

Study on Uniqueness of Fingerprints

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Purpose & Background

Purpose

- ◆ To quantitatively evaluate the uniqueness of fingerprints

Background

- ◆ Since identical twins and family members have the closest genetic attributes, it is considered that the similarity between fingerprints of different members from the same family yields relatively high matching scores than from different families.

Experiments

Fingerprint database

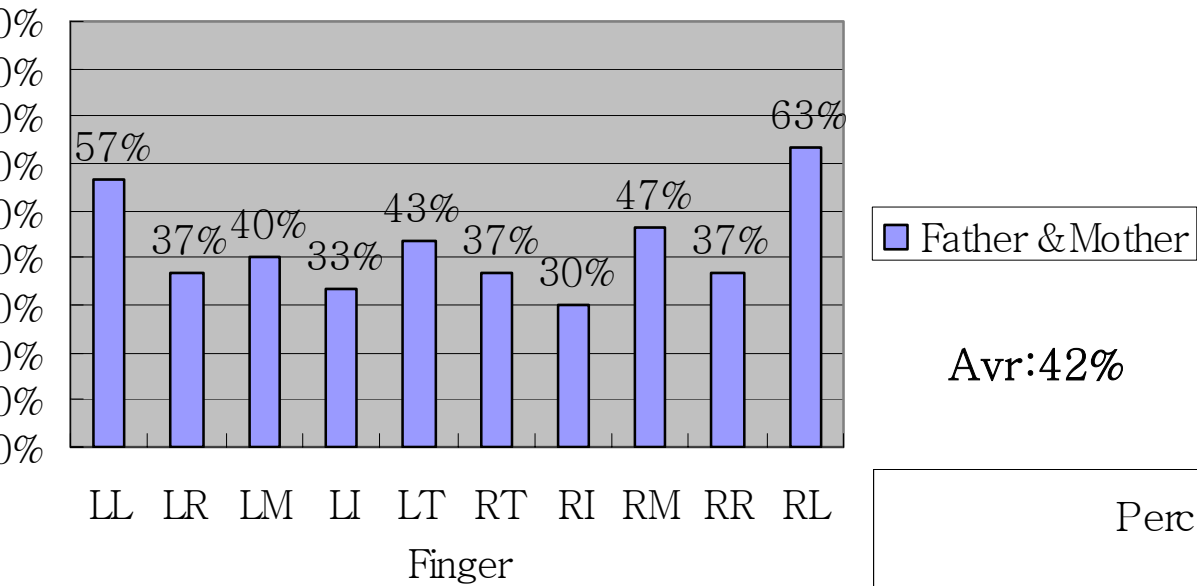
- ◆ Fingerprint reader : Optical
- ◆ Family :
 - 30 family × 4 member × 10 finger × 3 impression
- ◆ Twin :
 - 61 twin × 2 member × 10 finger × 3 impression

