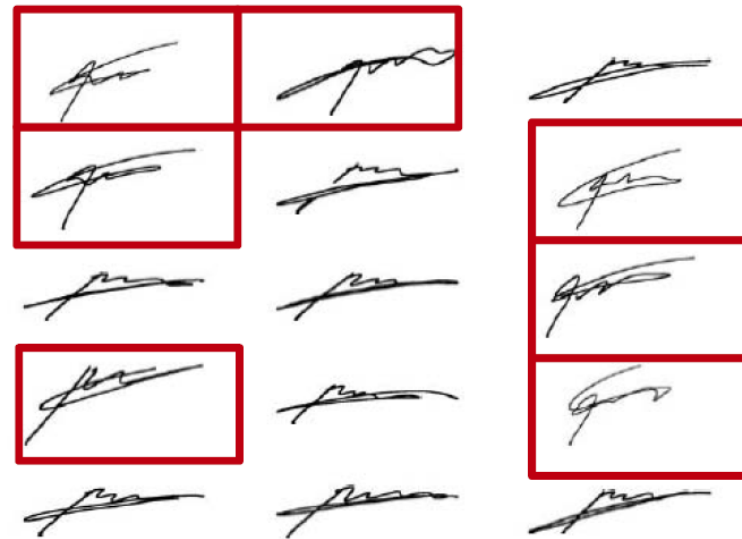
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The skilled forgeries  
are boxed

### Genuine samples



### Mixed samples



# Jacques Swanepoel

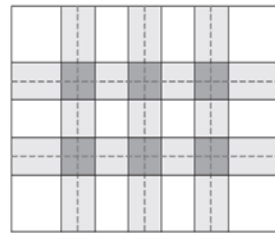
## Offline signature verification (MSc, 2009)

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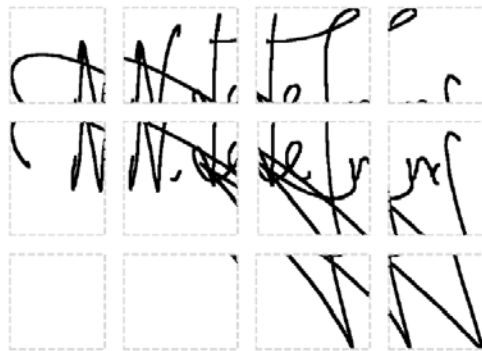
- Ensembles of flexible grid features
- Discrete observation HMM



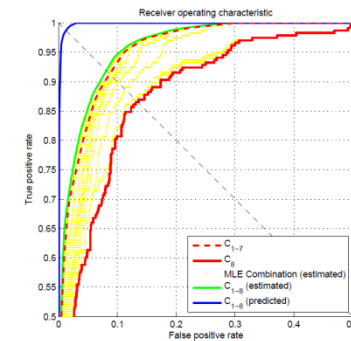
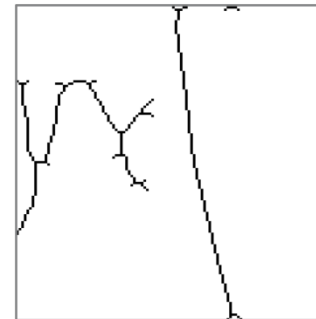
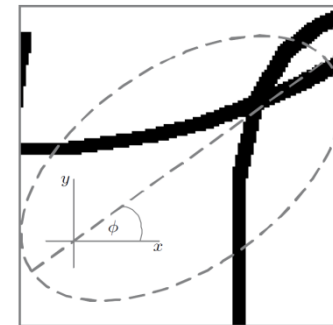
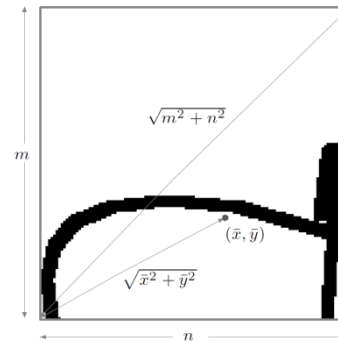
(a)



(b)



(c)

