BIOMETRIC IDENTIFICATION USING GLOBAL DISCRETEZATION

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2017-2018

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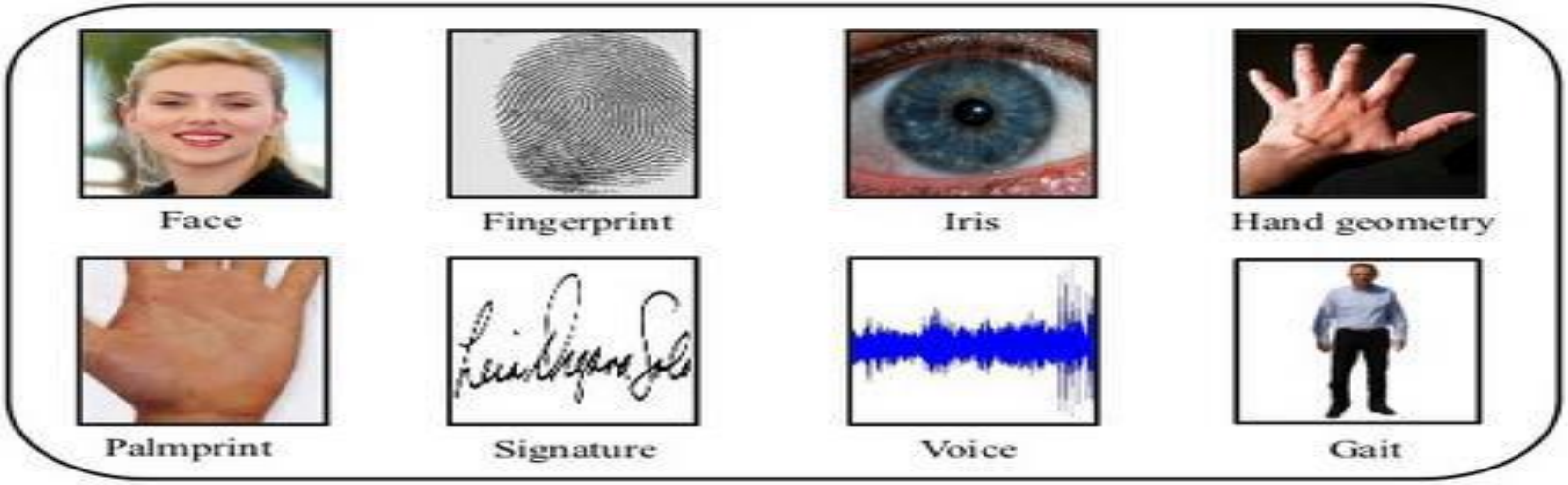
Overview

- Biometric is the measurement and statistical analysis of people's unique physical and behavioral characteristics.



- One of the important biometric is Fingerprint .

Overview

- We touch things every day: a coffee cup, a car door, a computer keyboard. Each time we do, it is likely that we leave behind our unique signature—in our fingerprints.

Fingerprinting facts

- No two fingerprints are identical.
  - @ All of your own fingerprints are different.
  - @ Even identical twins, who share the same DNA, have different fingerprints.

Fingerprinting facts

- Fingerprints are caused by sweat and are detected by the forensic scientist using dyes, chemicals or lasers.
- Fingerprinting is the most widely used forensic technique today.
- Fingerprints can be used to replace passwords, ID cards and other methods for limiting access to buildings, computers etc.

History

- There’s evidence that fingerprints were used on clay tablets during Babylonian business transactions in 500 BC. Fourteenth century Chinese merchants used children’s palms and footprints to distinguish them. And in early Egyptian history, traders were differentiated by their physical characteristics.

Why is it important ?

