

# Visual processes underlying fingerprint examination and comparison



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## 1. Research Questions

- How do fingerprint experts decide whether two prints share the same source or not? What features of a print are used by experts? Do they use the same or similar features? Do they use the features suggested by ACE-V?
- So far we only know that fingerprint experts seem to process fingerprints globally (like faces), and are able to ignore irrelevant information (Busey & Vanderkolk, 2005). They also appear to use a common set of visual features when under time pressure (Busey et al., 2011). Experts are better than novices at accurately matching good quality images with larger *image area* (Kellman et al., 2014).

## 2. Research Focus

- What image features guide perceptual categorisation in examination / comparison / verification?  
How are results affected by external constraints?
- Stage of comparison process?
  - Time-pressures?
  - Case-specific information?

## 3. What do we propose to do?

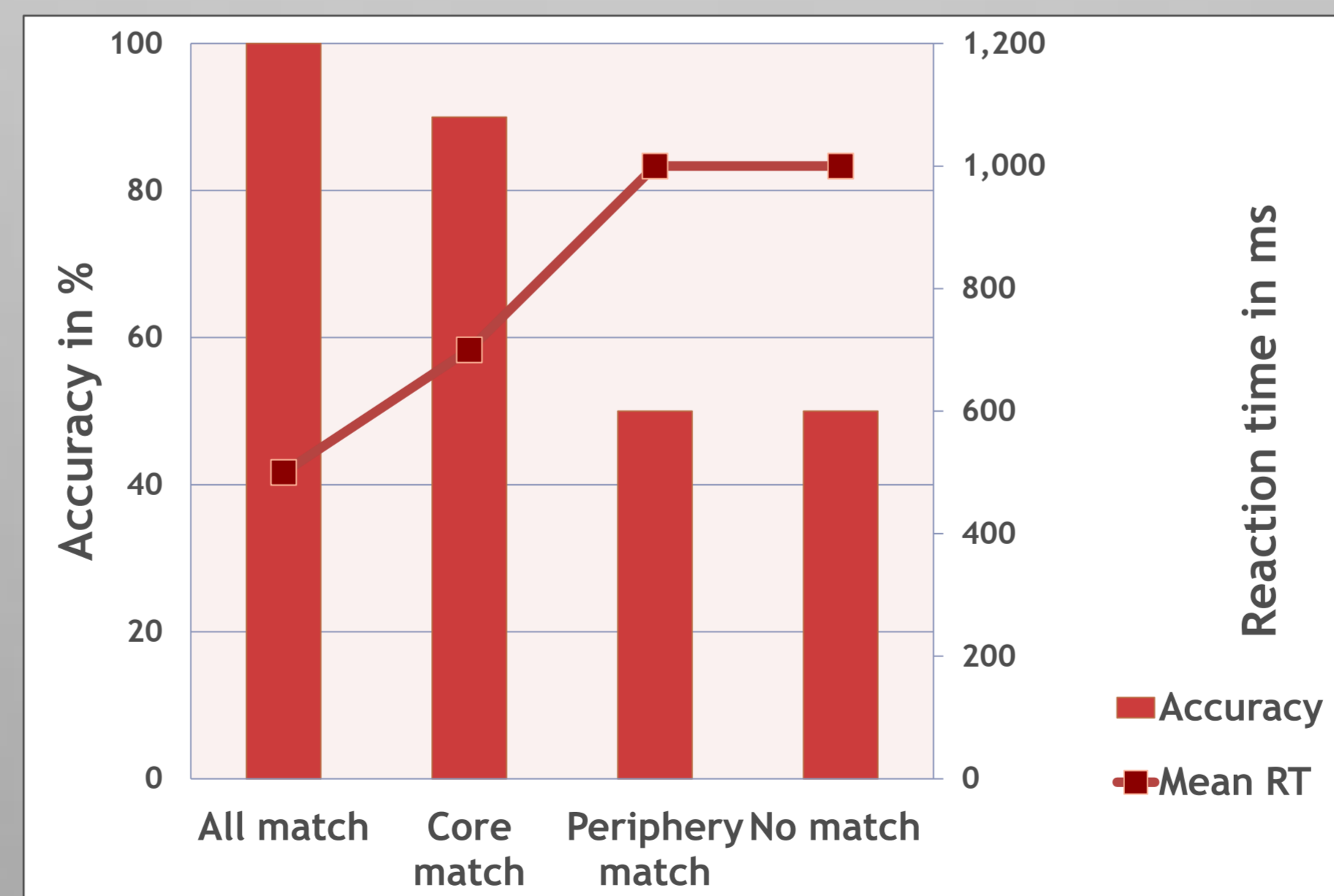
- psychophysical and eye-tracking studies
- target detection or perceptual categorisation tasks
- collect reaction time and accuracy responses
- collect eye-movement data
- participants: fingerprint experts and trainees, as well as students (fingerprint novices)
- may train a group of student volunteers to be fingerprint/pattern recognition experts over the course of the project

## 4a. What are we looking at right now?

How strong is the influence of the core on categorisation ability?



## 4b. Expected results



## 5. What for?

- Interesting and instructive for participants: See and understand how your eyes move across prints and marks
- Understanding the visual processes underlying fingerprint examination can improve training and examination guidelines, and support expert witnesses in court
- Contribute to knowledge in forensic / criminology as well as psychology/neuroscience (possible applications to computer vision)

## References

- Busey, T., Yu, C., Wyatte, D., Vanderkolk, J., Parada, F., & Akavipat, R. (2011). Consistency and variability among latent print examiners as revealed by eye tracking methodologies. *Journal of Forensic Identification*, 61(1), 60-91.
- Busey, T. A., & Vanderkolk, J. R. (2005). Behavioral and electrophysiological evidence for configural processing in fingerprint experts. *Vision Research*, 45(4), 431-448.
- Kellman, P. J., Mnookin, J. L., Erlikhman, G., Garrigan, P., Ghose, T., Mettler, E., . . . Dror, I. E. (2014). Forensic comparison and matching of fingerprints: Using quantitative image measures for estimating error rates through understanding and predicting difficulty. *PLoS One*, 9(5), e94617.
- Images were created using the demo version of SFinGe, developed at Biometric System Laboratory, University of Bologna, <http://biolab.csr.unibo.it>