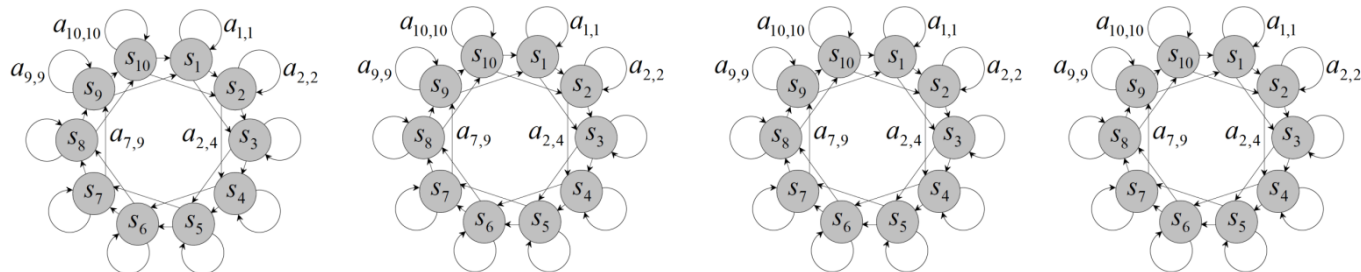
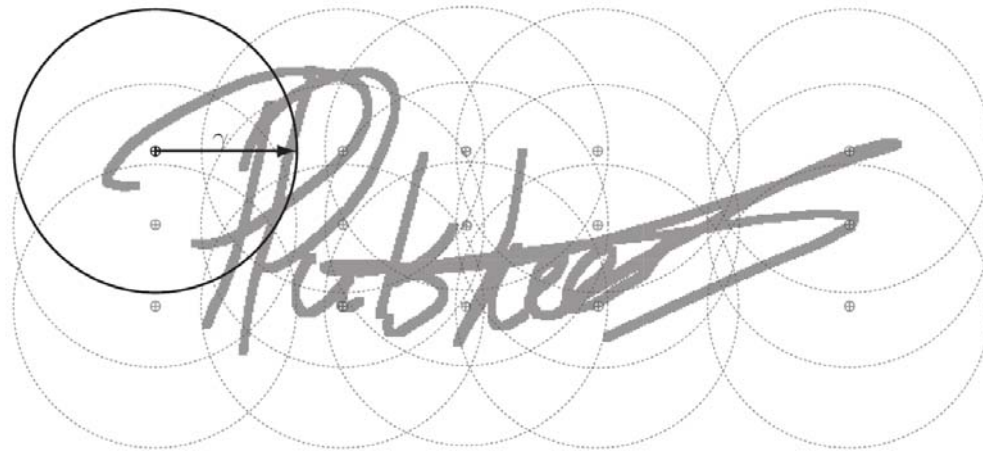


# Mark Panton

## Offline signature verification (MSc, 2010)

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- Features from local retinas
- Ensemble of ring-structured HMMs

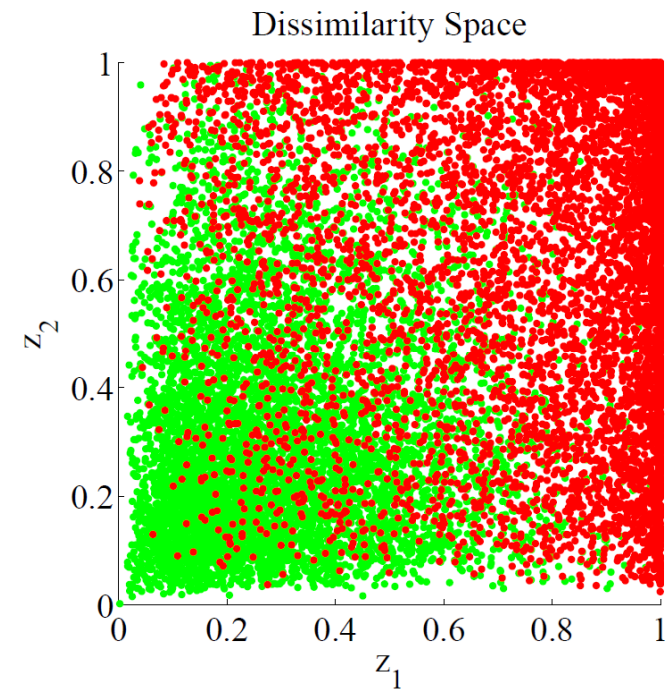
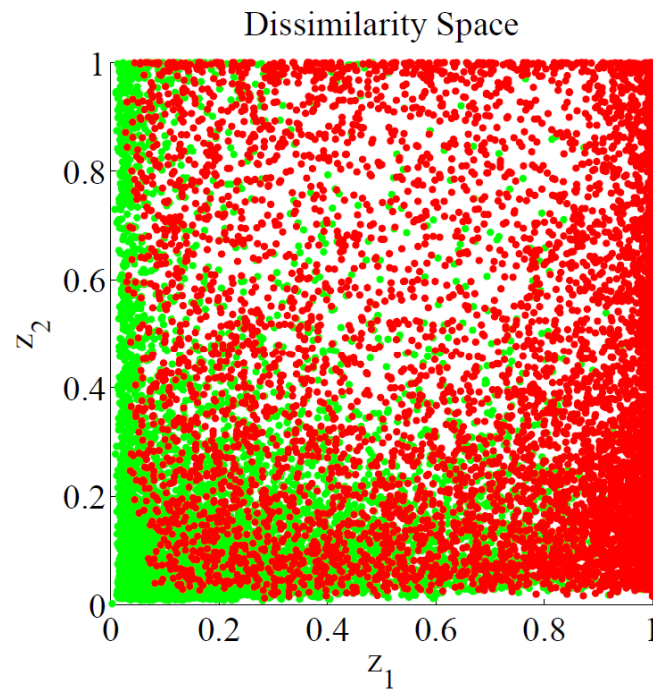