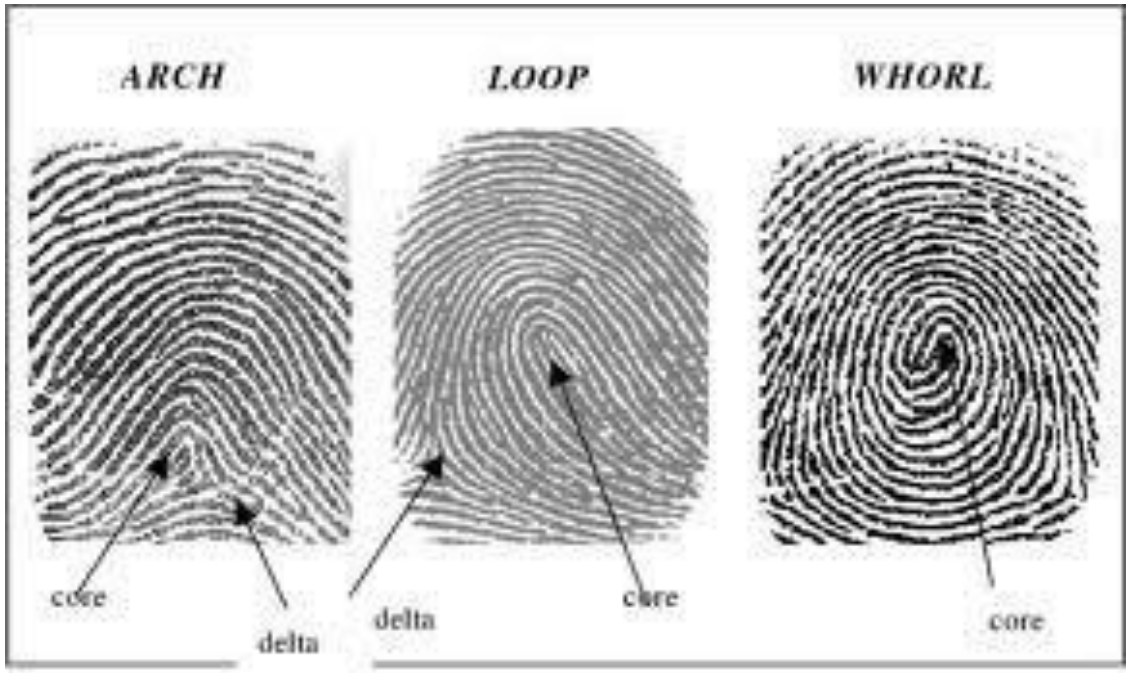
- Most biometric systems will serve one of the two purposes:
- identification or
- verification/authentication.

Why is it important ?

Pattern recognition is so vital for serving many various engineering and scientific fields such as computer vision, biology and artificial intelligence. Fingerprint analysis specifically is considered as an essential branch in pattern recognition field as it plays the most important function in court and forensic document investigations .

Fingerprint Classes

There are 3 specific classes for all fingerprints based upon their visual pattern: arches, loops, and whorls.



Fingerprint Type Classification

Arch

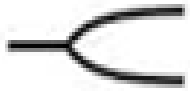
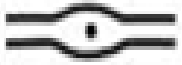
Left Loop