Evaluation methods

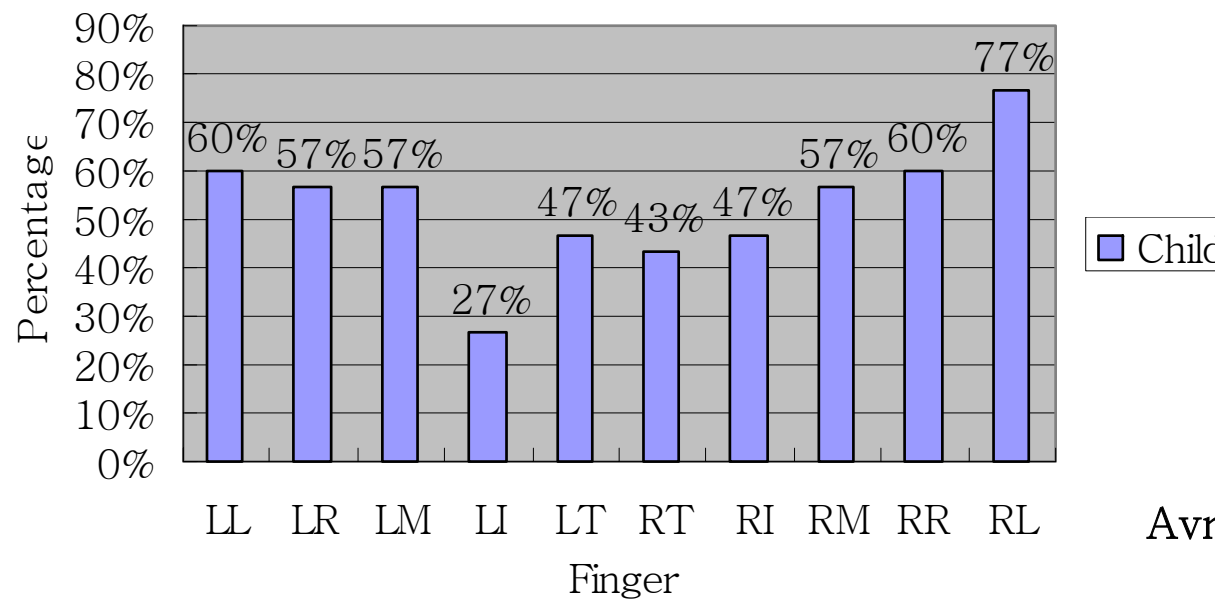
- ◆ Comparison of distributions of matching scores between twins and non-twins
- ◆ Comparison of distributions of matching scores for a possible combinations of family members
- ◆ Analysis of dependency in fingerprint types between parents and children

Results (1)