# Jacques Swanepoel

## Signature verification (PhD, 2015)

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- **Writer-independent approach**
- **Writer-specific dissimilarity normalisation**

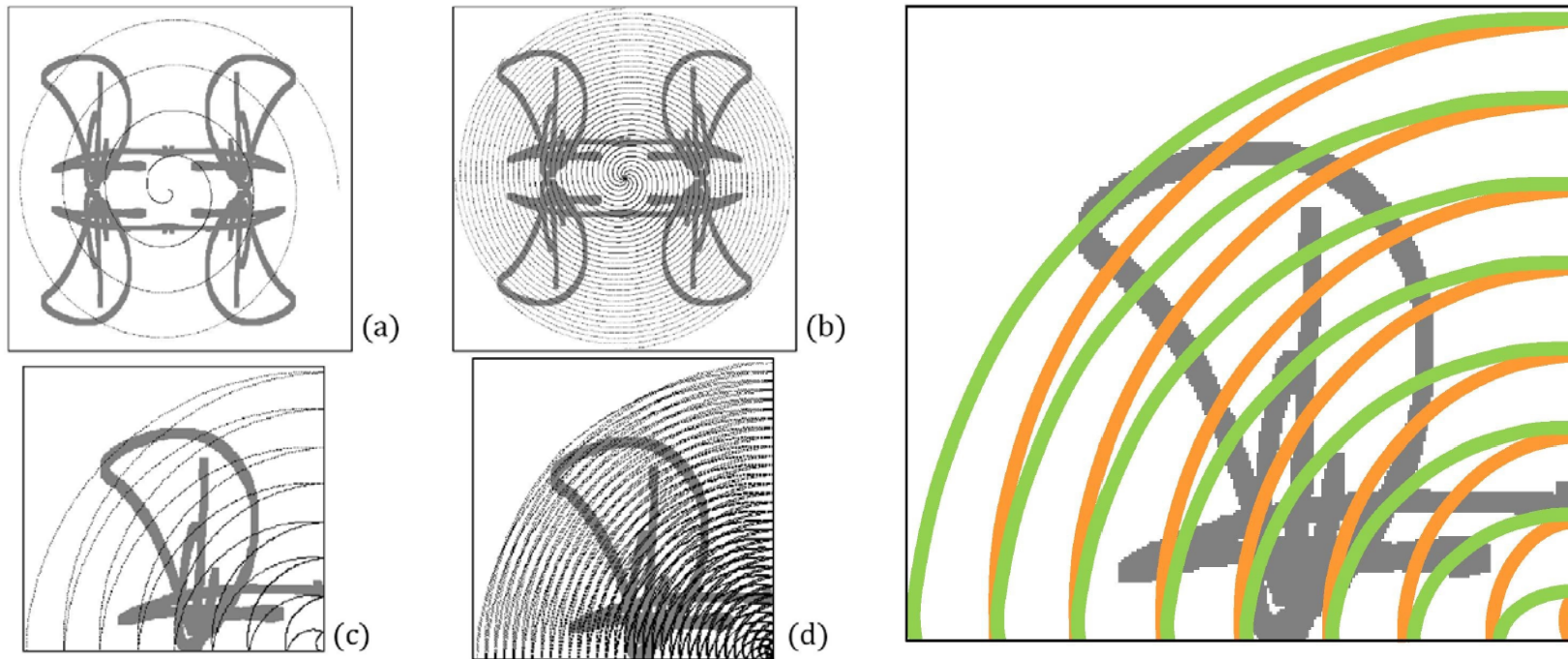


# Carlien Fick

## Offline signature verification (MSc, 2017)

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- Textural features from modified DRT
