Fingerprints For Social Good

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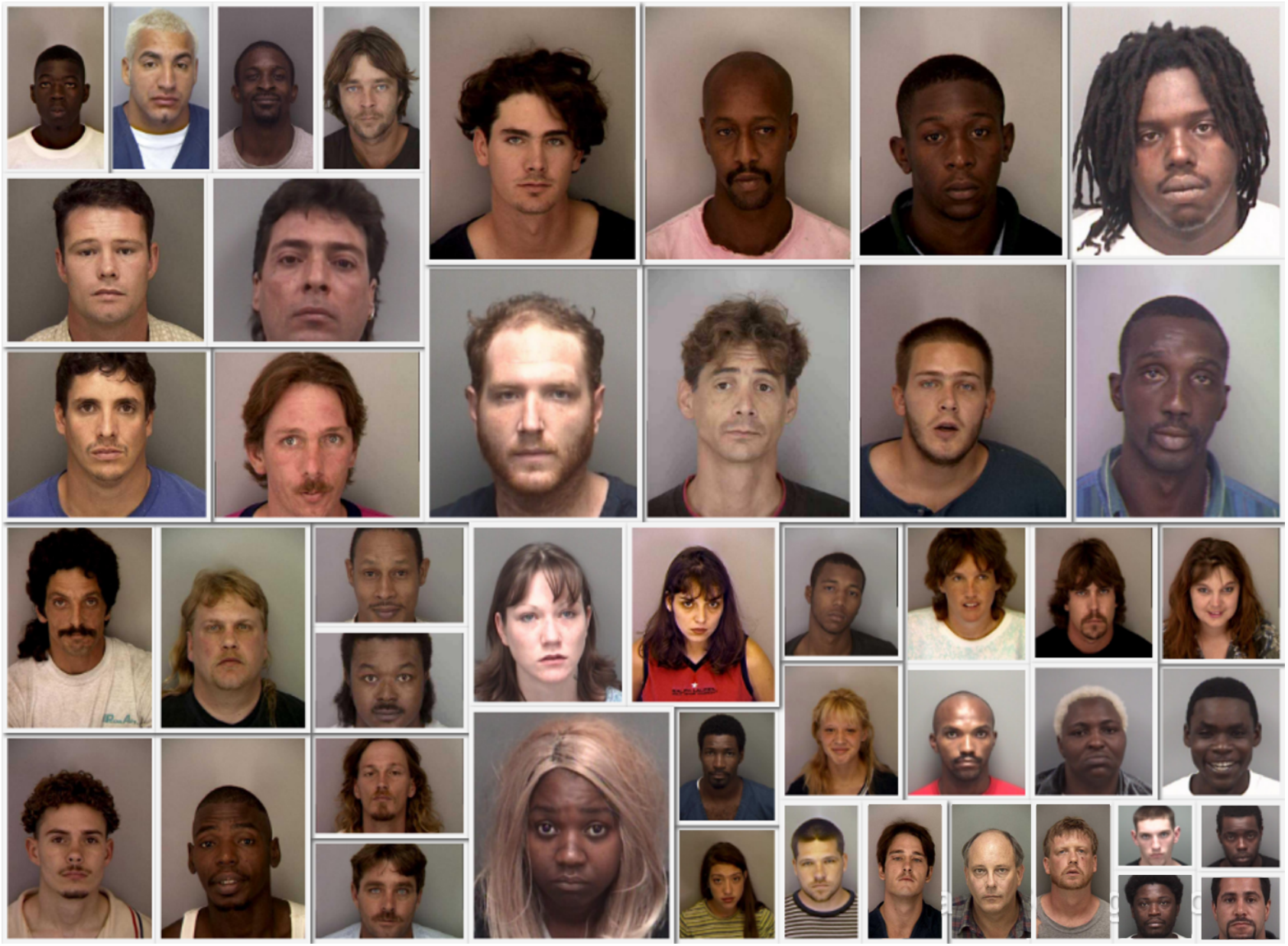
Current Applications: Demographics

