Biometrics Introduction

By

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Definition

”Biometric Technologies” are

automated methods

of verifying or recognizing the identity of a **living person** based on

a **physiological**

or **behavioural** characteristic

Definition Explaining

- Automated
  - Different from human identification

- Living person
  - Single persons, no groups
  - Alive not dead (just JOKING)☺

Definition Explaining

- Physiological biometrics
  - Fingerprint, Iris, Face, Hand
- Behavioural biometrics
  - Signature, Gait, Voice

History - 1

- Dates back to ancient Egypt
- Anthropometry (bodily measurements):
  - Adolphe Quetelet (1871), Belgian mathematician
  - Alphonse Bertillon (1880's), French policeman
- Fingerprints and palmprints
  - Used already by Babylonian kings
  - Jan Evangelista Purkinje, Czech studying sweat glands
  - Juan Vucetich, Argentinian policeman, first to take fingerprints in ink
  - Francis Galton, Edward Henry: Galton-Henry system for classification

History - 2

- Fingerprints and facials, 1880’s, Henry Faulds, William Herschel and Francis Galton
- fingerprint recognition on current form, 1960’s
- Hand geometry, 1970’s
- Retinal, signature and face verification, 1980’s
- Iris recognition, 1990’s
- Newer and newer: gait, keystroke dynamics, mouse movement, cardiac sounds, brain waves

Positive / Negative

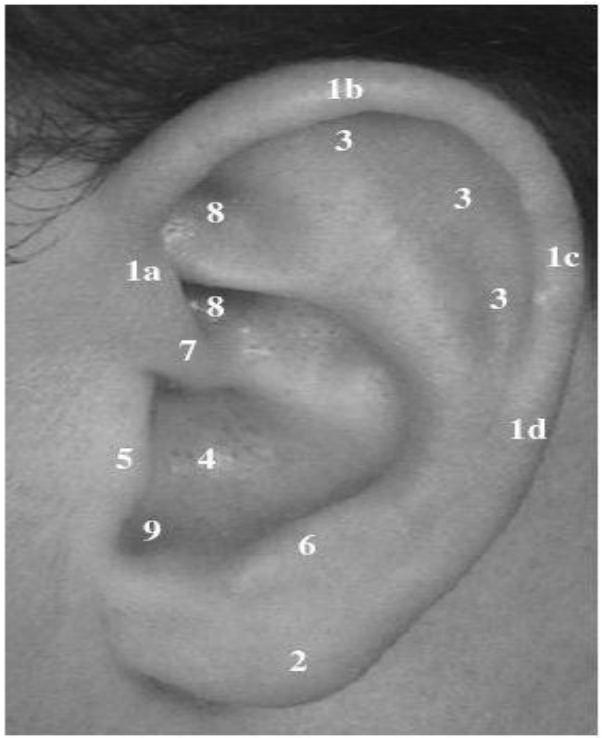
- Positive recognition
  - To prevent multiple people from using the same identity
- Negative recognition
  - To prevent one person from using multiple identities

Physiological / Behavioural

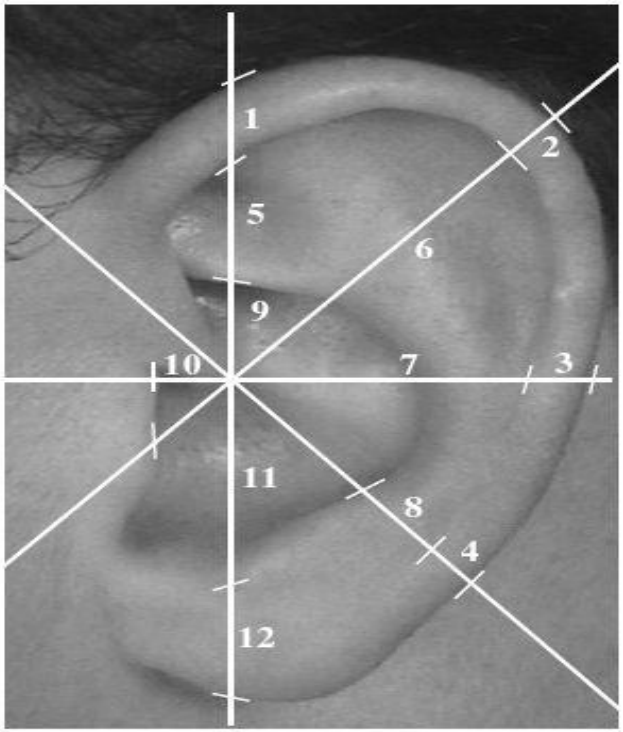
- Physiological:
  - Physical features ”unchangeably” attached to a person
  - E.g. fingerprint, DNA, and face
- Behavioural:
  - Behaviour that is very specific to a person
  - E.g. signature, gait, and voice

Examples - Ear

- Shape of ear can be used for authentication



(a) Anatomy.