- Classifier combination, template matching

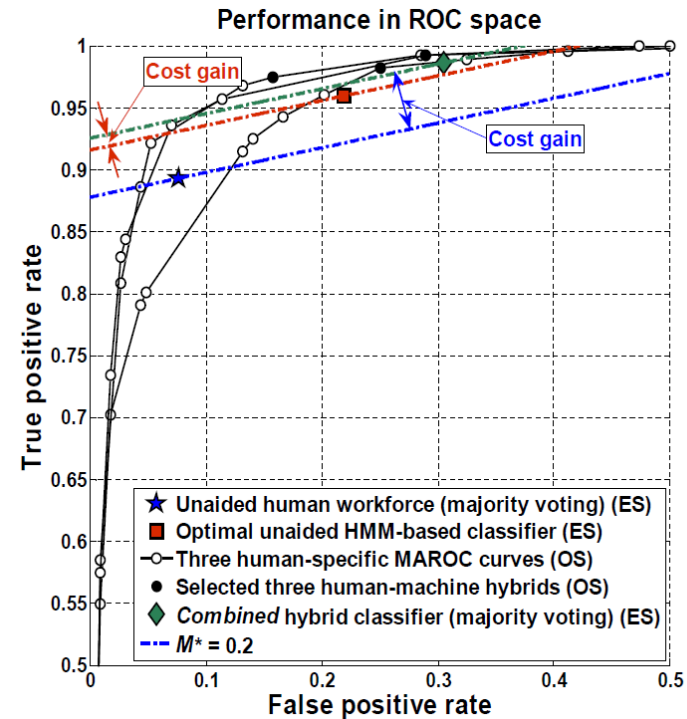
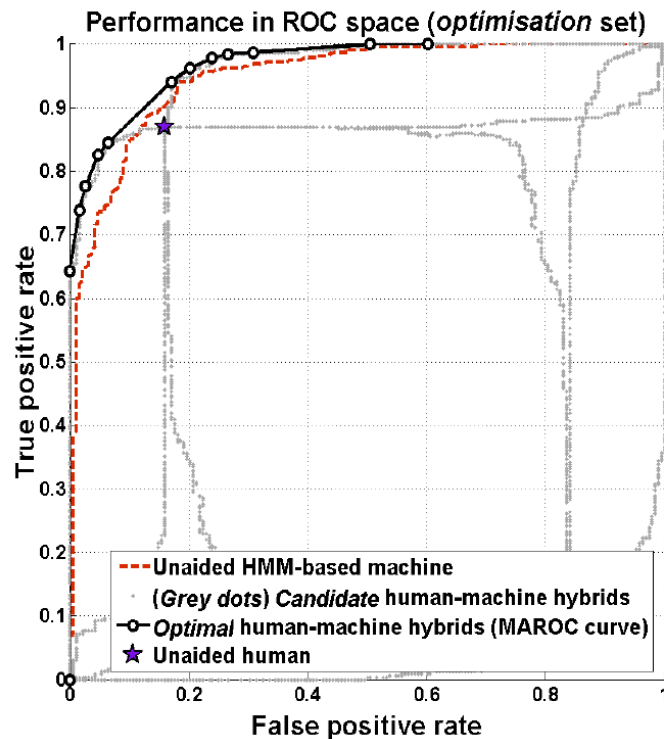


# Hanno Coetzer / ETS, Montreal

## Classifier combination

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- Human-machine collaboration
- Cost-sensitive authentication



