Biometric Recognition

By

R.SOWMYA

(06D31A1250)

What is Biometrics?

- Recognizing human based upon one or more intrinsic physical or behavioural traits.
- - Face
  - Voice
  - Fingerprints
  - Iris etc

Requirements

- Universality
- Distinctiveness
- Permanence
- Collectability
- Performance
- Acceptability
- Circumvention

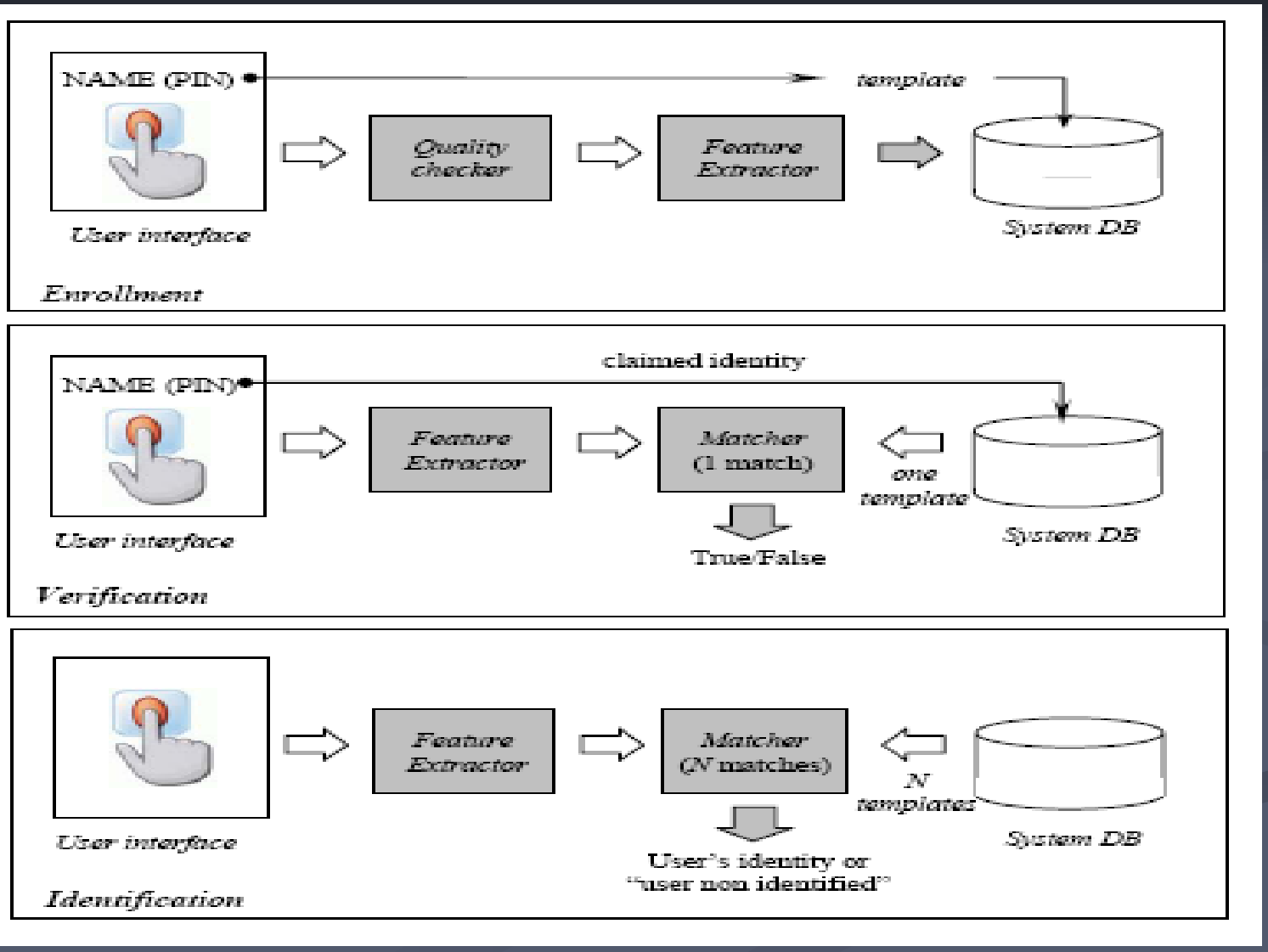
Biometric System

- Acquiring Biometric data
- Extracting Feature set from Acqired data
- Comparing Feature set