Right Loop

Whorl

undecided

Type of Minutiae

Minutiae	Types
	Bifurcation
	Lake
	Spur
	Crossover
	Dot or island

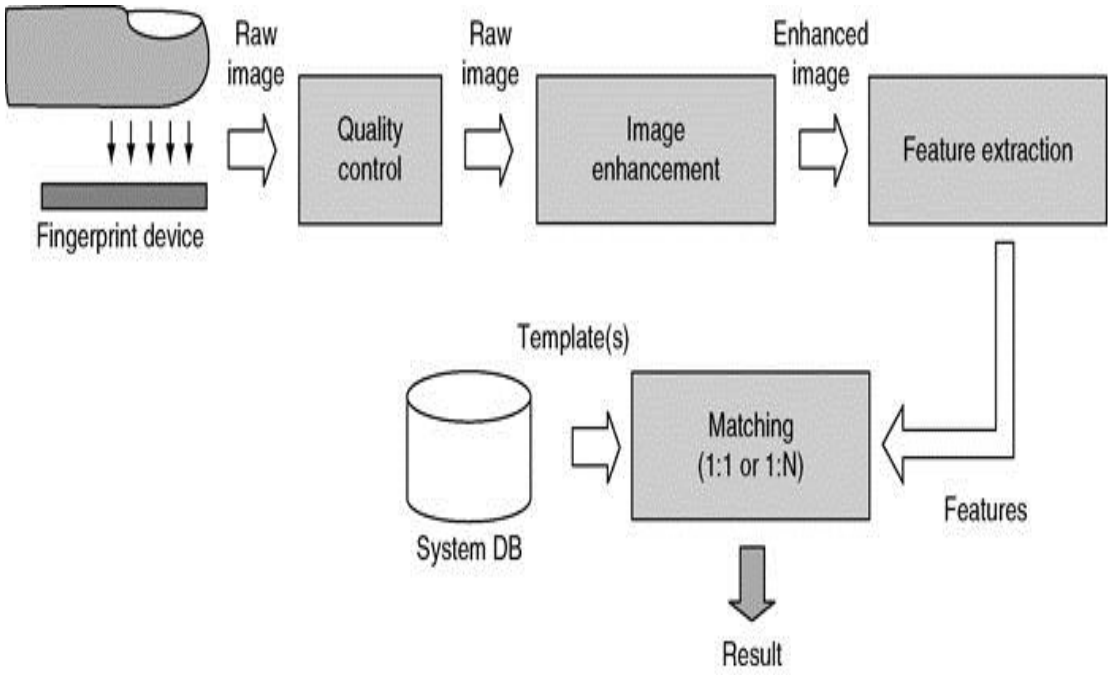
Interesting Info

Fingerprint Factoid:
60% of people have loops, 35% have whorls, and 5% have arches