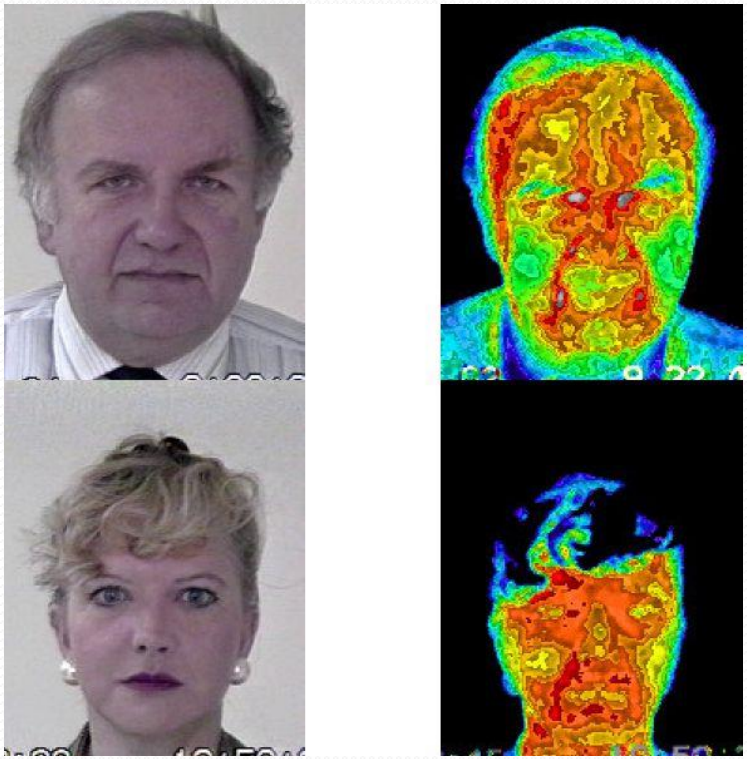
(b) Measurements.

