Infant-ID: Fingerprints for Global Good

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http://biometrics.cse.msu.edu/

ID4Africa LiveCast, Feb 24, 2021

Vaccination Clinic in Benin (June 2014)

Requirements: Accuracy, speed, social acceptance, usability, low cost, backup power

Saran Ashram Hospital Dayalbagh (Sept 2015)

Beginning of longitudinal fingerprint collection (4 collections in 12 months)

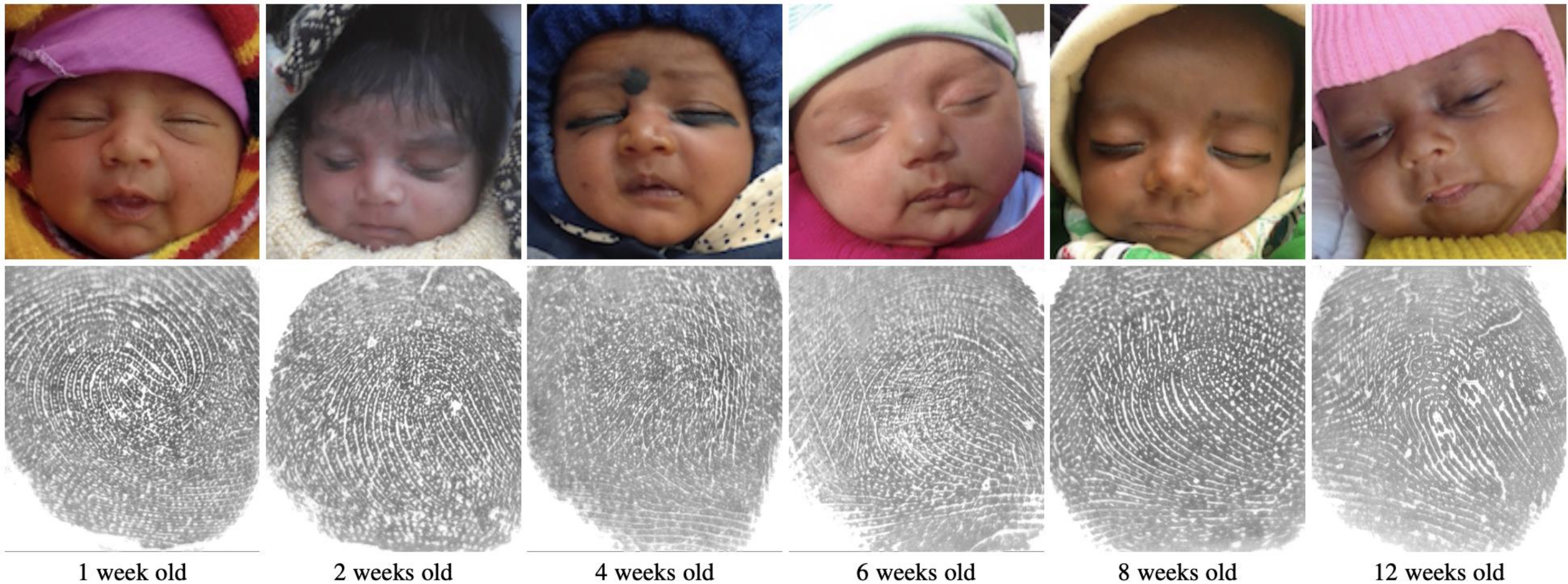# Choice of Biometric Trait

Palmprint

Fingerprint

Face

Iris

Footprint

Limitations: palmprints (fists closed), face: (fast aging), iris (crying/sleeping), footprint (dirty feet)

Infant Fingerprints

| 1 week old | 2 weeks old | 4 weeks old | 6 weeks old | 8 weeks old | 12 weeks old |

Fingerprints: visible at birth, parental acceptance, ergonomic, low cost, high throughput