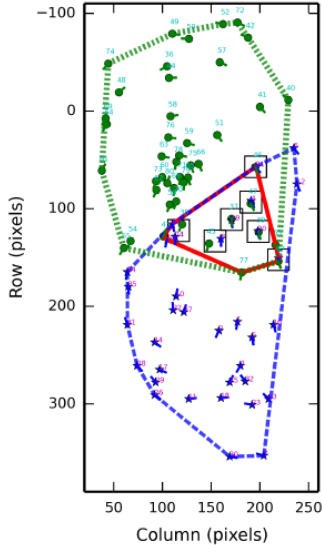
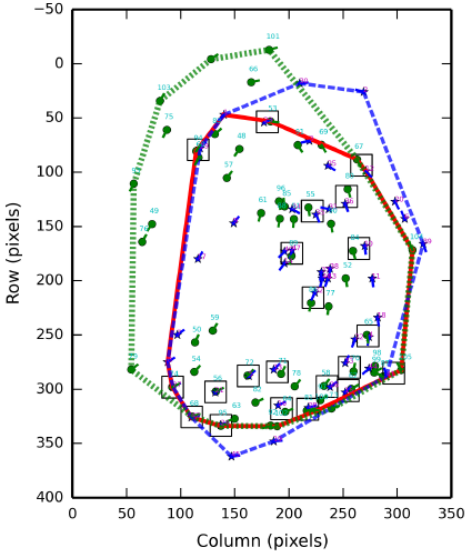
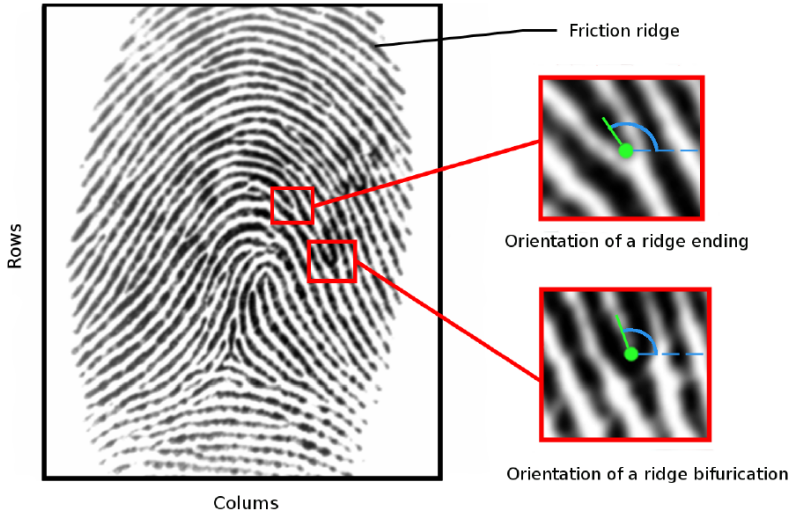


# Anton de Kock

## Fingerprint matching (MSc, 2016)

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- Minutia-based approach
- Comparison of similarity scores



- Overlapping region
- - - Convex hull of minutia points from set 1
- ⋯ Convex hull of minutia points from set 2
- Minutia points from set 2
- \*\*\* Minutia points from set 1
- Paired minutia points

# Emile Beukes

## Hand vein-based authentication (MSc, 2018)

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- Morphological reconstruction
- Template matching



(a)



(b)



(c)