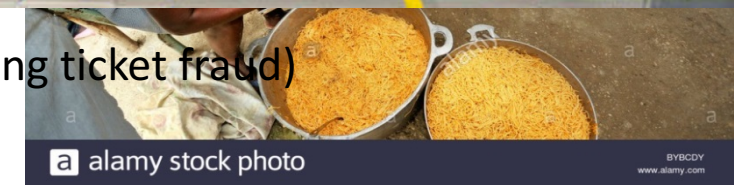


Emerging Applications: Demographics

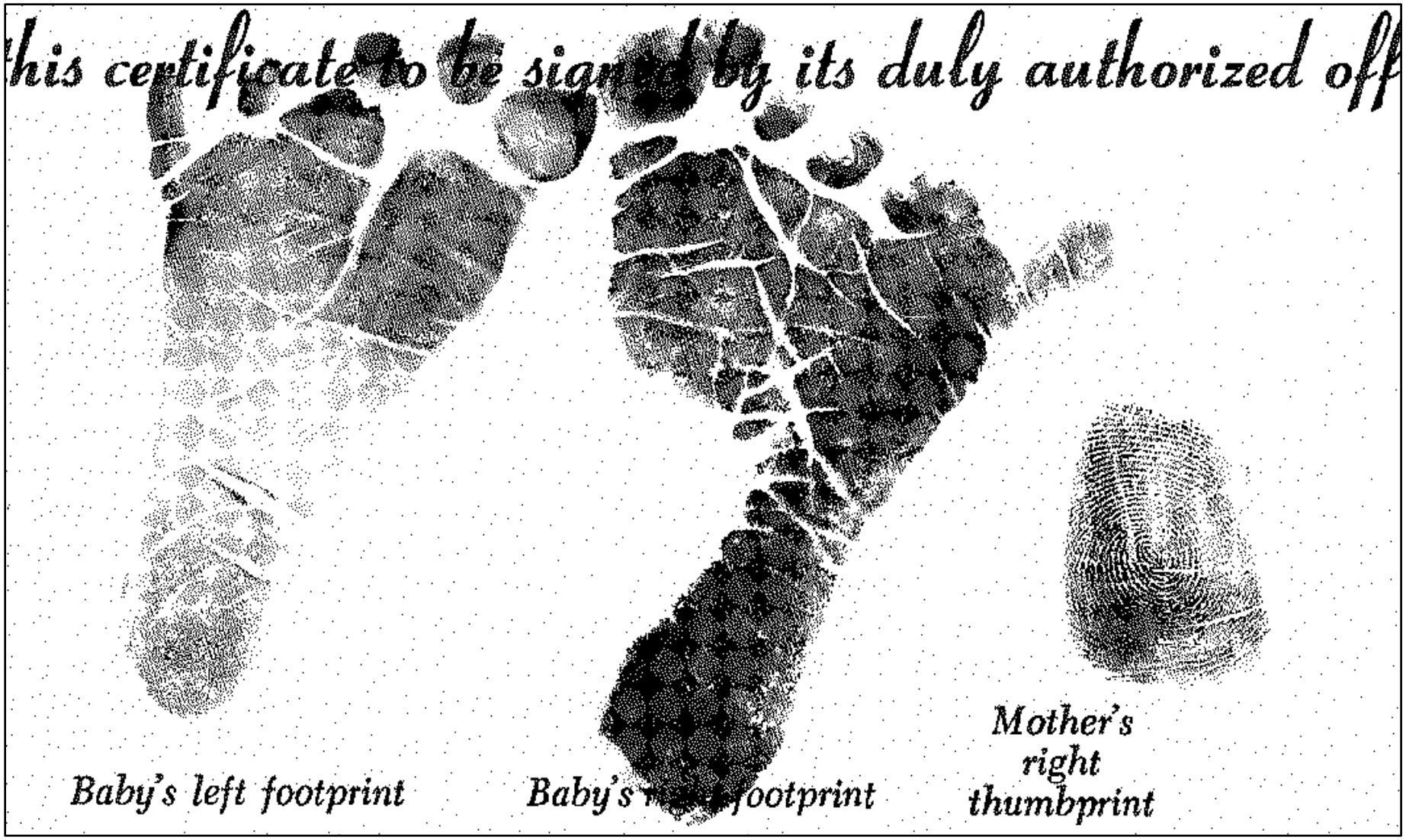
Applications

M shed)