Challenges

Distortion

Dry

Moist
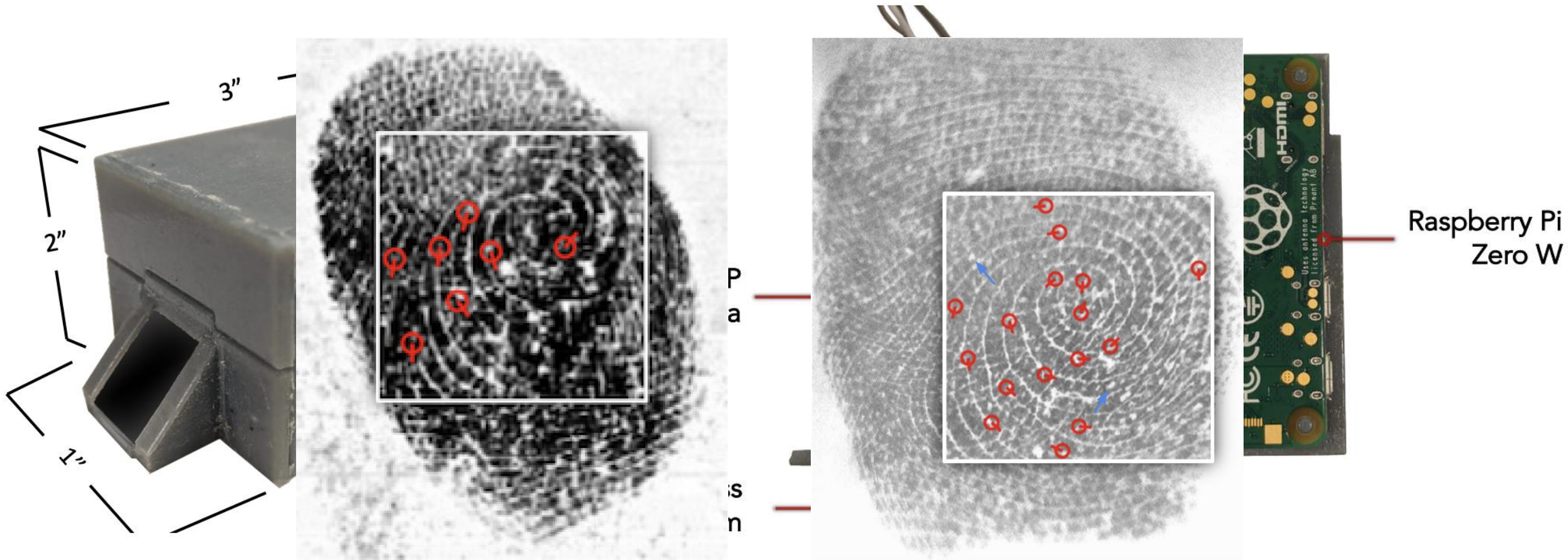
Time gap

Motion blur

Dirty

Small ridge spacings

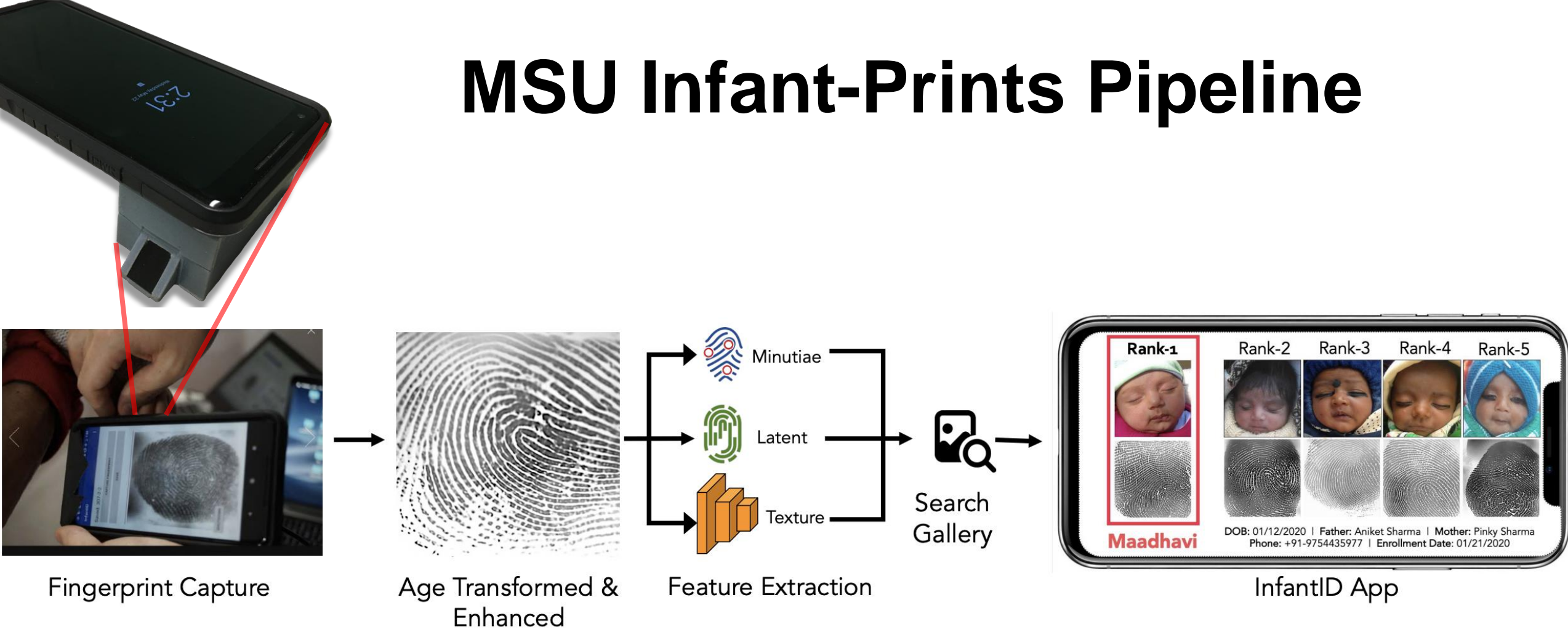**Reader requirements:** High-Res (1,900 ppi); fast capture, manual control for focus

