Biometric Recognition of Children

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CSIR
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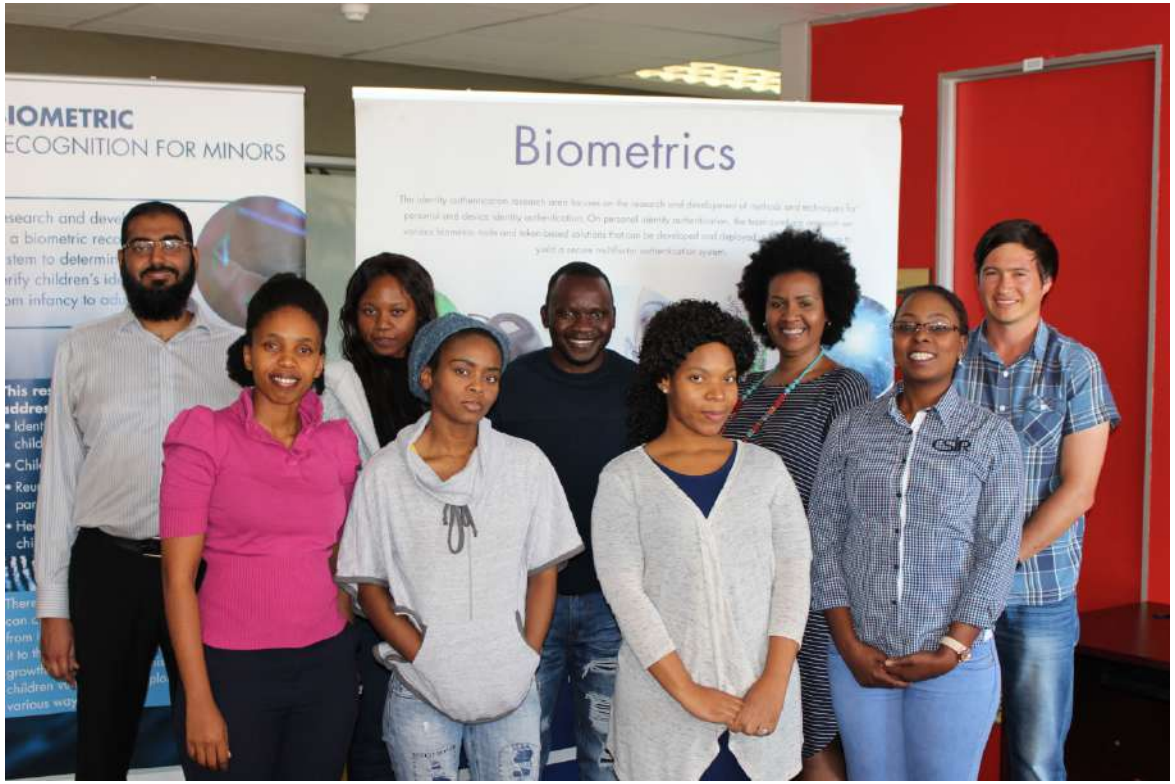
Why?

- Organization:
  - Council for Scientific and Industrial Research(CSIR)
  - Mandate: “Research and technological innovation to improve the quality of life of the people” of South Africa.

- Current challenge to South Africa and the world:
  - Biometric recognition of children
  - persistently from birth to adulthood



Biometrics for Children team

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Why? - ID Theft Example

Matric pupil gets back his identity

SOUTH AFRICA Thursday 26 May 2016 - 9:59pm

JOHANNESBURG, 26 May 2016 – Lawrence Phakathi was battling to use his ID number to register for the Grade 12 exams because he was the victim of identity theft. eNCA is happy to report that this story has a happy ending. Video: eNCA

Why? - Child Swapping

Devastated mum seeks baby-swap daughters

Chisom Jenniffer Okoye

The traumatised mother lost the child she raised as her own when DNA proved the girl is not hers, and still hasn't found her blood daughter.

Why? - ID Fraud

Child Identity Fraud Hit More Than One Million U.S. Victims in 2017 According to New Javelin Strategy & Research Study

Total losses of $2.6 billion, substantial out-of-pocket costs to victims' families, and links to bullying and known perpetrators all characteristics of this damaging problem

SAN FRANCISCO, April 24, 2018 – More than one million children were victims of identity fraud in 2017, resulting in total losses of $2.6 billion and over $540 million in out-of-pocket costs to families, according to the 2018 Child Identity Fraud Study released today by Javelin Strategy & Research.

