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Hand Geometry

Close Set

. Identification System

matching metric

Euclidean Distance

Absolute Distance

D1 Distance

.%

Absolute Distance

MATLAB 7.9.0(2009b)

### Abstract

We propose a Identification System Based on Human Hand Geometry Features, we extract 50 features to use it in recognition process. By constructing the principle of *Close Set Identification System*, the system database has been built using modified digital scanner. The system were tested on database contain 500 images referred to 50 persons, 10 images for each person.

The evaluation of the system performance was calculated by using three matching metrics that are Absolute Distance, Euclidean Distance, D1 Distance and get on the highest recognition rate using Absolute Distance more than 97%.

MATLAB 7.9.0(2009b) programming language has been used to execute the paper algorithms, because its facilities in processing digital images.

Biometrics

. Physiological

Behavioral

. [ ]

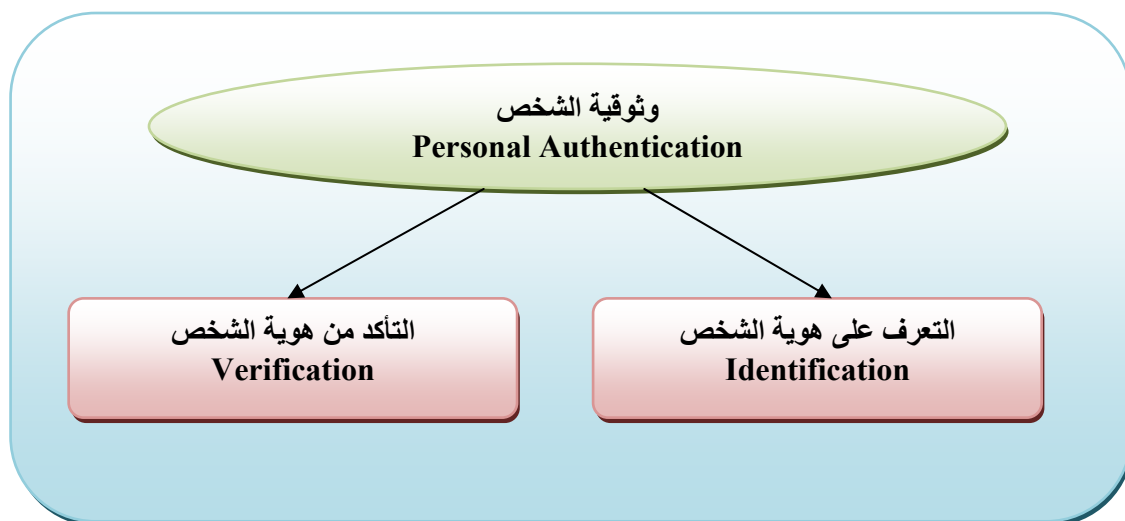
## Authentication Methods

Authentication

. [17]

Personal Authentication

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## Identification Problem

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(one\_to\_many)

: Closed Set Identification \_\_\_\_\_

: Open Set Identification \_\_\_\_\_

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## Verification Problem

Claimed Identity )

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one\_to\_one)

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## Hand Geometry of Hunan Hand

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Fingernail bed                  Palm print                  Fingerprint  
 . Hand geometry                  Vein pattern  
 Hand geometry

[ ]

[ ] [ ]

## Advantages Of Hand

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## Geometry

Hand geometry

: Personal Authentication

- [ ] :Ease Of Use •
- [ ] : Resistant to spoofing •
- [ ] : Small template size •
- [ ] High Ability Of Readers •
- [ ] Reliability of Technique •

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- [ ]
- [ ] Low Resolution Images Non-Intrusive
- [ ] Fast results
- [ ]

## Disadvantages Of Hand Geometry Technique

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- [ ] [ ]
- :

peg- ( ) [ ] Jain, based

( ) [ ] Sanchez-Reillo  
 Gaussian mixture model (GMM)

morphological analysis

. Feature Vector

feature-based ( ) [ ] Wong and Shi

-hierarchical- framework for hand geometry recognition

Finger Lengths

Finger Widths

Fingertips

Interfinger Baselines

( )