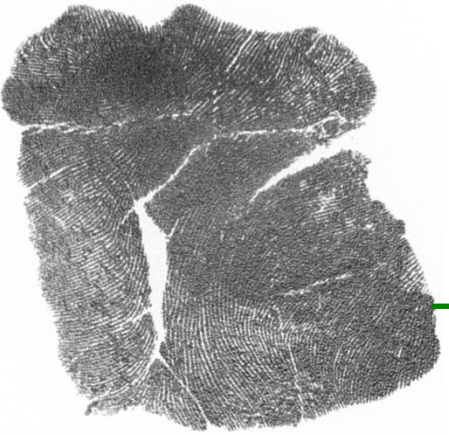
Disneyworld (preventing ticket fraud)



Linking Child and Parents Biometrics

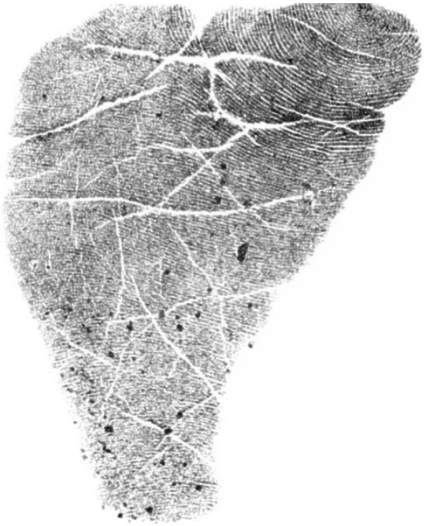


Why Fingerprints?

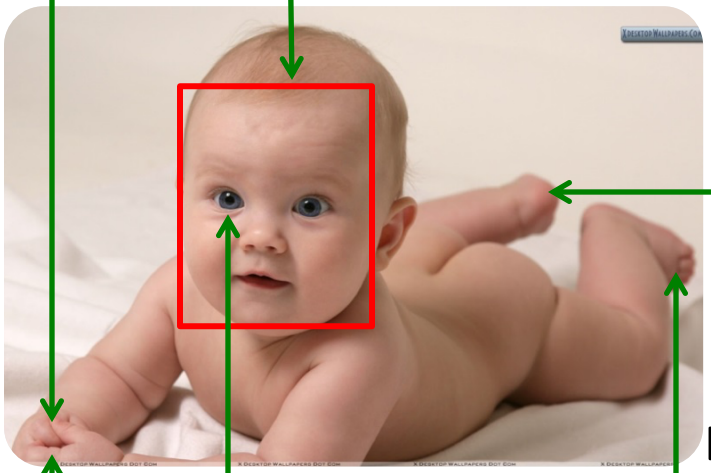


Palmprint

Face

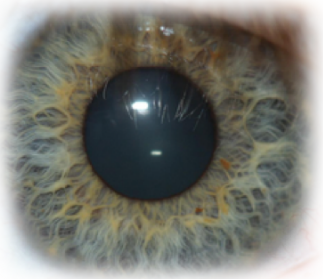


Footprint



Fingerprint

Iris



DNA?

Ballprint

Objectives

- Feasibility of child recognition via fingerprints
- Conduct a longitudinal study