Examples - Face

- Used by humans
- Many different techniques available

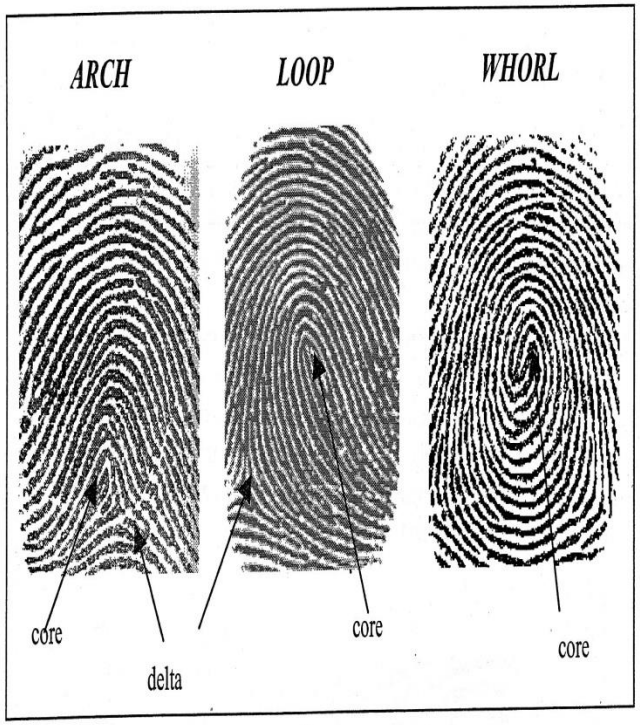
Examples - Thermograms

- Facial, hand, hand vein



Examples - Fingerprint

- Global features

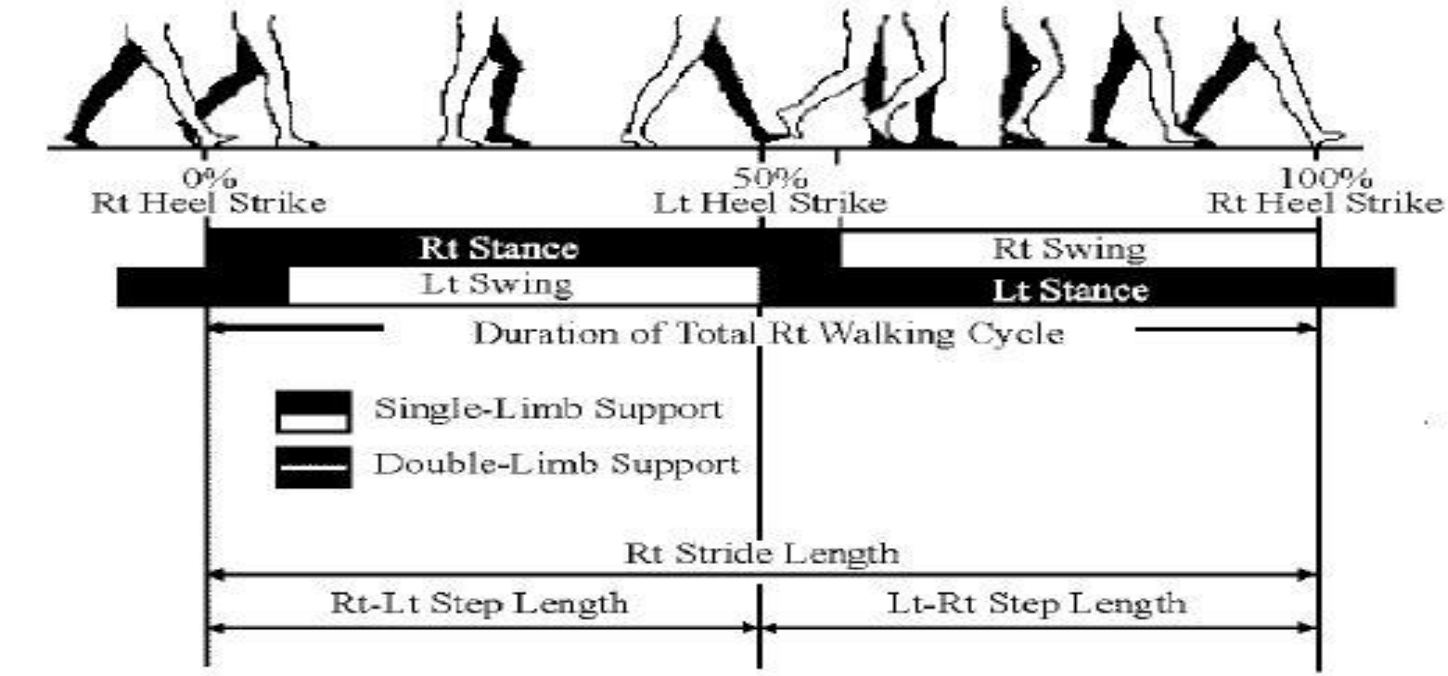


Local features

	Termination
	Bifurcation
	Lake
	Independent ridge
	Point or island
	Spur
	Crossover