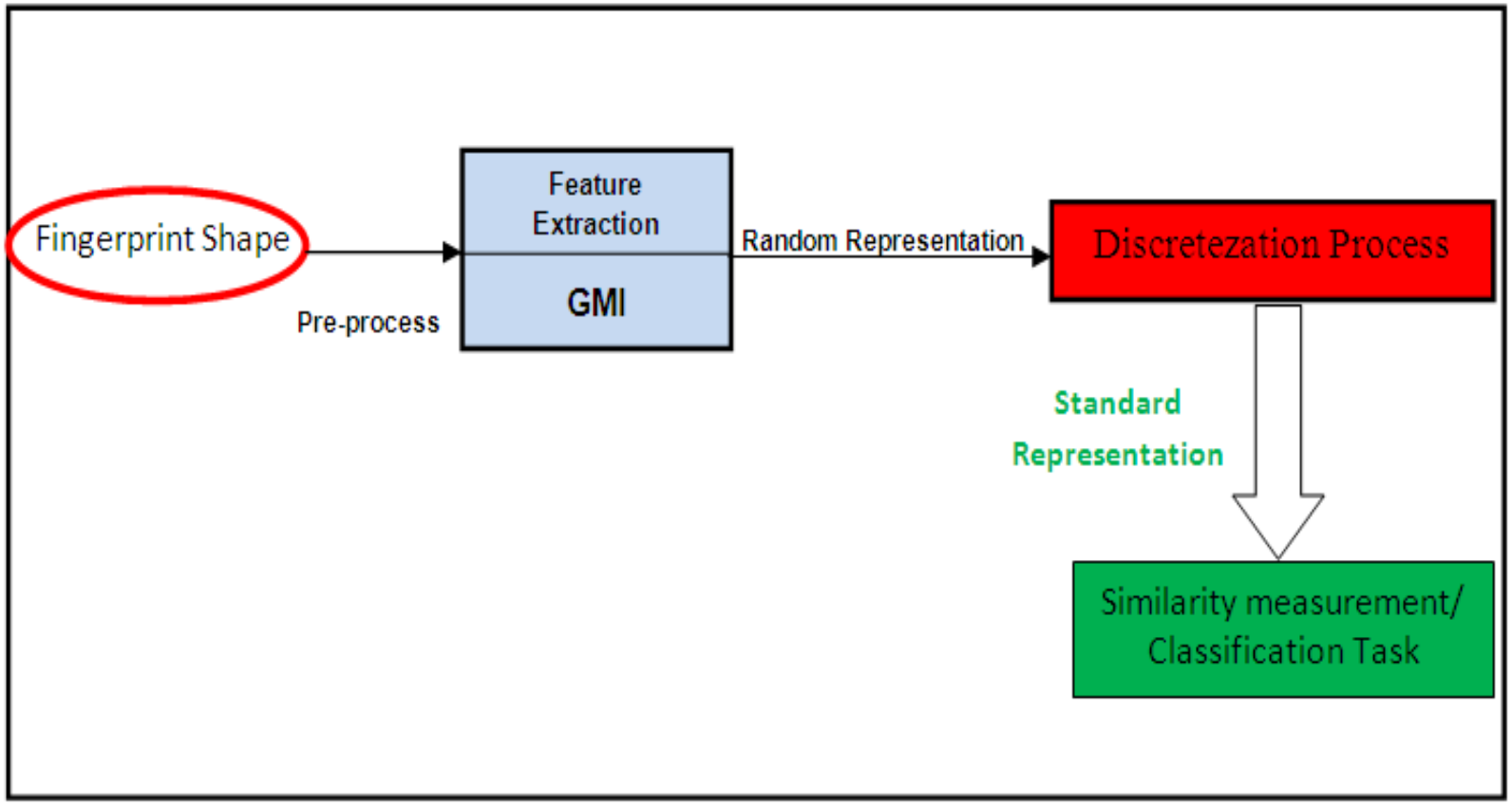
Traditional Framework

- Identification of people must demonstrate reliability and accurately especially in the domains of business transactions and in the access to confidential information. The currently available fingerprint biometric Identification concentrates on feature extraction and task of classification for authorship identification. In fingerprint, the random representation may cause degradation to the performance of classification.

Traditional Framework



New Framework



Global Feature– geometric moments Features

1) An input image data reading from left to right as well as from top to bottom.

2) The image data thresholding for the area extraction of the target process.

- Calculation of geometric moments, to in terms of translation, scale as well as in terms of rotation (geometric moment invariants) invariants using the following formulas:

Global Feature– Geometric moments Features

$$\Phi 1 = \mu_{20} + \mu_{02} \quad (5)$$

$$\Phi 2 = (\mu_{20} - \mu_{02})^2 + 4\mu^2 11 \quad (6)$$

$$\Phi 3 = (\mu_{30} - \mu_{12})^2 + (3\mu_{21} - \mu_{03})^2 \quad (7)$$

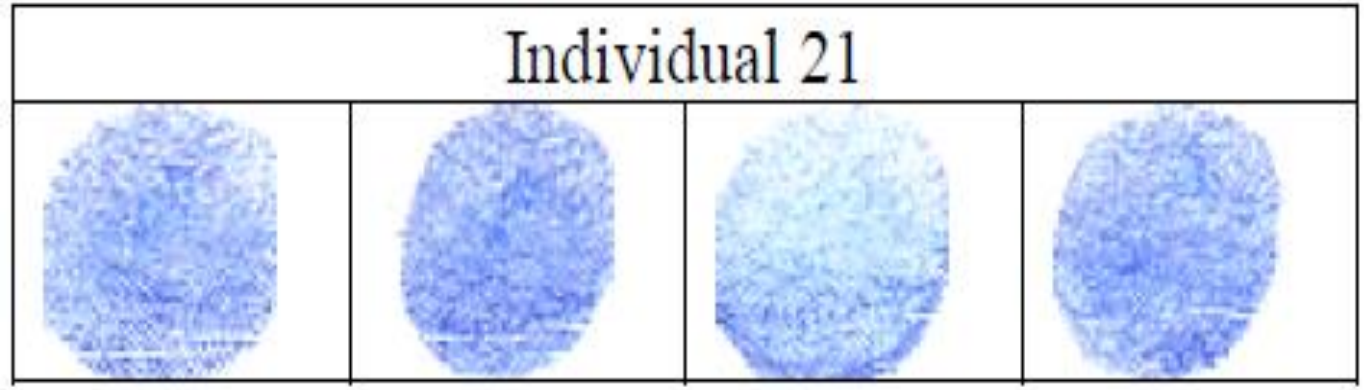
$$\Phi 4 = (\mu_{30} - \mu_{12})^2 + (\mu_{21} - \mu_{03})^2 \quad (8)$$