The report, sponsored by Identity Guard, finds data breaches are especially damaging for minors. Among those who were notified their information was breached, 39 percent became victims of fraud, compared with 19 percent of notified adults. The limited financial histories of minors give fraudsters a long-term opportunity to slowly develop networks of accounts, mimicking legitimate holdings.

Fraud Against Children Totaled $2.6 Billion in 2017

Why?

- legal identity for children
- civil registration and civil identification right from birth to death
- Address issues such as:
  - identity theft
  - identity fraud
  - border management / combatting child trafficking
  - electronic healthcare systems / healthcare management
  - education and social services management
  - identifying lost children

Challenges

- Acquiring biometrics as close to birth as possible
- Consistently matching these biometrics with the same person as they grow towards adulthood

Which modality?

- Different biometrics have different applicability in different scenarios
- Multi-modality allows for more robust and reliable identification systems
- Therefore, multimodal systems!
- Which modalities?

Which modalities?

Key
Good
Medium
Poor

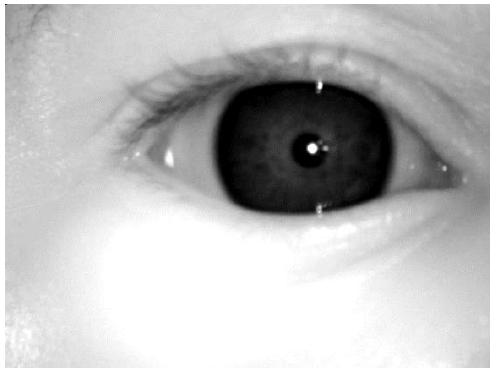
	Fingerprint	Iris	Ear	Face	Voice	Palmprint	Footprint	Palm/Finger Vein
Universality								
Uniqueness			?					
Permanence								
Collectability								
Acceptability			?					
Expected Performance			?					
Circumvention resistance			?		?			

Which modalities

- Chose to focus on 3:

Fingerprint

Iris



Ear

- Tested on children as young as 6 weeks

Where we are - Fingerprints

- Existing devices not effective with infants and toddlers
- Solution:
  - Build new acquisition device
  - Contactless
  - High resolution

Where we are - Fingerprints

10 week old with CSIR infant fingerprint scanner

10 week old with conventional fingerprint scanner

Where we are - Fingerprint

Age groups	Equal Error Rate	No. of fingers
6 weeks <= age <= 4 months	15.56%	360
4 months < age <= 6 months	15.45%	382

- Working on hardware improvements
  - Increased acquisition area → to reduce partial fingerprint occurrence
  - Improve focus → to reduce blurry fingerprint occurrence

- Looking for ways to:
  - recruit more participants and
  - ensure repeat participation for long term matching with growth