Percentage of the Same Type between Father & Mother

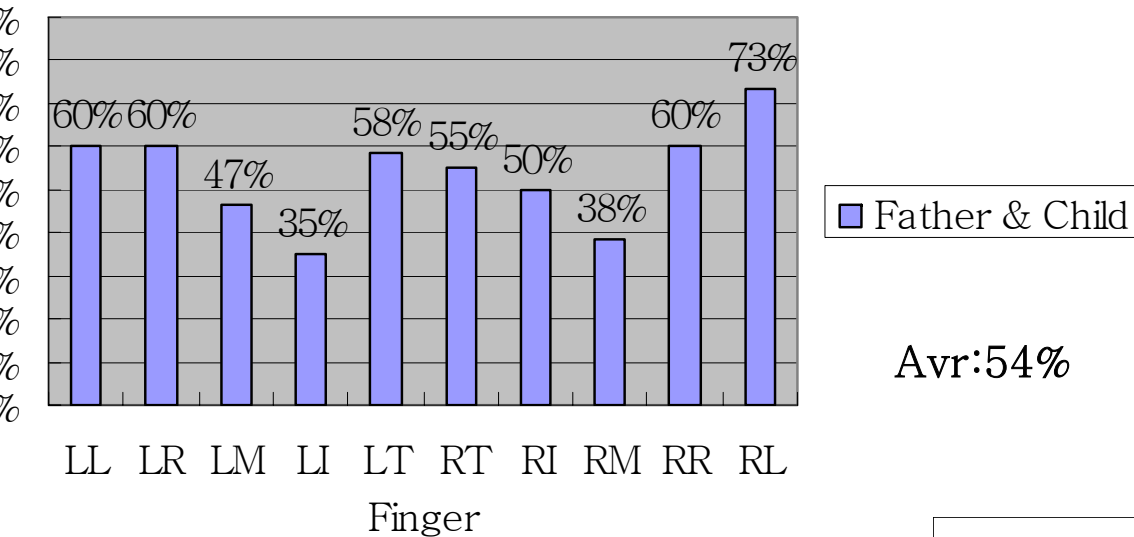


Percentage of the Same Type between Child & Child

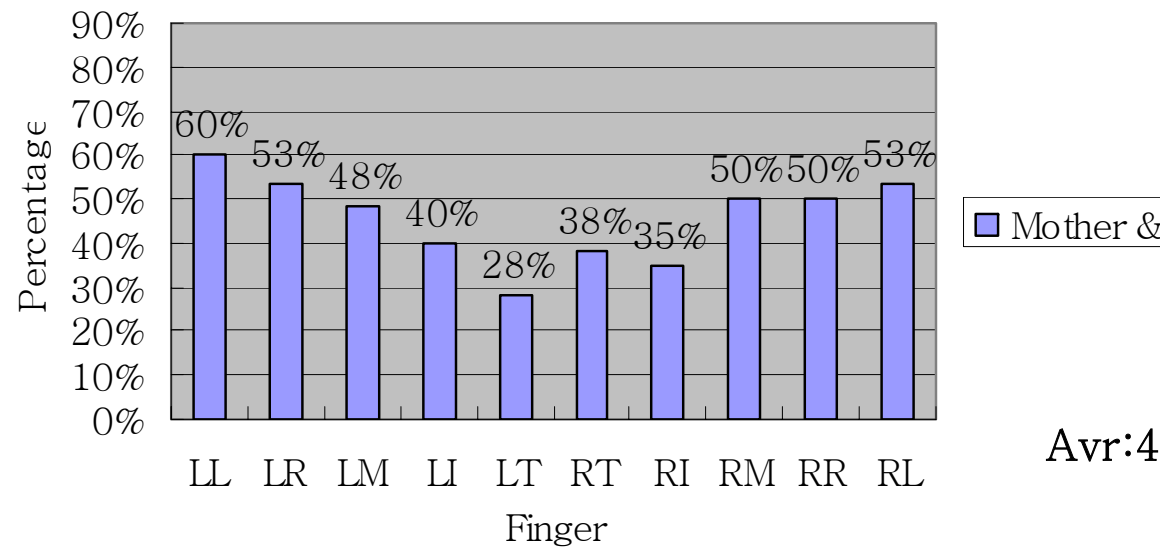


Results (2)