Matcher requirements: Robust to motion blur, noise/distortion, time gap between enrollment and test image

MSU Infant-Prints Reader

Raspberry Pi Zero W

MSU Infant-Prints Pipeline

Fingerprint Capture

Age Transformed & Enhanced

Feature Extraction
- Minutiae
- Latent
- Texture

Search Gallery

InfantID App

Rank-1 — Maadhavi
Rank-2
Rank-3
Rank-4
Rank-5

DOB: 01/12/2020 | Father: Aniket Sharma | Mother: Pinky Sharma
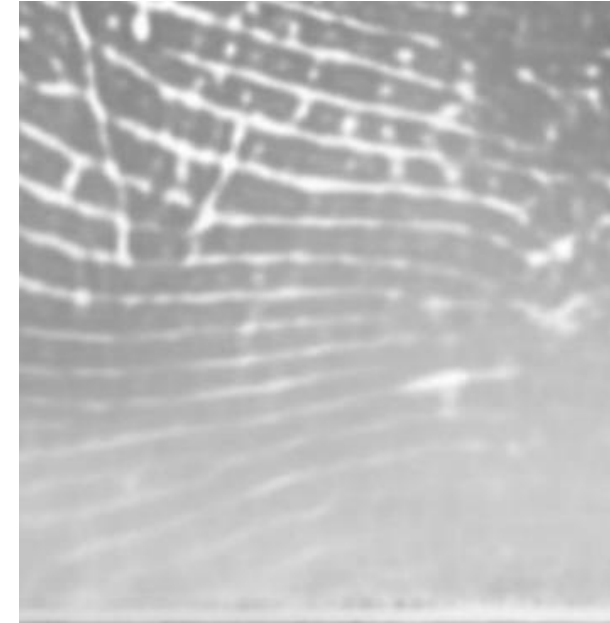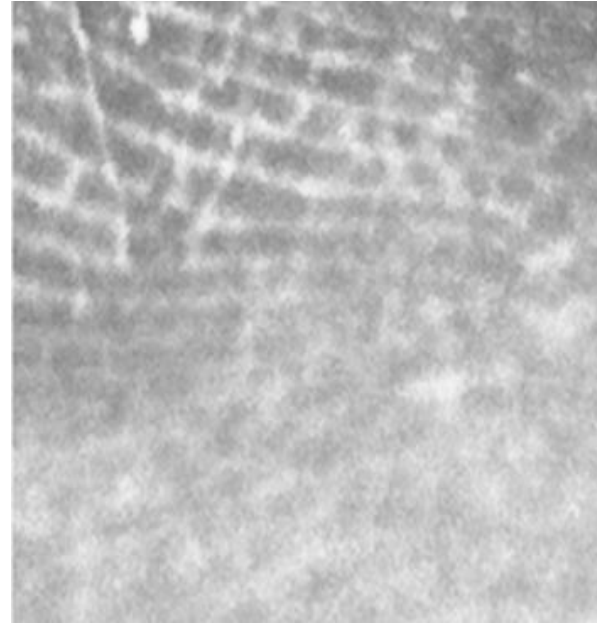Phone: +91-9754435977 | Enrollment Date: 01/21/2020