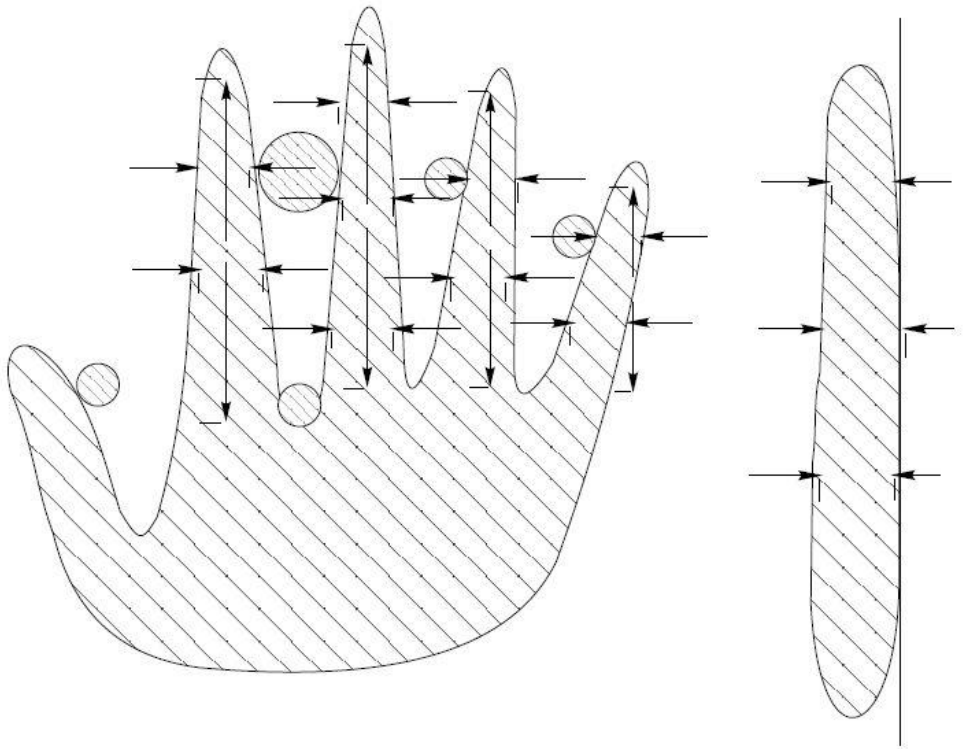
Examples - Gait

- "Great Juno comes; I know her by her gait" from "The Tempest“ by Shakespeare



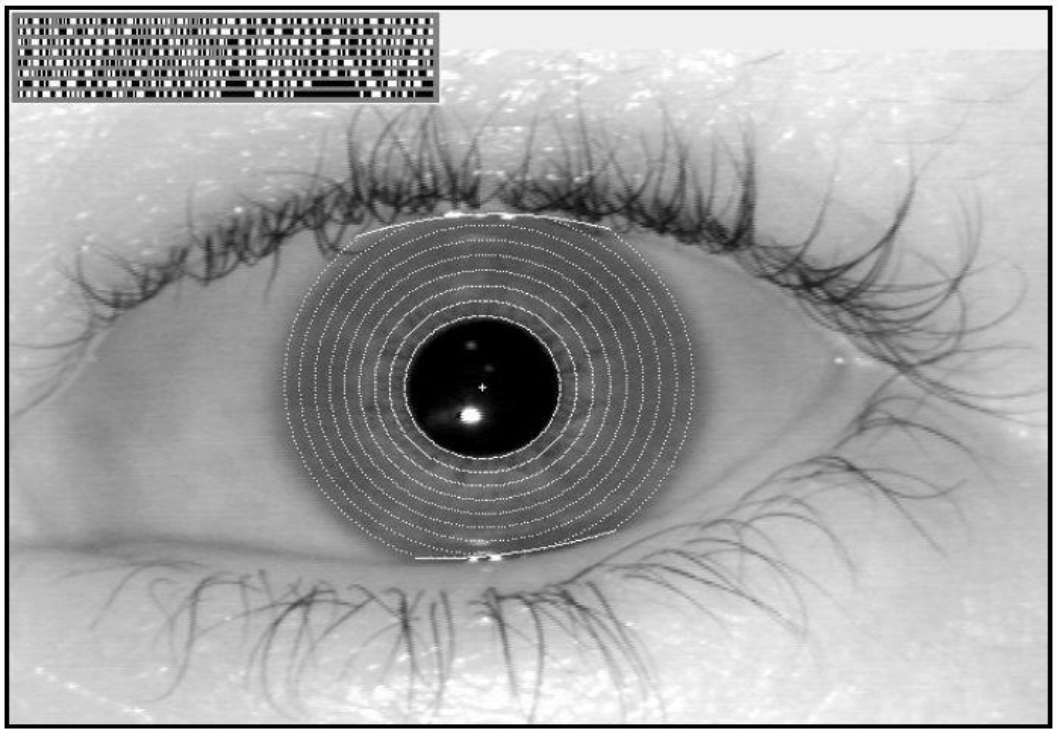
Examples - Geometry

- Hand and finger geometry



Examples - Iris

- Remains unchanged after 2 years
- Iris code.