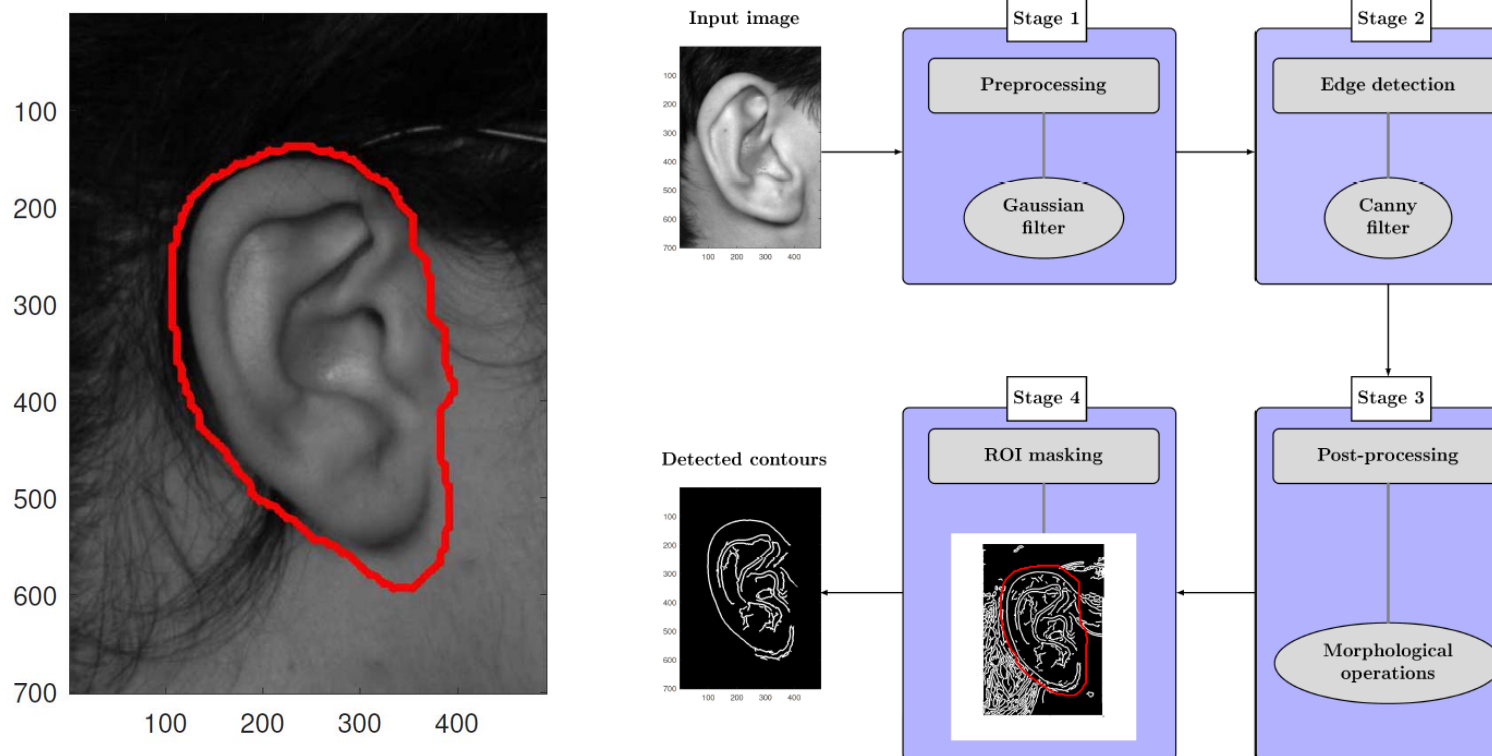
(d)

# Aviwe Kohlakala

## Ear-based authentication (MSc, 2019)

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- CNN-based ROI detection
- Matching of prominent curves

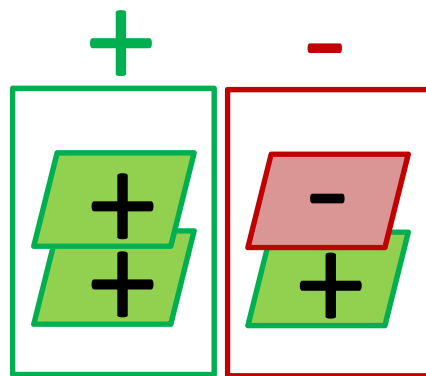


# Emile Beukes

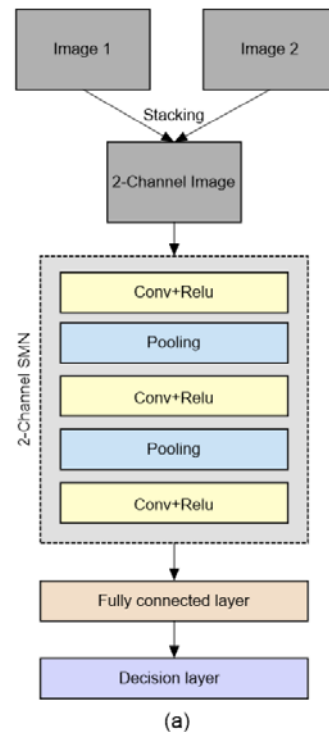
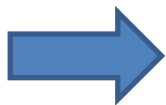
## Hand vein-based authentication (PhD...)