Age: 16 months

Mar. 2015
16 months

Sept. 2015
22 months

Jan. 2016
26 months

Mar. 2016
28 months

Requirements: Compact & high res. reader; robust matcher; high throughput

Fingerprints of Young Children

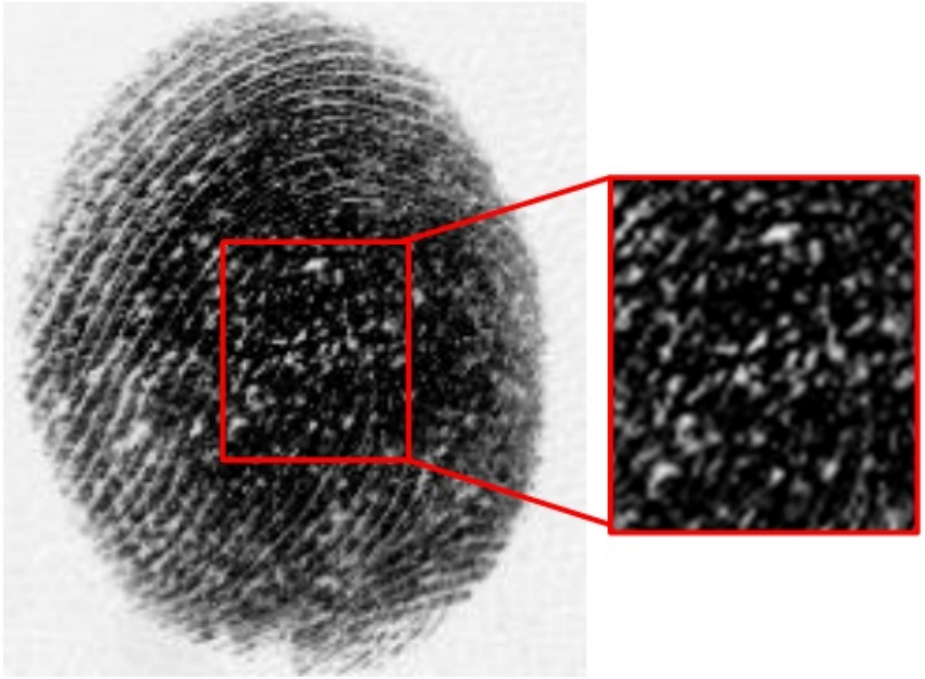
- Galton (1892) collected all ten fingerprints of a newborn from birth until she was 4.5 years old

- Conclusion:

  “The print of a child at the age of 2.5 years would serve to identify him ever after”

