

# Aadhaar

## Challenges in Enrolment & Authentication

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

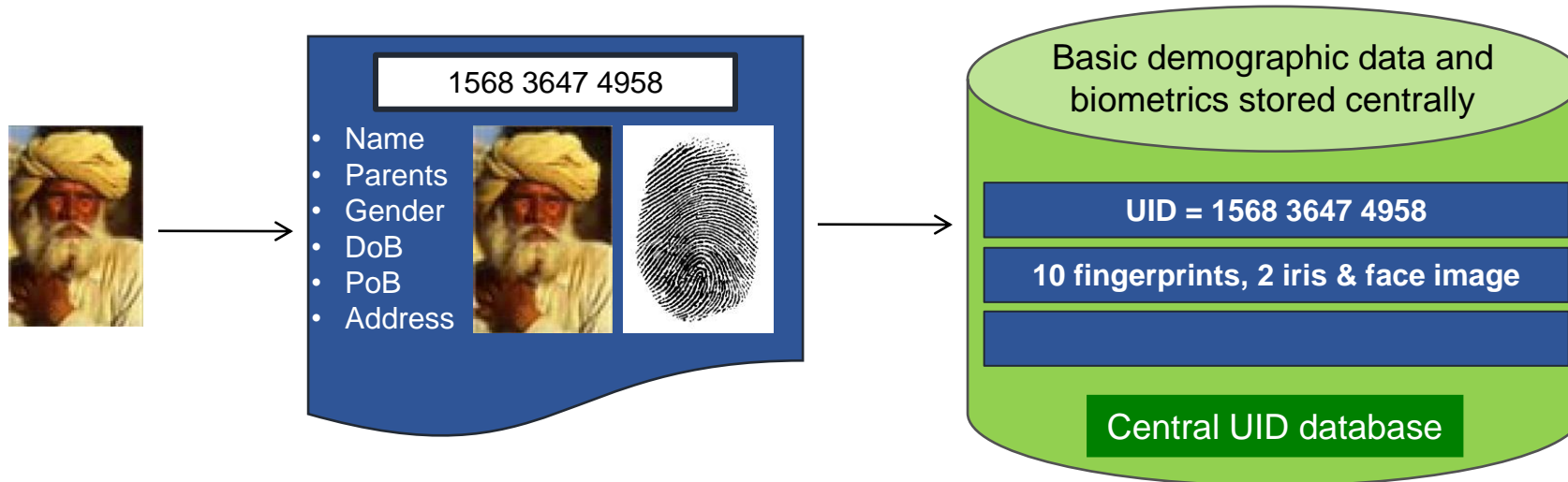
June 26, 2024

# Outline

- Aadhaar and its scale (~1.5 billion gallery)
- Diverse demographics of India
- Enrolment, de-duplication & authentication
- ~80 million authentications/day with different devices
- Challenges & path forward

# Aadhaar: World's Largest Biometrics System

“Issue a 12-digit unique identification number (UID) to Indian residents that can be used to **eliminate duplicate and fake identities.**”