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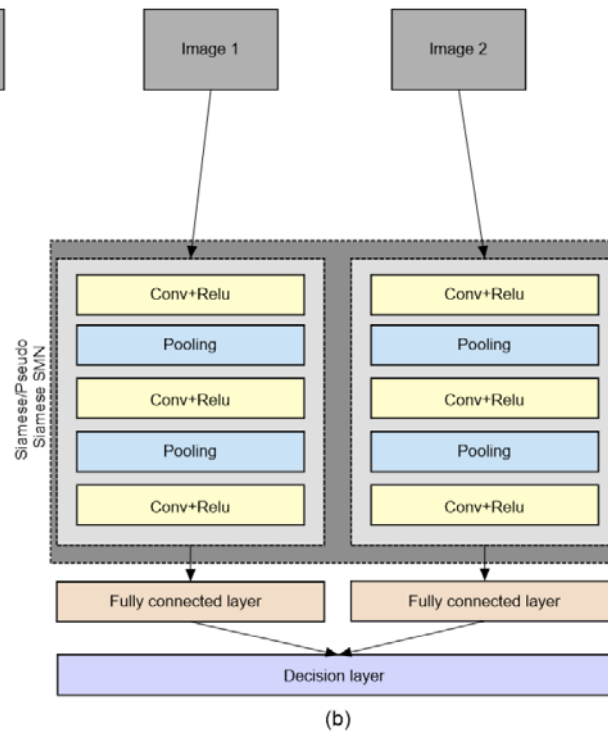
- Binary input images
- Similarity measure network (SMN)



Two-channel SMN

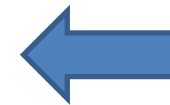


(a)



(b)

Siamese/  
pseudo-  
siamese  
SMN

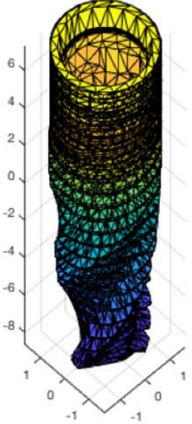
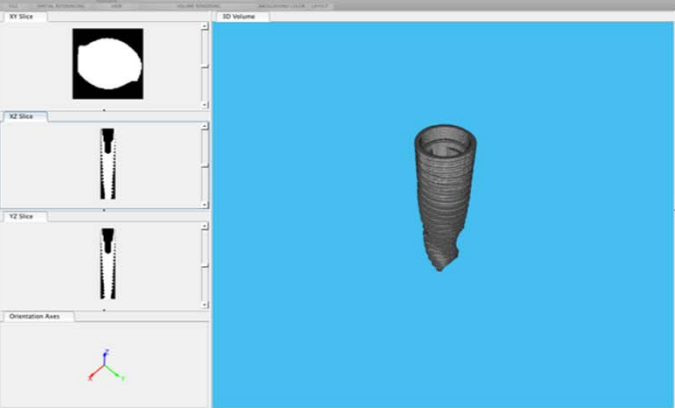
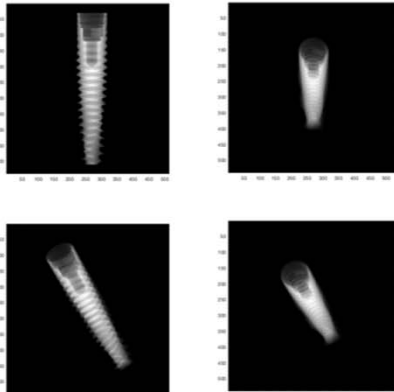