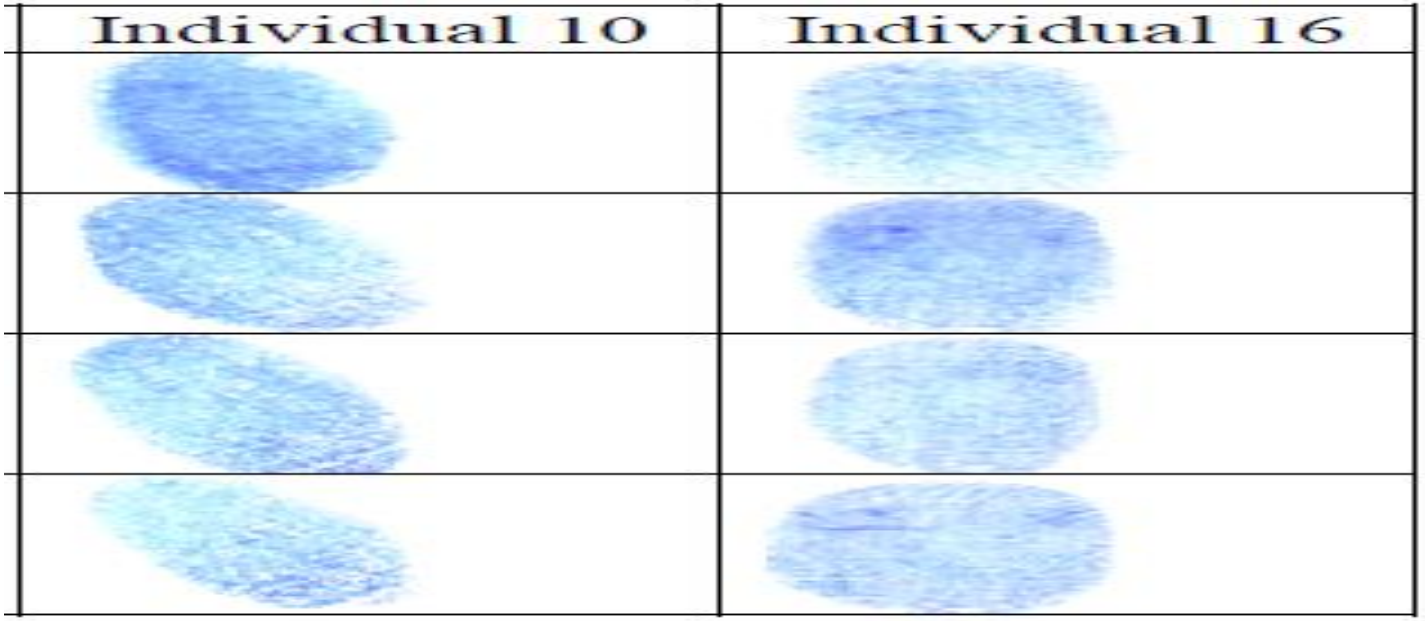
$$\Phi 5 = (\mu_{30} - 3\mu_{12})(\mu_{30} + \mu_{12})[(\mu_{30} + \mu_{12})^2 - 3(\mu_{21} + \mu_{03})^2] + (3\mu_{21} - \mu_{03})(\mu_{21} + \mu_{03})[3(\mu_{30} + \mu_{12})^2 - (\mu_{21} + \mu_{03})^2] \quad (9)$$

$$\Phi 6 = (\mu_{20} - \mu_{02})[\mu_{30} + \mu_{12})^2 - (\mu_{21} + \mu_{03})^2] + 4\mu_{11}(\mu_{30} + \mu_{12})(\mu_{21} + \mu_{03}) \quad (10)$$

$$\Phi 7 = (3\mu_{21} - \mu_{03}(\mu_{30} + \mu_{12})[(\mu_{30} + \mu_{12})^2 - 3(\mu_{21} + \mu_{03})^2] - (\mu_{30} - 3\mu_{12})(\mu_{21} + \mu_{03})[3(\mu_{30} + \mu_{12})^2 - (\mu_{21} + \mu_{03})^2 \quad (11)$$