Gaussian mixture model

Euclidean distance

preprocessing

( ) [ ] Zanu

(filtering, Binarization and contour detection)

Features

( )

Zanu

Multilayer Perceptron Networks

( ) [ ] Sharma

projected light patterns

( depth map of the palm )

projected texture pattern

## Hand Geometry

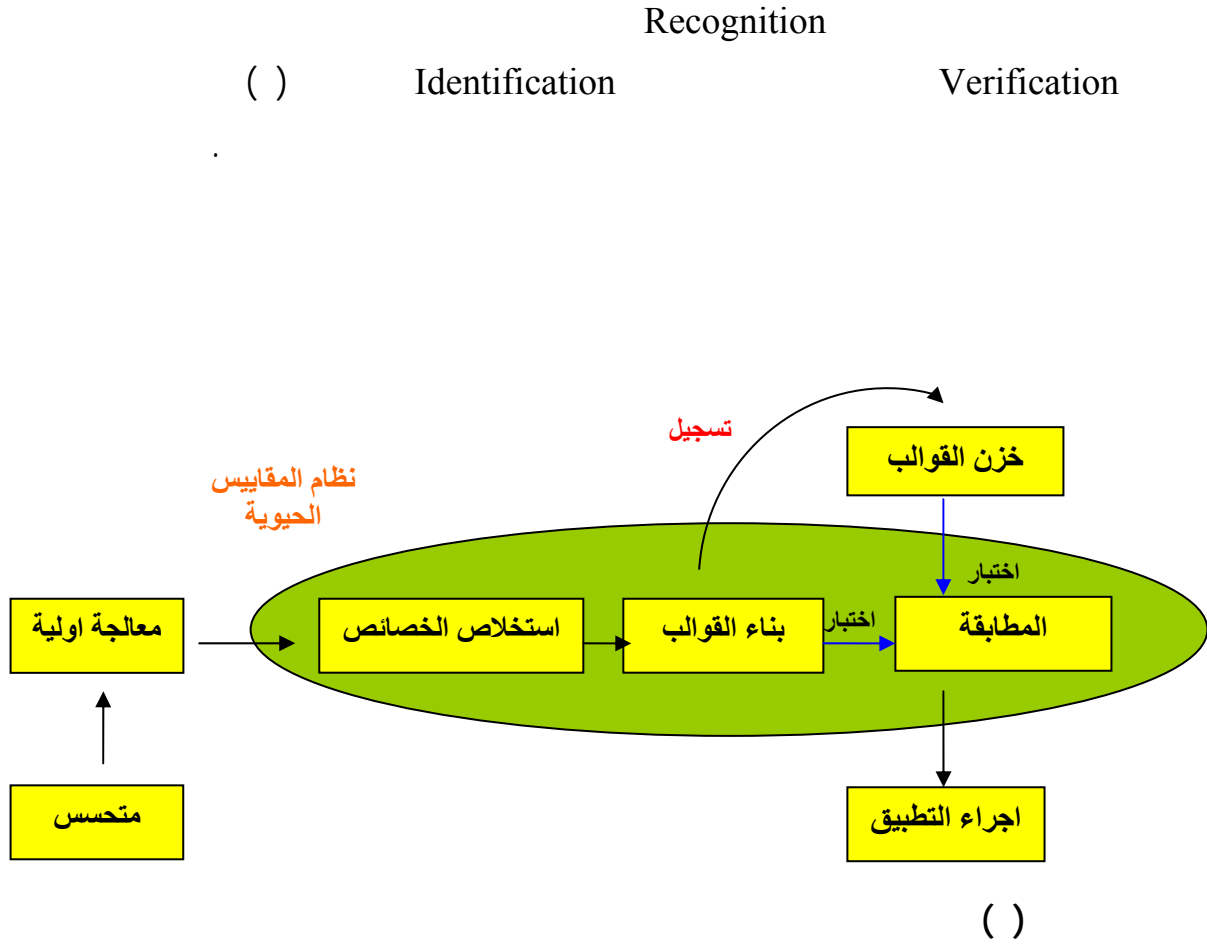
## Recognition System

Image Acquisition

Features Extraction

preprocessing

Features and characteristics



Data

Collection

System Database

flatbed desktop document scanner

)  
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reduce noise and shadow  
 right hand