# Hanno / Aviwe / Leuven

## Dental implant recognition (PhD...)

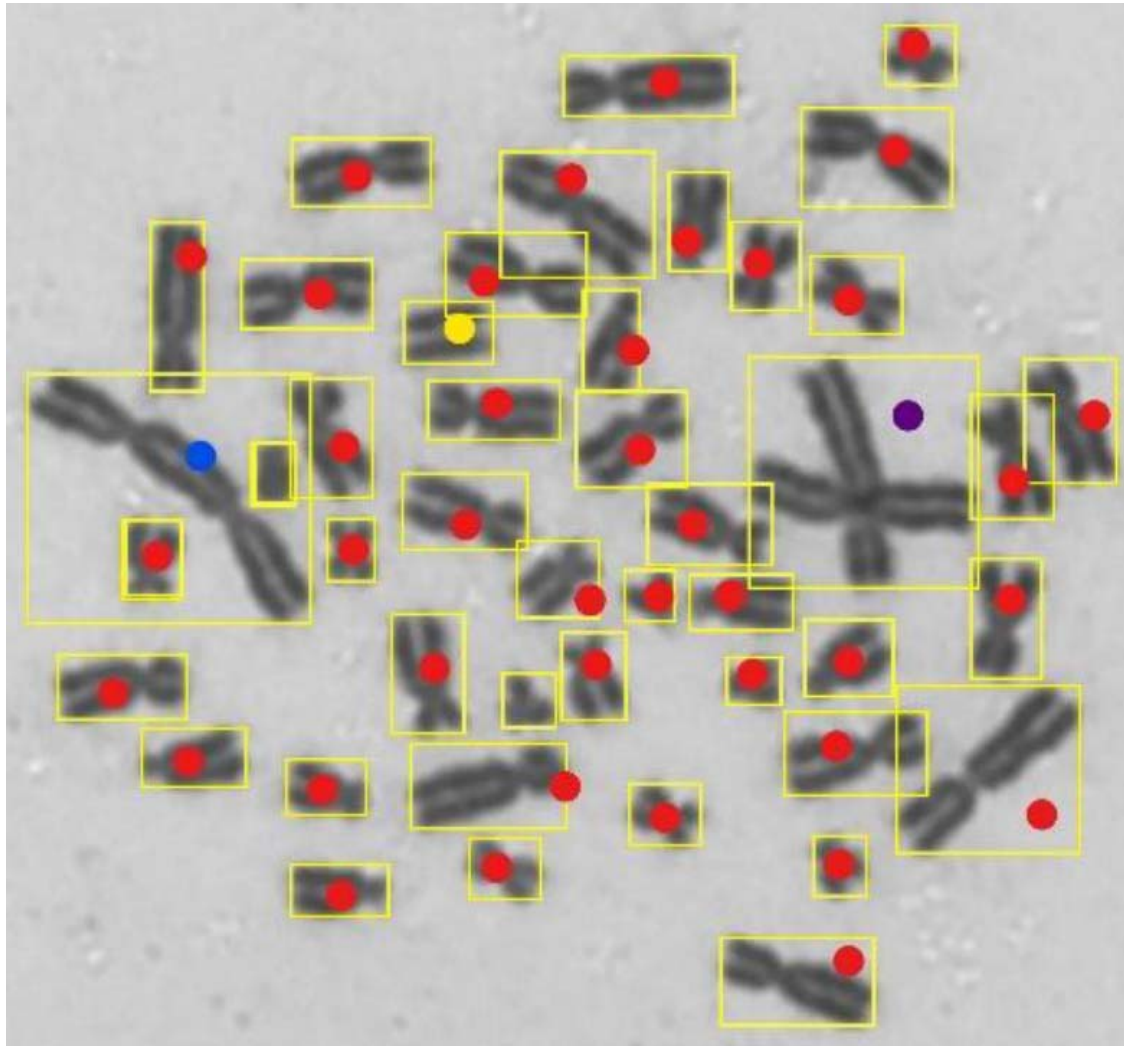
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- Artificial generation of training samples
- Convolutional neural network (CNN)

 A 3D visualization of a dental implant's surface, rendered as a triangulated mesh. The mesh is colored with a gradient from blue at the base to yellow at the top. It is shown in a 3D coordinate system with axes ranging from -1 to 1.	 A software interface showing a 3D volumetric representation of a dental implant. The main window displays a blue 3D model of the implant. On the left, there are three panels for 'XY Slice', 'XZ Slice', and 'YZ Slice', each showing a 2D cross-section of the implant. Below these panels are 'Orientation Axes'.	 Four simulated x-ray images of a dental implant, arranged in a 2x2 grid. Each image shows the implant from a different perspective, highlighting its cylindrical shape and the threaded section.	 A single actual x-ray image showing a dental implant installed in a patient's jaw. The implant is clearly visible against the surrounding bone structure.
<p>Triangulated surface model</p>	<p>Three-dimensional volumetric representation</p>	<p>Simulated x-ray images (training data)</p>	<p>Actual x-ray image (test data)</p>

**Sarah Galloway / iThembaLABS**  
**Detection of dicentric chromosomes (MSc...)**

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**Thanks!**