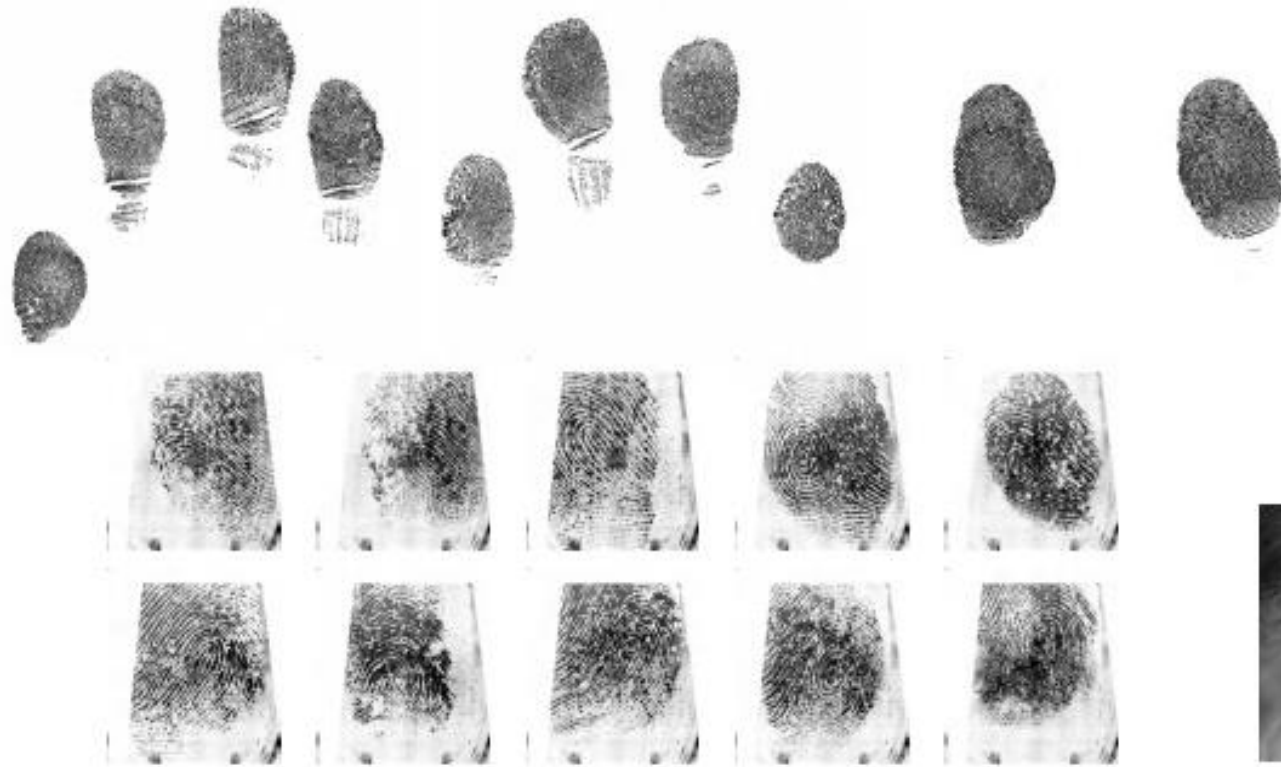


- “Efficient, transparent, and targeted delivery of subsidies”; no one is denied UID
- **Enrollment, de-duplication and authentication** for a population of ~1.4 b