Modes of Biometric System

- **Verification mode**
  - **Positive Recognition**
- **Identification mode**
  - **Negative Recognition**

Block diagram of Enrollment,verification and identification



Biometric System is designed using following modules

- Sensor Module
- Feature Extraction Module
- Matcher Module
- System data base Module

Biometric System Errors

- Imperfect imaging condtions
- Changes in the users characteristics
- User's interaction with the sensor

Types of Errors in Biometric verification

- False Match
- False non match
- Null and Alternative Hypothesis:

  H0&H1
- Associated decisions

  D0&D1
- Probability of FMR & FNMR

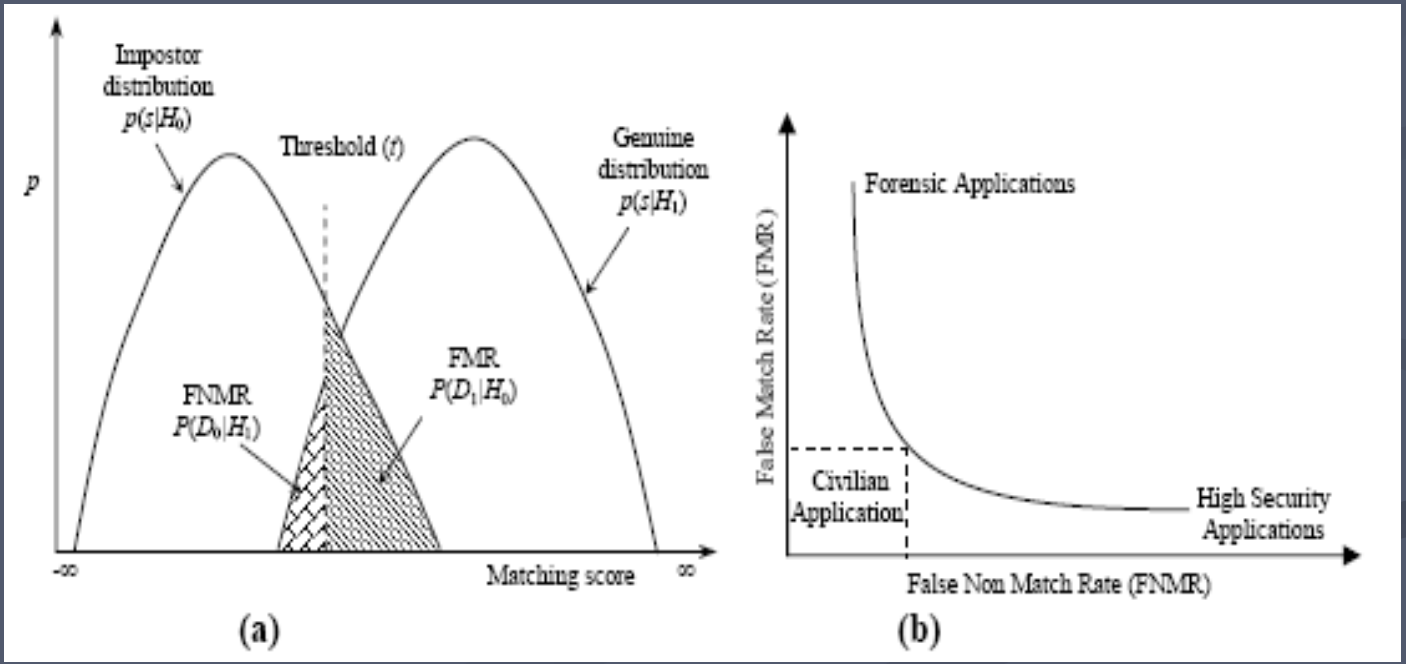
  $FMR = P(D1 | H0)$.

  $FNMR = P(D0 | H1)$.