Effect of Sensor Resolution

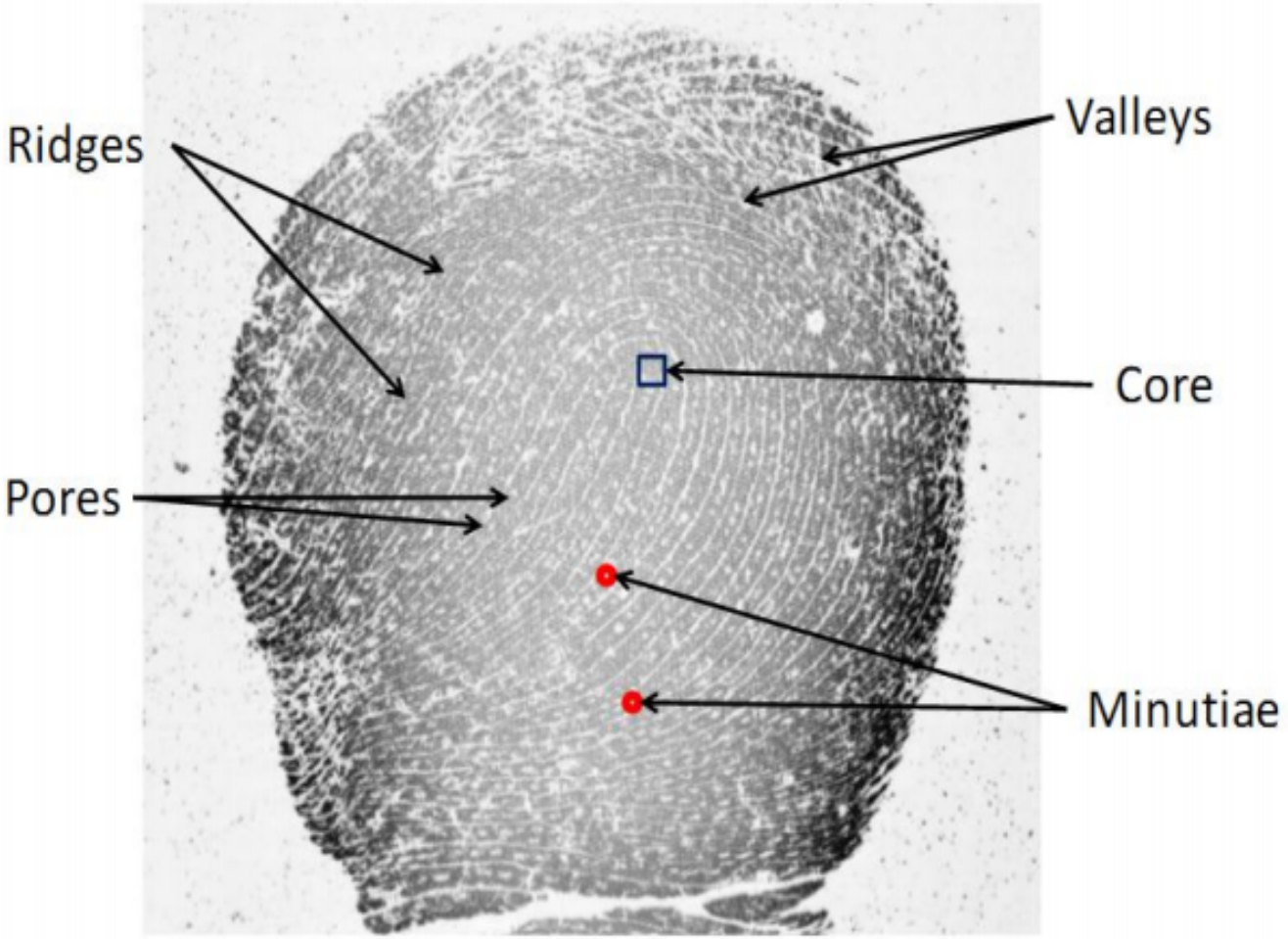
6-weeks old child



DP U.are.U 4500 (500 ppi)

NEC Zakuro (1270 ppi)

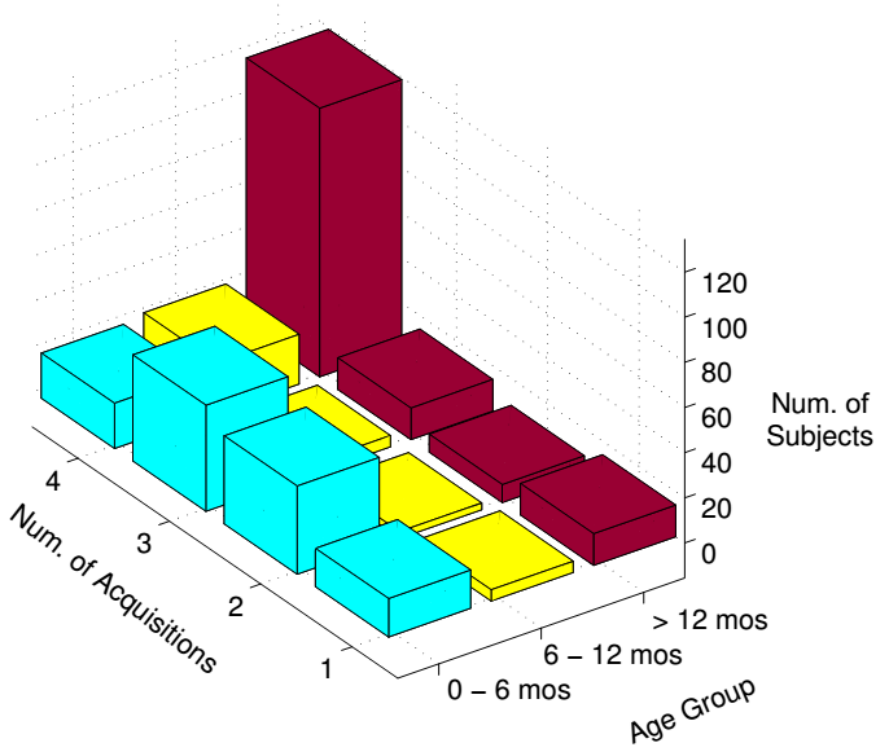
Fingerprint of a 6 Hours Old Child



Data Collection Environment

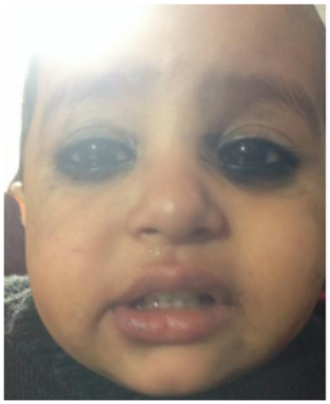
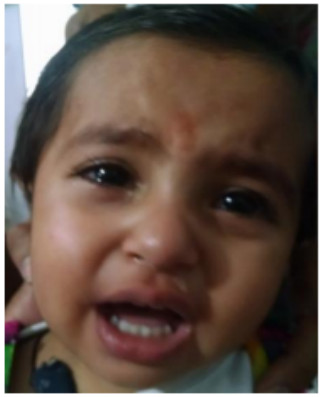
Saran Ashram hospital, Dayalbagh, Agra, India