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)

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Peg-free

colored image

jpg

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## Preprocessing

: Preprocessing

colored image

• grayscale image

grayscale image

• Binary image

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Enhancement Filters

Average

.UnSharp

Disk

• Canny Edge Detection



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## Feature Extraction

preprocessing

Boundary of Hand Shape

Chain Code Algorithm

landmarks

landmarks

( )



( )

landmarks

: ( )

Landmarks=(lm1,lm2,lm3,.....,lm9)

Finger Tip

Finger Valley

## Finger Base Lines - -

Finger Base Lines

start curve finger point

end curve finger point

thumb baseline , index baseline , ) : Finger Base Lines

middle baseline , ring baseline , little baseline )

## Finger Lengths - -

finger length

middle point of base

finger tip

(L1,L2,L3,L4,L5)

line

## Finger Widths - -

finger tip

base lines

$$FW=(W1.1,W1.2,W1.3,W2.1,W2.2,W2.3,.....W5.1,W5.2,W5.3)$$

## Palm Width

- -

palm shape

Palm Width=(PW1,PW2)

first

width of palm

second width of palm

## Palm Length

- -

palm width

middle

palm length

middle point of second

finger tip point

palm width=(pl) palm width

## Finger Top Regions

- -

finger top region

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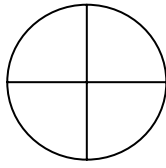
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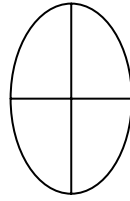
=

max\_radias\_of\_finger  
 min\_radias\_of\_finger

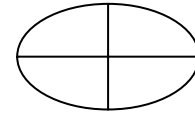
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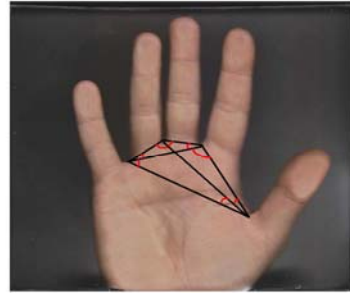
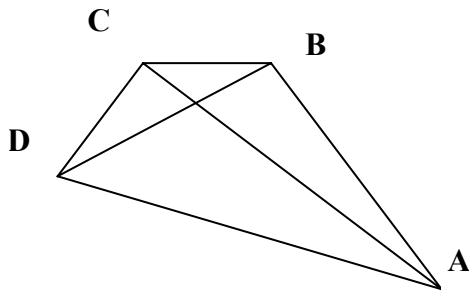
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**Line Segments and Angle Values**

Angle Values      Line Segments      Landmarks

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### Line Segments

- -

( ) (DB BA CA DA)

landmarks

### Angles between Line

- -

### Segments

CAD BAC)

(DBA CBD ACB DCA CDB BDA

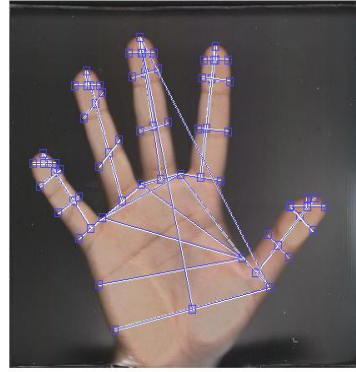
:

CBD

$$\angle CBD = \arccos(((BC)^2 + (BD)^2 - (CD)^2 / 2(BC)(BD))$$

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( )

	) (L1,L2,L3,L4,L5) (
	( ) ( W1.1,W1.2,W1.3 W1.4,W1.5)
	( ) (W2.1,W2.2,W2.3 W2.4,W2.5)
	( ) ( W3.1,W3.2,W3.3 W3.4,W3.5)
	(PW1,PW2)
	(pl)
	( )
	( )
	) (
	(DB BA CA DA)
	CDB BDA CAD BAC) (DBA CBD ACB DCA