# Enrollment

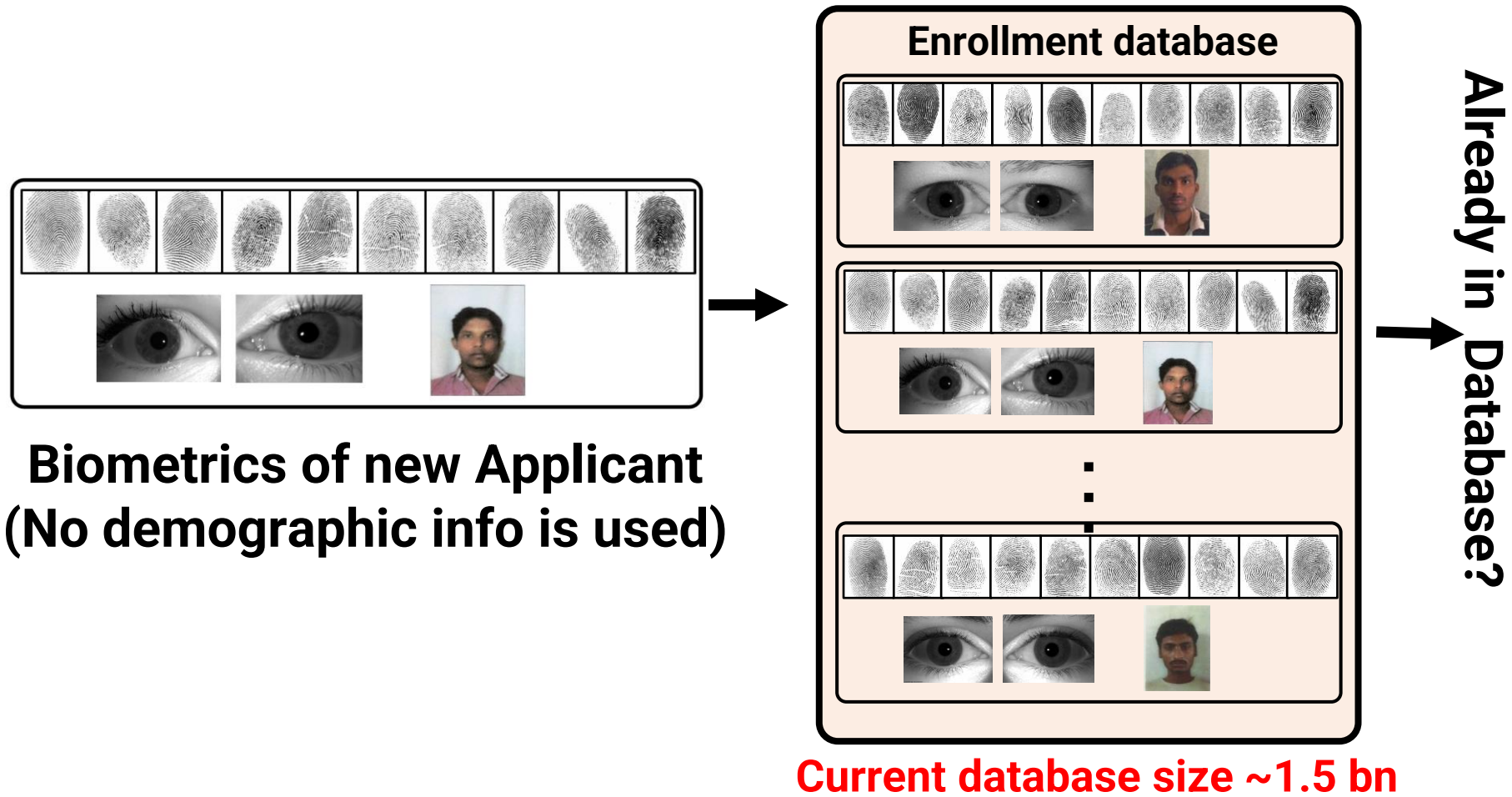


# Enrolled Images

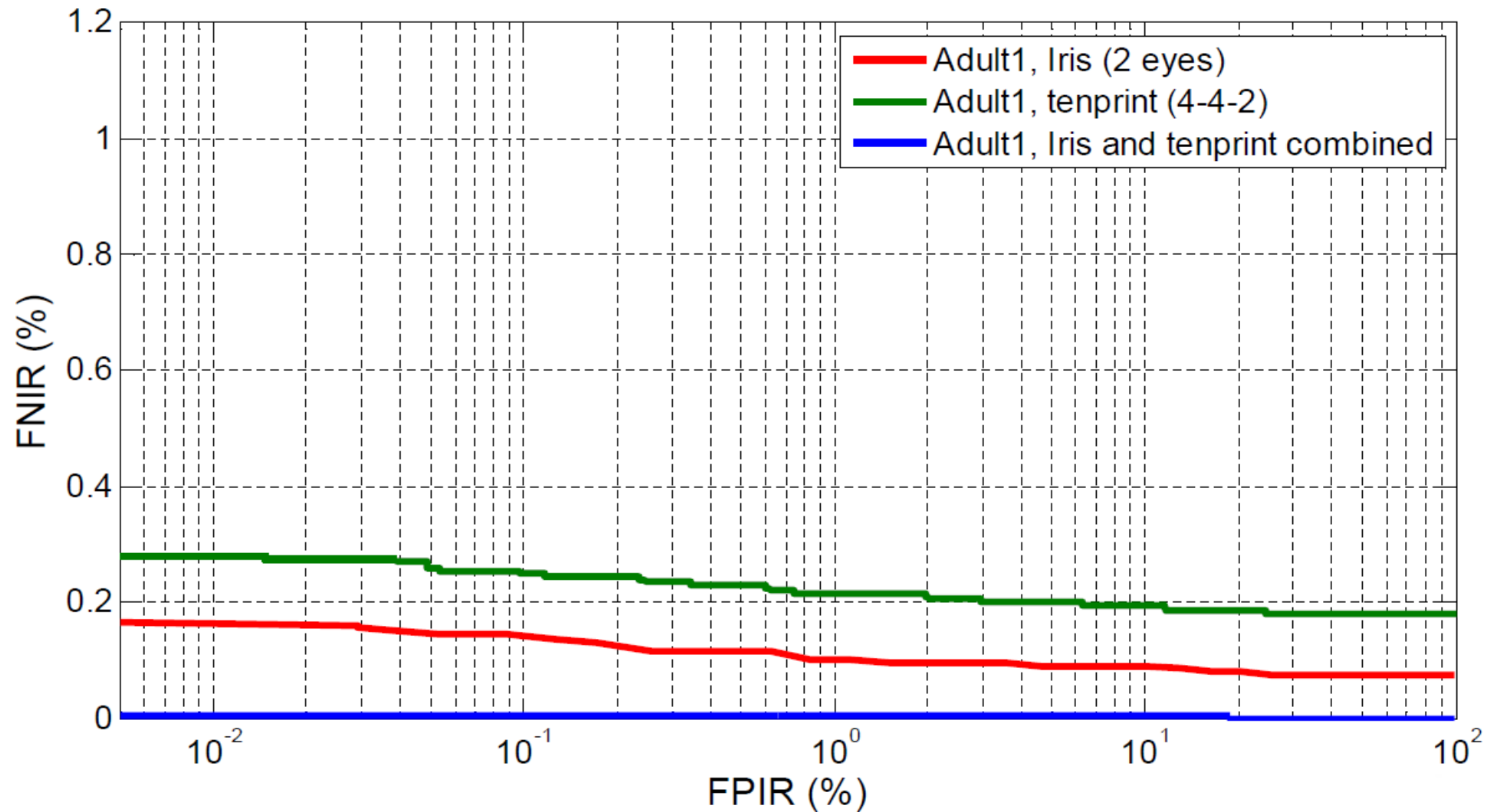


Minimum age of enrollment is 5 years with re-enrollment at age 15; age not verified