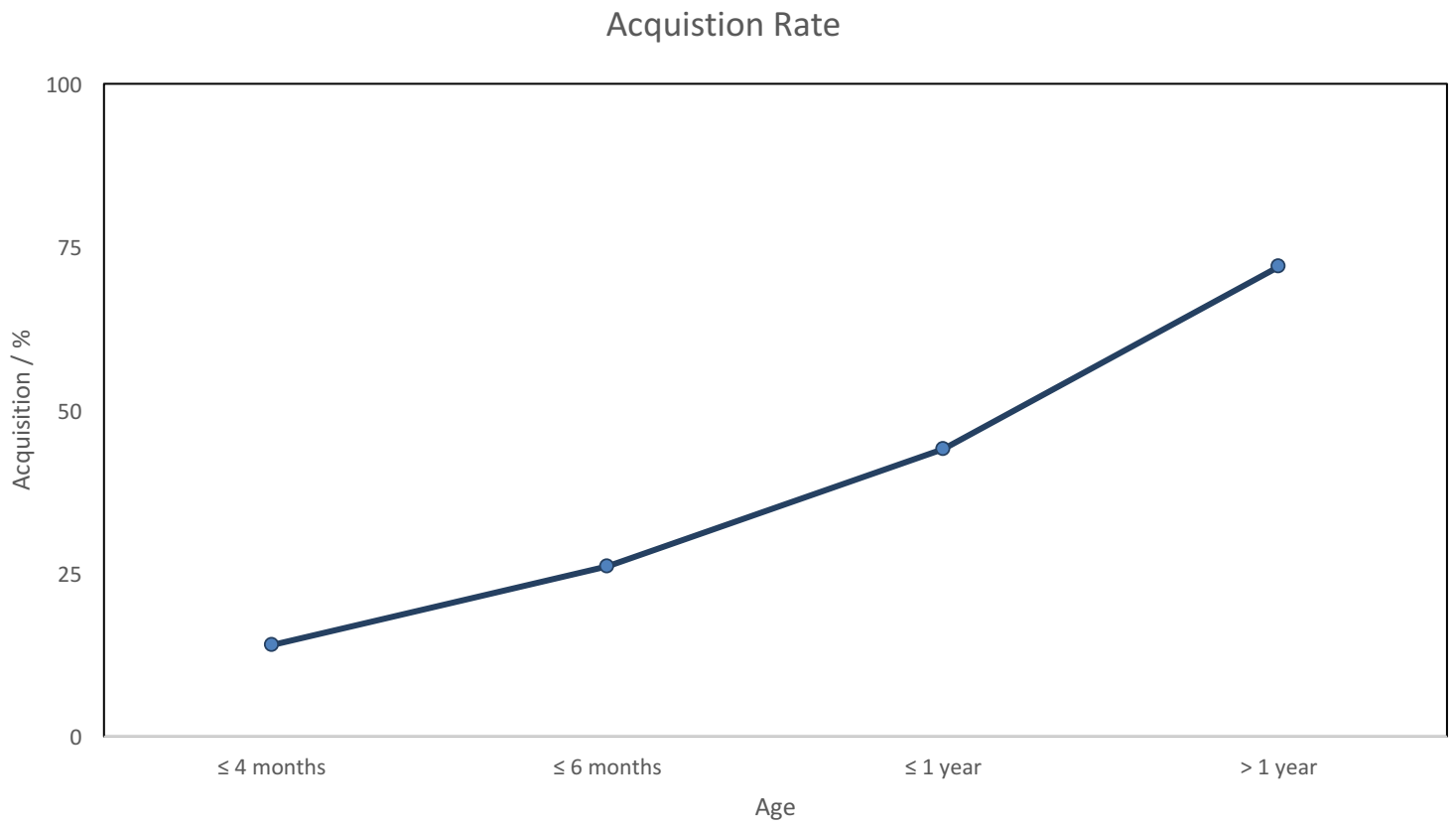
Where we are - Iris

Commercial off-the-shelf scanner

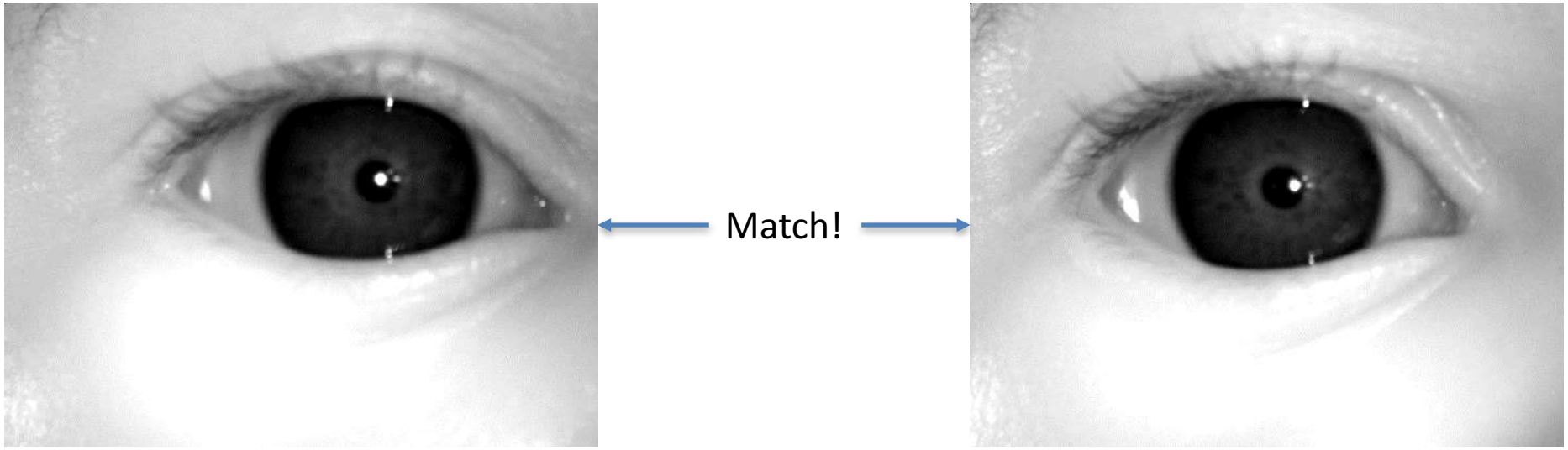
- Challenge: Children too young to understand instructions and cooperate
  - Negatively affects ability to acquire irises