- **Image capture:** Reader to smartphone over bluetooth

- **Preprocessing:** Image enhancement and aging correction

- **Matching:** Fusion of minutiae, latent, texture matchers
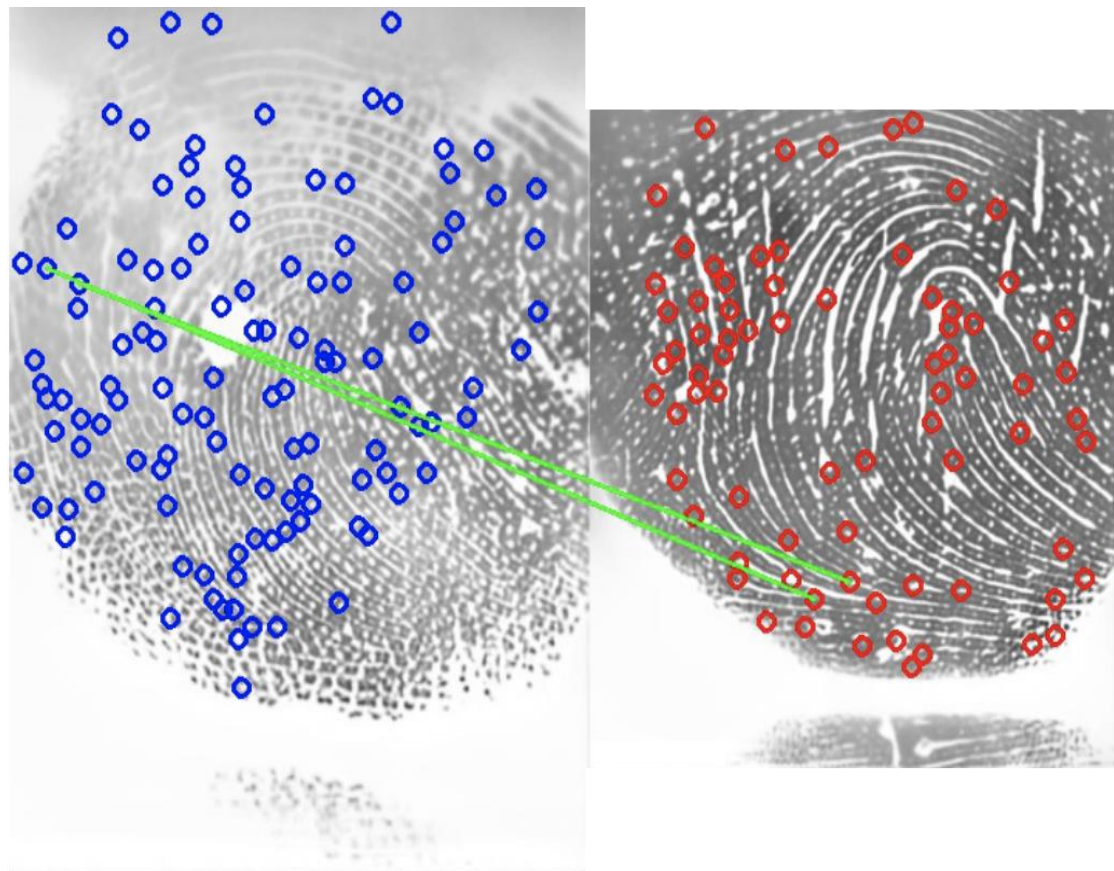
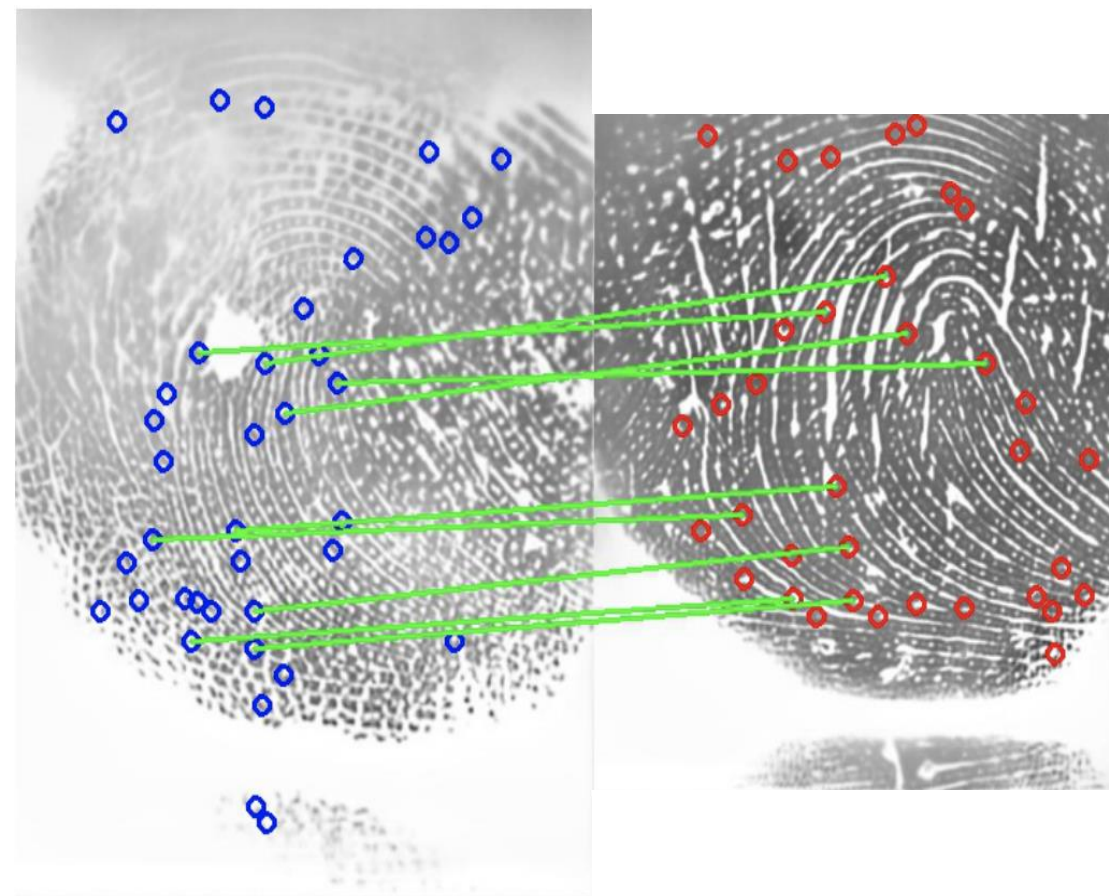# Image Pre-processing