Fingerprint Samples





PRE-DISCRETIZED FEATURES

individual 5

27.5520	714.5021	7.9366	6.9630	4.8536	1.8432	1.3480
22.7320	496.7869	5.1393	4.1807	1.7496	9.1894	6.2457
22.7320	543.9102	5.2581	4.6568	2.1702	1.0798	5.8233
16.4341	198.5976	1.8995	1.4030	1.7496	1.9120	6.2457

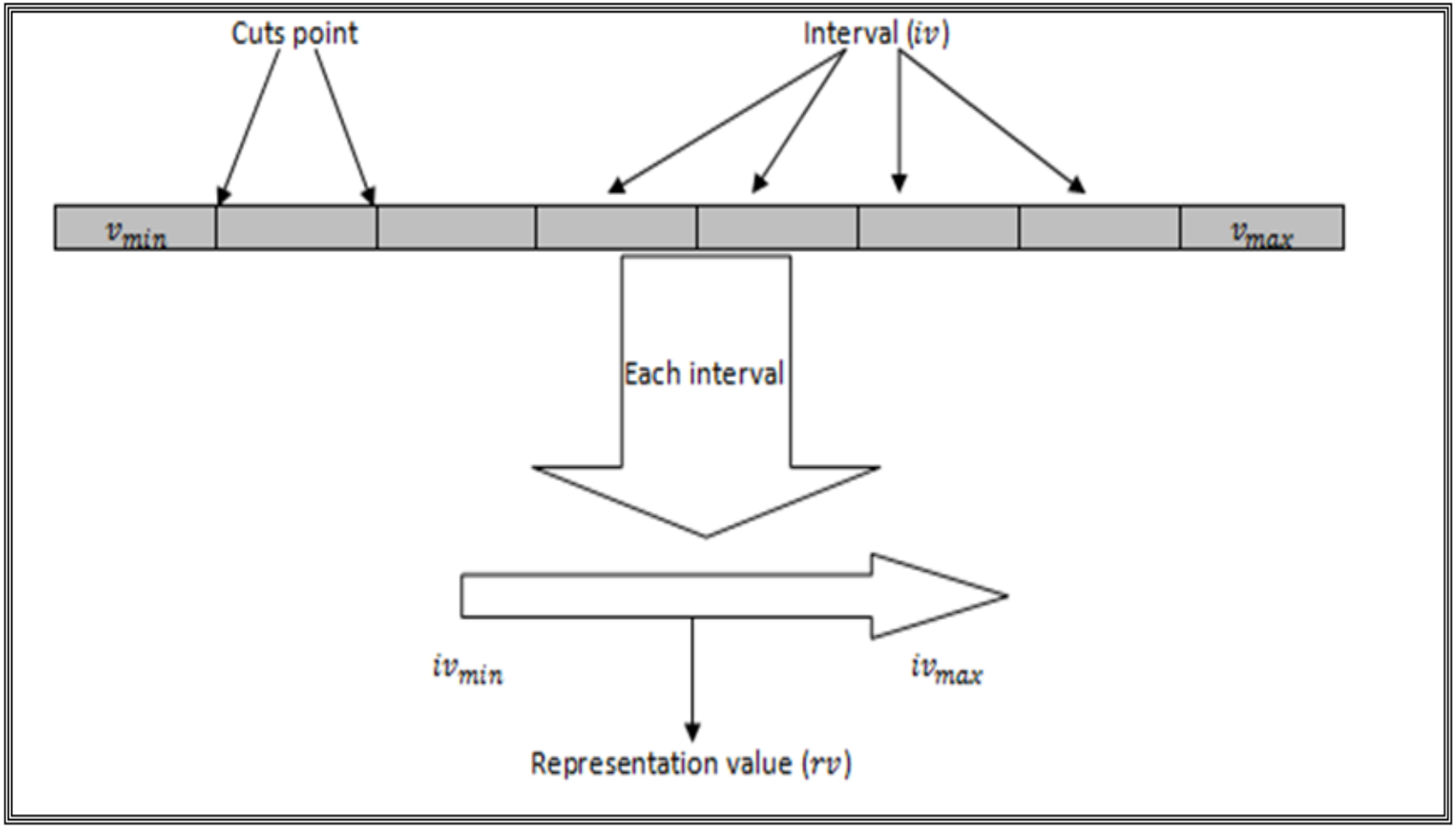
Discretization Phase

The process of Discretization first focuses on the conversion of the continuous characteristics value into discrete value. The value is then divided into categories with suitable intervals. The discretization serves as a way to better present the data of the continuous characteristics. The process of classification depends highly on the result of the discretization process.

Geometric Moments Feature-based Discretization (GMFD)

The GMFD method used on the Fingerprint for individual identification is based on the Invariant Discretization (ID) method . Invariant Discretization (ID) is a supervised algorithm because knowledge of the character image is given to represents each individual . In ID process, the procedure will first create set of appropriate cuts to represent information for each individual . The number of cut equals to the number of feature vectors in each row. From each cut, ID will then divide the range values (in a row) with the size of the cuts using minimum and maximum value of the specific individual . Therefore, each cut will have upper and lower estimation and representation value that represents each feature vector of each character image.

Discretization Phase



POST-DISCRETIZED FEATURES

52.0385	663.5434	52.0385	52.0385	52.0385	52.0385	52.0385
52.0385	459.7084	52.0385	52.0385	52.0385	52.0385	52.0385
52.0385	561.6259	52.0385	52.0385	52.0385	52.0385	52.0385
52.0385	153.9560	52.0385	52.0385	52.0385	52.0385	52.0385

Identification Phase

For identification task, the discretized and Un-discretized datasets will be experimented using ANN classifier, Rough set Theory.

Performance Measurement with Rough set Theory