Percentage of the Same Type between Father & Child

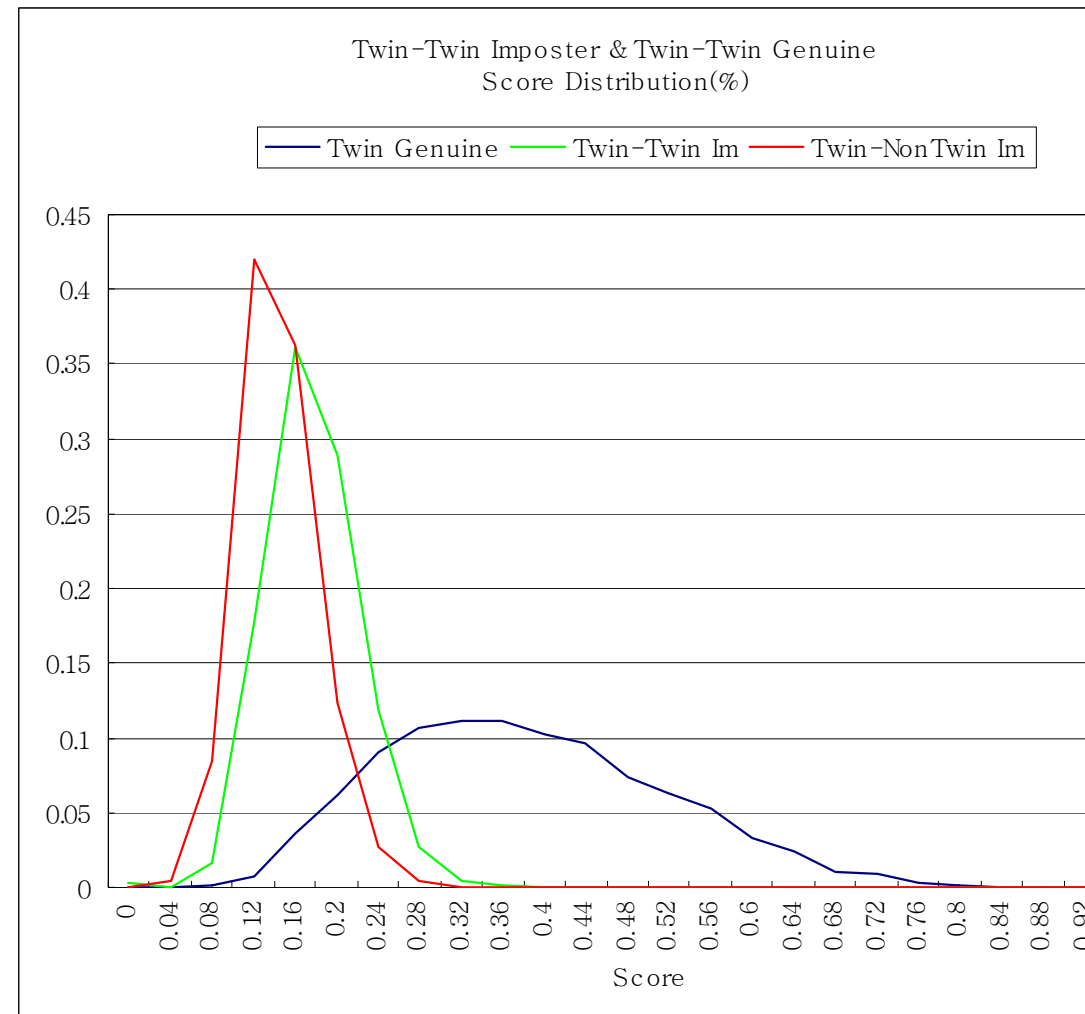


Percentage of the Same Type between Mother & Child



Results (3)

	Type	Type	Type	Type
arent				
ildren		X	 	X
entage (%)	68.11	31.89	71.67	28.33



Observations

The percentages of same types between siblings and between twins are 10% and 15% higher than that of parents, respectively.

The percentage of same types between a parent and a child is 5~10% higher than that of parents.

The type of a child follows either of parents' type about 70%.

The distribution of matching scores for twins is similar to the distribution of imposter matching.

The distributions of matching scores among family members are also similar to the distribution of imposter matching.

An Empirical Study of Multi-modal Biometrics using Face, Fingerprint and Voice

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Purpose & Background

Purpose

- ◆ To demonstrate the feasibility of improving the performance and availability of biometric technology by integrating different modes of biometrics

Background

- ◆ Each single biometrics technology has its own limitations in different aspects.

Experiments

Experiment I

- ◆ Fingerprint + Face
- ◆ Scenario test
- ◆ 488 imposter matching and 3,228 genuine matching with 25 experienced subjects

Experiment II

- ◆ Fingerprint + Face
- ◆ Operational test
- ◆ 361 imposter matching and 1,810 genuine matching with 59 unexperienced subjects

Experiment III

- ◆ Fingerprint + Face + Voice
- ◆ Operational test
- ◆ 174 imposter matching and 403 genuine matching with 20 unexperienced subjects

Results (1)

	Scenario Evaluation (Test 1)				Operational Evaluation (Test 2)			
	FNMR (3228)	FMR (488)	FNMR+FMR (3716)	$\frac{\text{FNMR} + \text{FMR}}{\text{Total Number}}$	FNMR (1810)	FMR (361)	FNMR+FMR (2171)	$\frac{\text{FNMR} + \text{FMR}}{\text{Total N}}$
nger	456	0	456	12.2%	442	3	445	20.5%
nce	189	7	196	5.3%	469	29	498	22.9%
ed Sum	55	6	61	1.6%	178	48	226	10.4%
esian sifier	38	6	44	1.2%	173	27	200	9.2%

Results (2)

Evaluation Type		Operational Evaluation			
Evaluation Index		FNMR	FMR	FMR+FNMR	Error Rate(%)
Single Mode	Fingerprint	67	9	76	13.3%
	Face	108	10	118	20.6%
	Voice	67	20	87	15.2%
Bayesian Classifier	Fingerprint +Face	22	7	29	5.1%
	Face + Voice	29	8	36	6.2%
	Fingerprint +Voice	35	10	45	7.9%
	Fingerprint + Face + Voice	38	8	46	8.1%
Weighted Sum		20	8	28	4.9%
Voting 2 out of 3		41	3	44	7.7%

Observations

Even a simple combination rule such as 'Weighted sum' of matching scores can improve EER.

Most of FNMR cases are due to user's misuse.

Overall, The multi-mode biometrics outperforms single biometrics in recognition with the cost of processing time and memory space.

Choosing two out of three biometric modes is a trade-o