FMR & FNMR over genuine and impostor distribution

$$\mathrm{FMR} = \int_{t}^{\infty} p\left(S(X_Q, X_I)|H_0\right) dS\,,$$

$$\mathrm{FNMR} = \int_{-\infty}^{t} p\left(S(X_Q, X_I)|H_1\right) dS\,.$$



Comparision of various Biometrics

Biometric identifier	Universality	Distinctiveness	Permanence	Collectability	Performance	Acceptability	Circumvention
Face	H	L	M	H	L	H	H
Fingerprint	M	H	H	M	H	M	M
Gait	M	L	L	H	L	H	M
Hand geometry	M	M	M	H	M	M	M
Hand vein	M	M	M	M	M	M	L
Iris	H	H	H	M	H	L	L
Keystroke	L	L	L	M	L	M	M
Odor	H	H	H	L	L	M	L
Palmprint	M	H	H	M	H	M	M
Retina	H	H	M	L	H	L	L
Signature	L	L	L	H	L	H	H
Voice	M	L	L	M	L	H	H

Applications of Biometrics

- Commercial Applications
- Government Applications
- Forensic Applications

Advantages and Disadvantages of biometrics

- **Positive Recognition in Commercial Application**
- work either in verification or Identification mode

  1)Knowledge based methods (e.g pin & password)

  2)Token based methods(e.g keys and cards)
- **Negative Recognition in Government and Forensic Applications**
- Identification mode
- Employee back ground checking
- Preventing terrorist from boarding airplanes

Limitations of the biometric systems

- Noise in sensed data
- Intra class variations
- Distinctiveness
- Non Universality
- Spoof attacks

a)Effect of noisy images on a biometric system.

b)Intra-class variation associated with an individual's face image

c)example of "failure to enroll" for fingerprints

Multi modal biometric Systems

- Combination of two or more biometric Systems

  (e.g Face & Finger print of a person or multiple fingers of a person)

- **Muti modal Biometric provide following things**
- It address the problem of non-universality
- Anti-Spoofing
- Authentication

Modes of operation

- **Serial mode**

  -one biometric trait
- **Parallel mode**

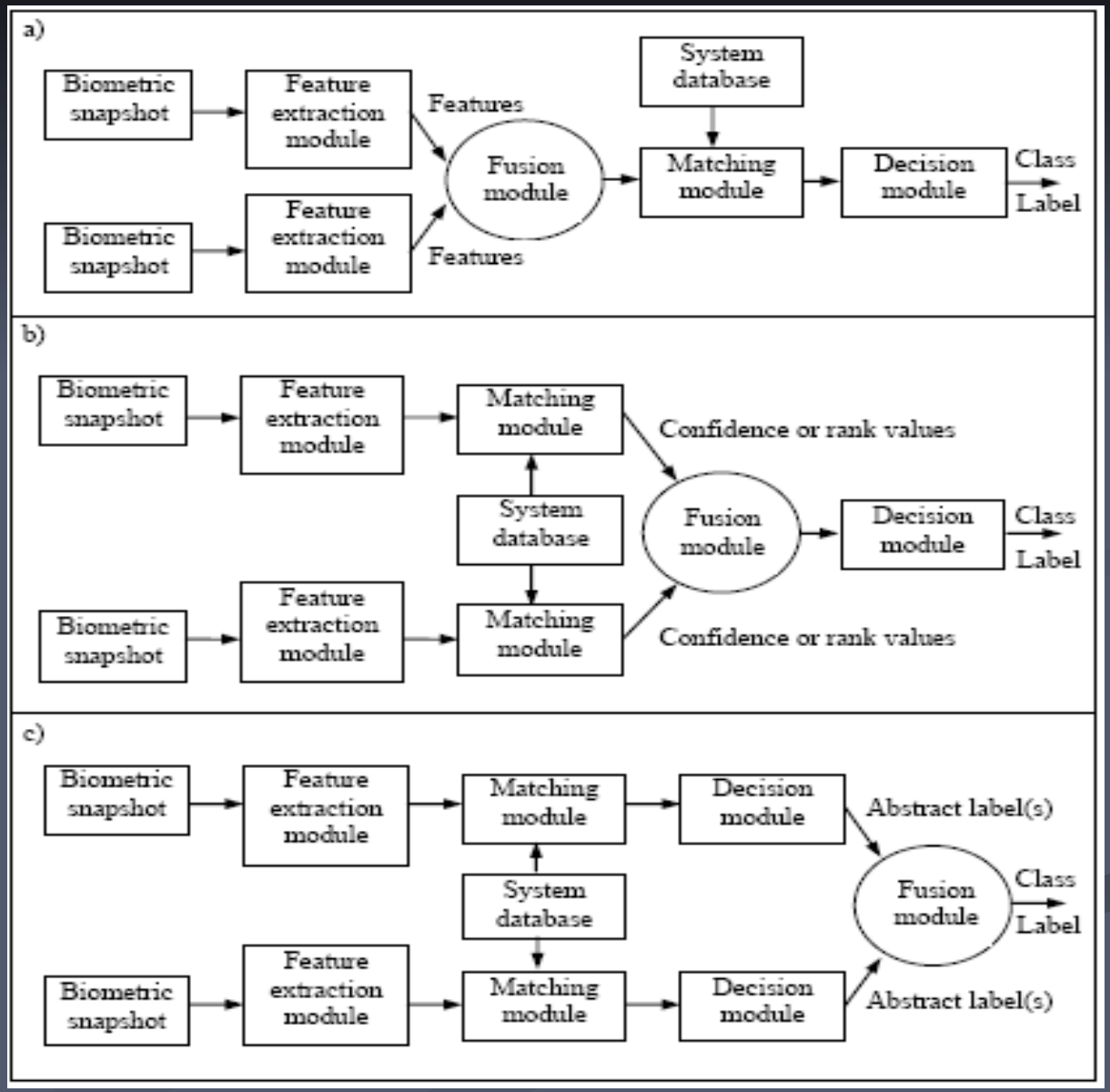
  -Multiple traits
- **Hierarchical (Cascade mode)**