Where we are - Iris

- Acquisition improves with age



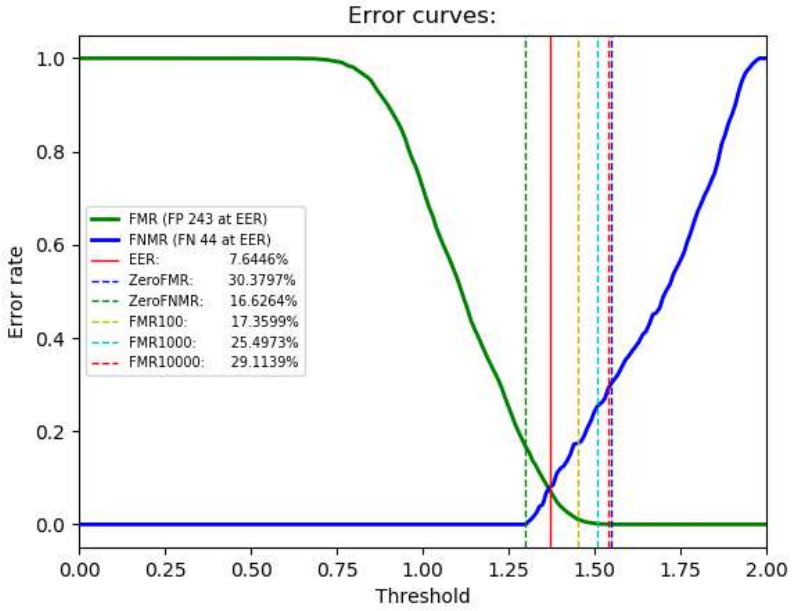
Where we are - Iris

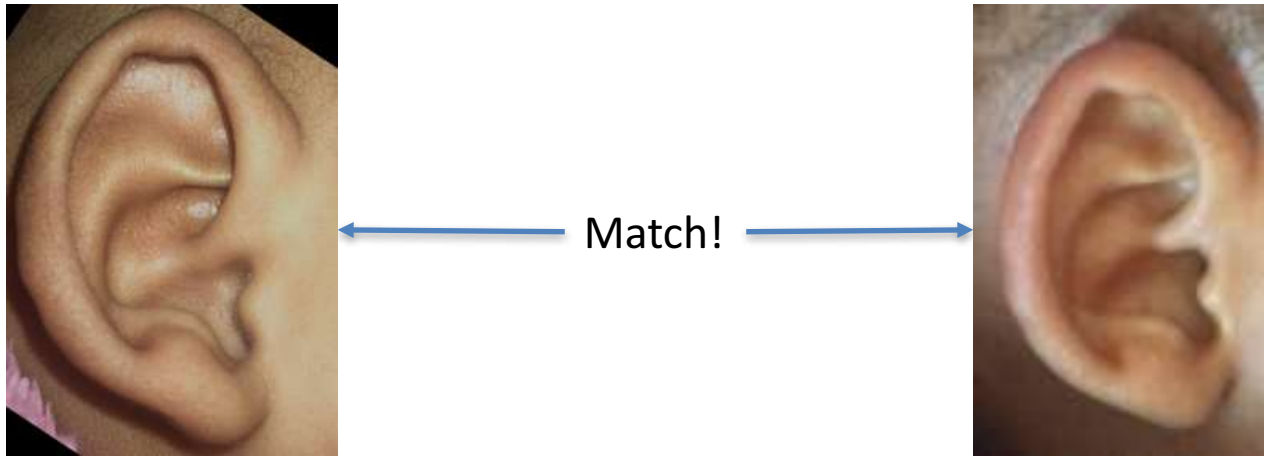


6 week old

- We **can** match when acquisition is successful!
- Way forward:
  - Need to design better acquisition hardware
  - in consultation with camera optics experts

Where we are - Ear





8 months

24 months

- Equal Error Rate: 7.64%
- Using 76 unique ears from children
  - Single instance
  - 340 impressions

- Can match over 16 months

Conclusion

- Biometric recognition of infants shows promise
- Multiple modalities are possible
- Multimodal fusion will be investigated
- Further refinement ongoing
- Require more opportunities to test and validate
- Looking for collaborative opportunities for further real world testing and refinement

Thank you

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