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## Enrollment

Reference Template  
Reference Template

Database

## Matching or Classification

make decision  
reject  
accept user  
user  
identification the user  
accept user

matching metric

:

### Absolute Distance

$$D_a = \sum_{i=1}^d |y_i - f_i|$$

:

**Euclidean Distance**

$$D_e = \sqrt{\sum_{i=1}^d (y_i - f_i)^2}$$

:

**D1 Distance**

$$D_1 \text{ Distance} = \sum_{i=1}^d \frac{|y_i - f_i|}{y_i + f_i}$$

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Closed Set Identification

System

: matching metric

Absolute Distance

Euclidean Distance

D1 Distance

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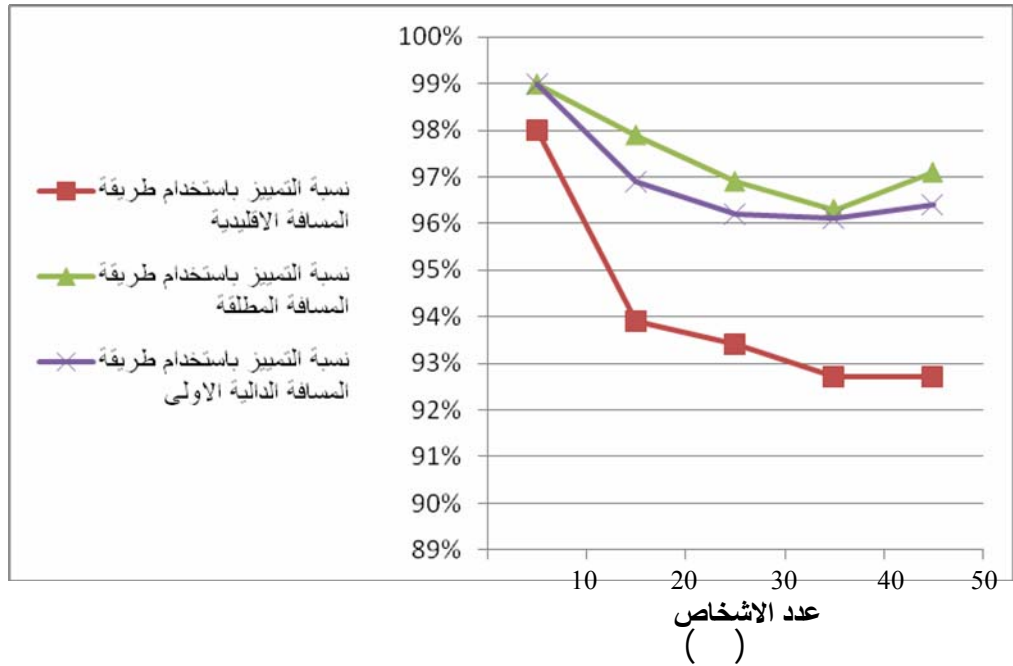


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%	%	%	
% ,	% ,	% ,	
% ,	% ,	% ,	
% ,	% ,	% ,	
% ,	% ,	% ,	

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FAR=0.1812% FRR=14.583% EER=4.62				Using of Hand Geometry in Biometric Security Systems
RR=87.44%				Personal Authentication Based On Hand Geometry Verification
RR=85%				Access Control System With Hand Geometry Verification And Smartcard
TA=89% FA=2.2% HitRate=96% FAR=4.9%				Peg-free Hand Geometry Recognition Using Hierachical Geometry and Shape Matching
CER in v=3% CER in I=6%				Personal Verification and Identification Using Hand Geometry
RR= 97.11%				

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" Echange LLC CGAP

[www.cgap.org/qm/document-1.9.2760/IT\\_bio\\_ar.pdf](http://www.cgap.org/qm/document-1.9.2760/IT_bio_ar.pdf)

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