# De-duplication



# PoC for De-duplication (2008)



Face recognition was not very accurate at the time

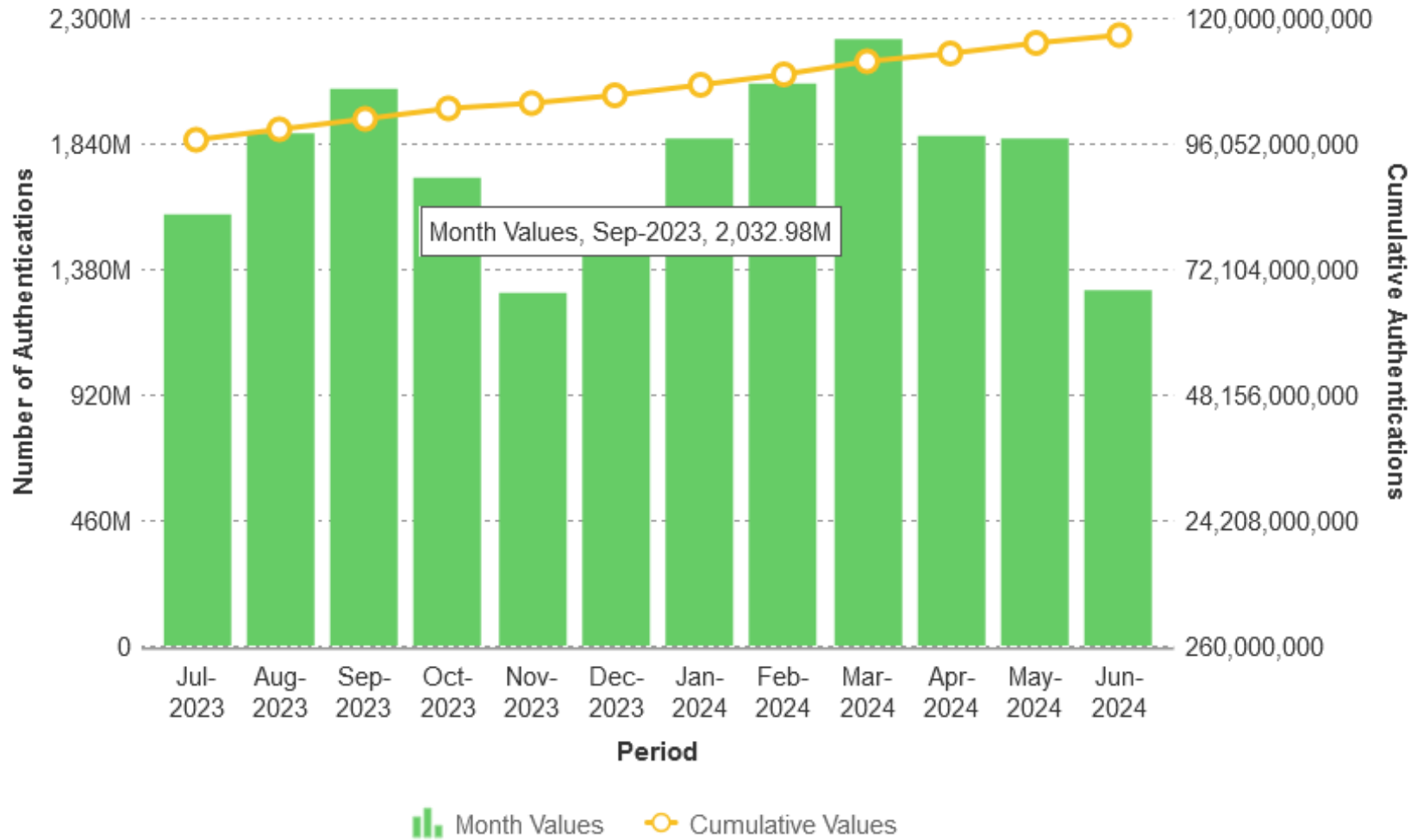
# Authentication



Aadhaar + biometric; currently, fingerprint is the most common biometric



# Authentication Trend

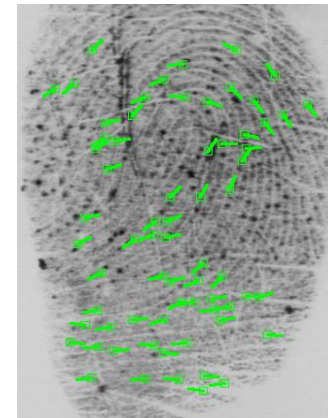


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**Biometrics-enabled authentication is popular**

# Enrollment Challenges

- Extrinsic vs. intrinsic factors affecting image quality
- Substantial majority of the population work in agriculture, service and manufacturing sector
- Aging population (~10% above 65)
- Sensor placement (ergonomics; user interaction)
- Sensor upgrade/replacement
- Spoof detection



# Authentication/De-duplication Challenges

- Different sensors for enrollment and authentication; **cross-sensor matching.**
- DoB is not verified at enrollment; **estimate age from face image at authentication**
- Aadhaar is about “inclusion” so why are children being excluded? ~25 million babies born/year in India. Feasible to **enroll children as early as age 1 with fingerprints.**
- For some individuals, time gap between enrollment and authentication is already 15 years (2009-2014). **How robust are matchers w.r.t. time gap?**
- Biometric template is last updated at 15 but given the life expectancy in India is ~72 yrs, **additional template updates may become necessary.**
- India’ population is supposed to peak at 1.7 billion ~2060. **How will de-duplication work for a gallery exceeding 2 billion?**

# Summary

- Aadhaar is a remarkable civil registration system which has been adopted by masses in India (~17% of world population).
- Aadhaar, so far, has met stringent privacy & security guardrails
- Need to continuously monitor “denial of service”, raise the bar for recognition metrics and latency
- Aadhaar’s BIO-Challenge will give vendors and academic groups to test their algorithms against challenging data with large time lapse, poor quality, and diverse demographics and sensors
- Opportunity to use generative AI for training & test data