Examples - Keystroke

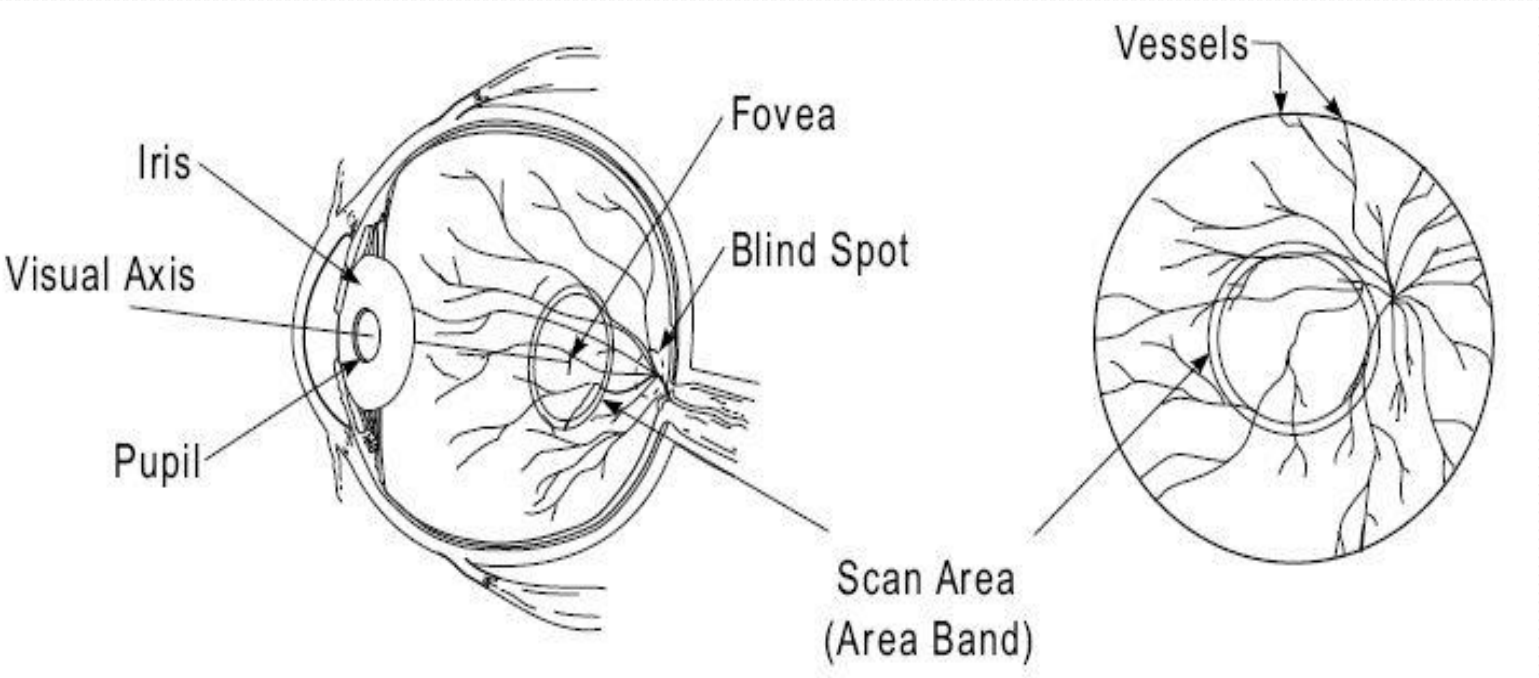
- Typical way of typing
- Combinations of keys
- Speed, force and press-down

Examples - Odor

- Used by humans
- Many problems

Examples – Retinal Scan

- Supposed to be the most secure biometric
- Not user friendly



Characteristics - overview

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

Characteristic - Universality

- Each person should have the characteristic
  - Failure to Enroll Rate (FER)

Distinctiveness

- Different persons should have different biometric properties
  - False Match Rate (FMR)

Characteristic – Permanence

- The characteristic should be sufficiently invariant over a period of time
  - False Non-Match Rate (FNMR)

Characteristic – Collectability

- The biometric property should be easy to collect (electronically) and to quantify

Characteristic – Performance

- This refers to the achievable recognition accuracy and speed
  - False Non Match Rate (FNMR)
  - Failure to Capture Rate (FCR)

Characteristic – Acceptability

- To which extent are people willing to accept the use of a specific biometric

Characteristic – Circumvention

- Reflects how easy it is to fool the system
  - False Match Rate (FMR)