Longitudinal Fingerprint Database



- 3 prints/thumb/session
- 3 face images/session
- 309 children in total
- 161 came to all 4 sessions

Subset	First Session	# Subjects (males)	Age Range (median age)	# Ret. Sess. 2	# Ret. Sess. 3	# Ret. Sess. 4	Time Lapse ($\triangle T$)
Subset A	1 (Mar. 2015)	204 (95)	0-5 (2.0) yrs	167	180	178	12 mos
Subset B	2 (Sep. 2015)	65 (33)	0-42 (6.1) weeks	*n.a.*	52	50	6 mos
Subset C	3 (Jan. 2016)	40 (18)	0-42 (7.6) weeks	*n.a.*	*n.a.*	30	2 mos

	Mar. 2015 (6 months)	Sept. 2015 (12 months)	Jan. 2016 (16 months)	Mar. 2016 (18 months)
Face				
Right Thumb 500 ppi				
Right Thumb 1,270 ppi				

Experimental Results

- **Fingerprint verification**

  500 ppi: Age at enrollment > 12 months
  100% TAR @ 0.01% FAR (time gap = 12 months)

  1270 ppi: Age at enrollment > 6 months
  98.9% TAR @ 0.01% FAR (time gap = 6 months)

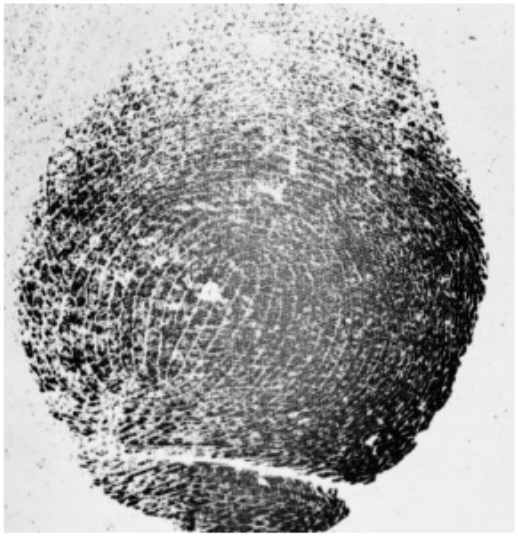
- **Fingerprint search (Gallery of 33K)**

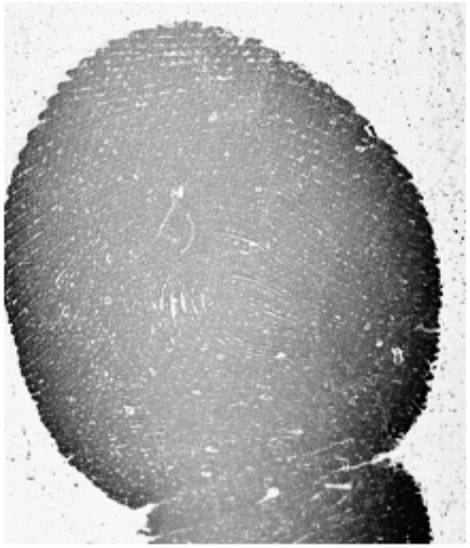
  500 ppi: Age at enrollment > 12 months
  Rank-1 retrieval = 100% (time gap = 12 months)

  1270 ppi: Age at enrollment > 6 months
  Rank-1 retrieval = 100% (time gap = 6 months)

http://www.cse.msu.edu/rgroups/biometrics/Publications/Fingerprint/Jainetal_ChildFingerprintRecognition_TechRep_MSU-CSE-16-5.pdf

Poor Quality (Age: 0-6 months)





1 day

4 months

6 months

Summary

- Growing opportunities for large-scale fingerprint recognition of young children
- Longitudinal study: fingerprint recognition is viable (~99% TAR @ 0.01% FAR) for children over 6 months at enrolment
- Future work:
  - Continue longitudinal study over the next 4 years
  - Sensor design (low cost, fast capture, compact)
  - Robust matcher