  - various biometric characterstics

  -tree structure

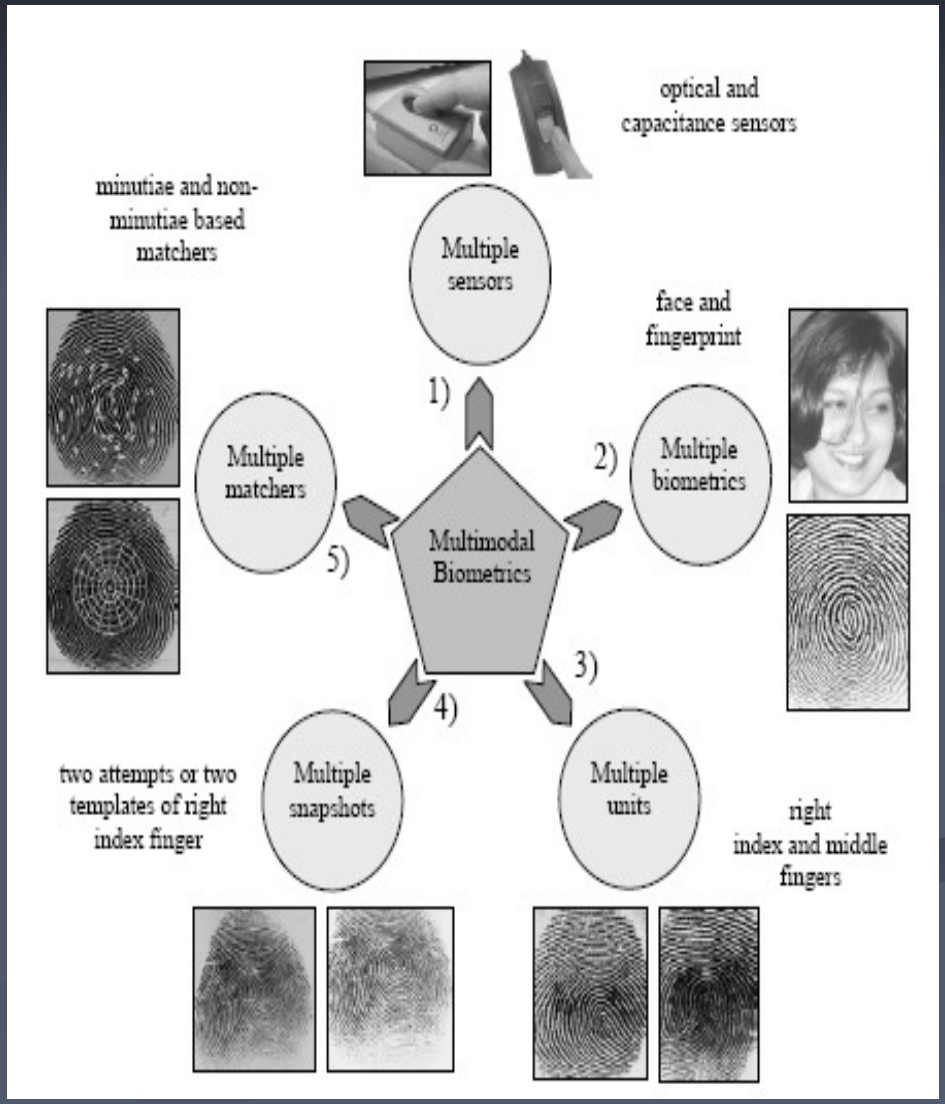
Levels of Fusion

- 1)Fusion at the Feature Extraction Level
- 2)Fusion at the matching Score level
- 3)Fusion at the decision level

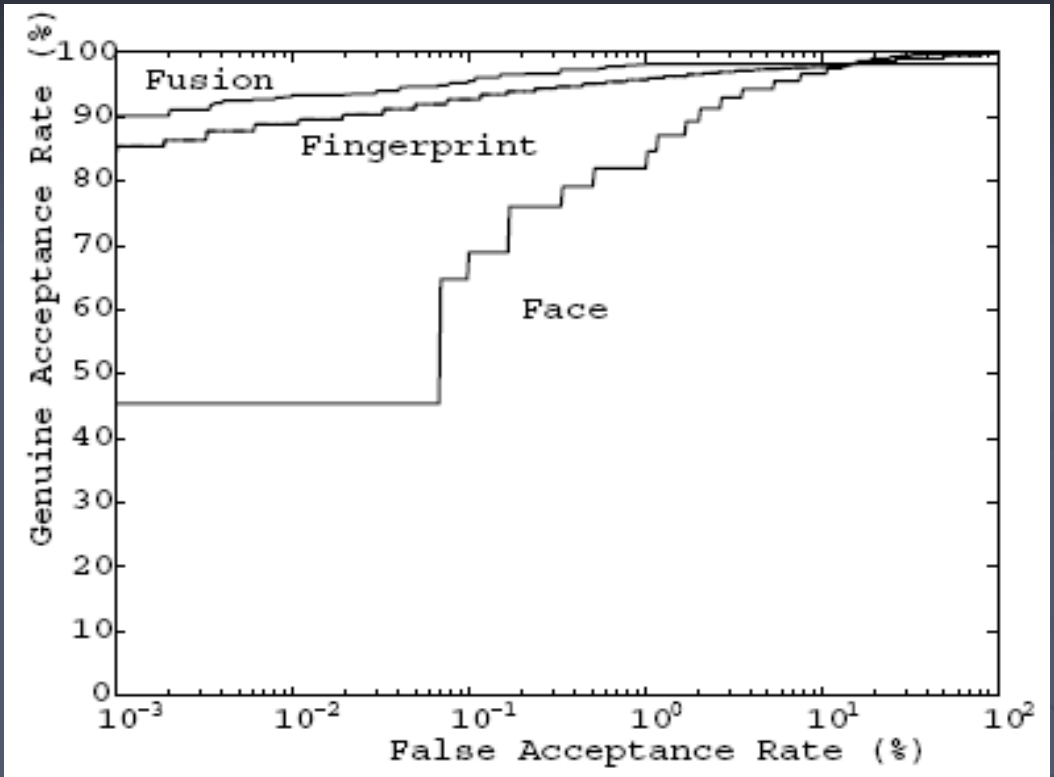


What to Integrate?

1. Multiple sensors
2. Multiple biometrics
3. Multiple units of the same biometrics
4. Multiple snap shots of the same biometrics
5. Mutiple representations and matching algorithms for the same biometric



Example of Multimodal biometric Systems



An improvement in matching accuracy is obtained when face recognition and fingerprint recognition systems are combined in an identification system

Coclusion

- Biometric Recognition is increasing interaction among the market,technology, and the applications. This interaction will be influenced by the added value of the technology, user acceptance, and the credibility of the service provider. It is too early to predict where and how biometric technology would evolve and get embedded in which applications. But it is certain that biometric-based recognition will have a profound influence on the way we conduct our daily business.

Thank you

(?)