Technique	Accuracy (%) 60% Training Data 40% Testing Data	Accuracy (%) 70% Training Data 30% Testing Data	Datasets
Holte 1R algorithm	20.12	33.4	Un-Dis
	90.8	92.6	Dis
Genetic algorithm	21.81	30.7	Un-Dis
	92.98	93.4	Dis
Exhaustive algorithm	13.6	11.5	Un-Dis
	93.6	95.3	Dis

Performance Measurement
with ANN

Technique	Accuracy (%) 60% Training Data 40% Testing Data	Accuracy (%) 70% Training Data 30% Testing Data	Datasets
ANN	48.7654	50.4305	Un-Dis
	89.5432	94.6578	Dis

Journal of Theoretical and Applied Information Technology
31st July 2017. Vol.95. No 14

ISSN: 1992-8645 www.jatit.org E-ISSN: 1817-3195

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ABSTRACT

Biometrics is the science and technology that involves the measurement and analysis of the human body's biological data. Biometrics involves the extraction a feature set from the obtained data. The feature set is then compared against the template set stored the database. Identification of people must demonstrate reliability and accurately especially in the domains of business transactions and in the access to confidential information. The currently available fingerprint biometric Identification concentrates on feature extraction and task of classification for authorship identification. In fingerprint, the random representation may cause degradation to the performance of classification. Thus, prior to the classification task, certain standards should be present to denote these unique features. In relation to this, the application of the discretization technique would be beneficial. Hence, a new framework for fingerprint biometric identification is proposed. This paper particularly shows the outcome of discretization process on fingerprint samples to attain individual identification. In this paper, the new proposed framework and classic framework were compared using samples. Based on the results, classification accuracies of 90% were obtained when using discretization process with fingerprint biometric identification.

Thank you for your attention