Correction for aging

Enhancement for deblurring

Better ridge structure correspondence and ridge separation

High Resolution Minutiae Extractor

Verifinger Minutiae

Infant-Prints Minutiae

False Non-Match changed to a True Match by high-resolution minutiae extractor
(score improved from 23 to 48; threshold: 32)

Evaluation

Enrollment: 12 weeks   Probe: 64 weeks

True Match 1-year time lapse

Enrollment: 9 weeks   Probe: 61 weeks

False Non-Match, 1-year time lapse

Time Lapse	3 Months	9 Months	12 Months
Infant-Prints	95%	90%	85%

- Reporting TAR @ FAR = 0.1%
- Infants enrolled at 2-3 months of age

Path Forward

- **Infant-ID is a difficult problem, similar to latent/partial fingerprint matching**
- **An archive of (longitudinal) infant fingerprints is needed to facilitate algorithm development & evaluation**
- **Need advances in both sensor design and robust matching method**
- **Training of field staff**
- **Incentivize researchers & vendors**

#AadhaarForMyChild

Biometrics (Fingerprints & Iris Scan) is not captured for a child below 5 years

These are added to the child's Aadhaar via mandatory biometric update after crossing 5 years of age

f @AadhaarOfficial   ▶ @AadhaarUID   🐦 @UIDAI   📷 @Aadhaar_Official

Biometrics are not developed for children before 5 years of age

https://uidai.gov.in/my-aadhaar/about-your-aadhaar/aadhaar-enrolment.html