Büro für
Daktyloskopie
dewiselle

Determination and Handling of Dactyloscopic Marks 10. AFIS

Harald Weisel, October 2005

AFIS

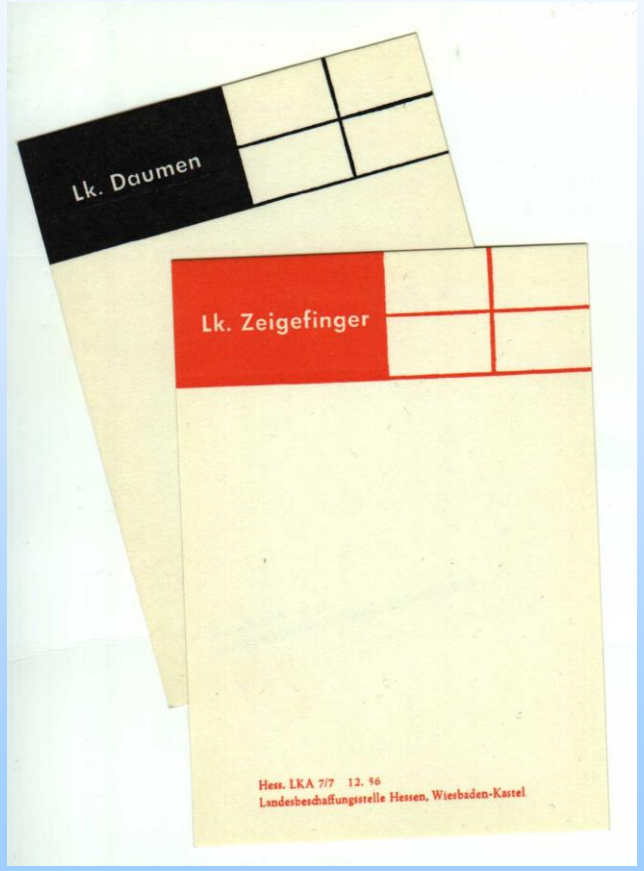
Automated Fingerprint Identification System

- The pioneers of latent print examination were able to compare a crime scene print to the prints of one or several persons (suspects) on the basis of pertinent leads only. This was a cumbersome and sometimes time-consuming procedure - the so-called manual comparison - which, however, is still practised today.

Historical Development

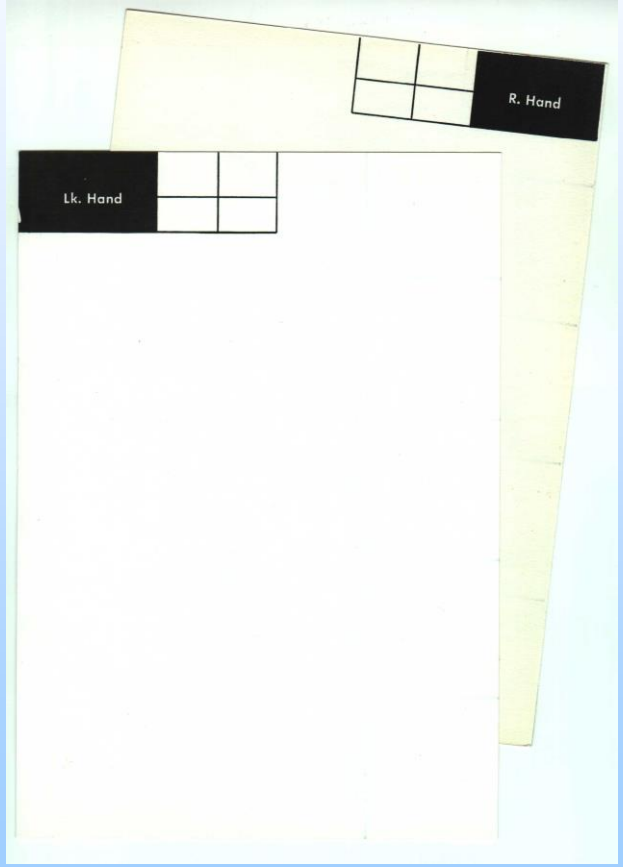
- Later on, in addition to the ten-print card collections used to search for persons, single finger and palm print files to be used for latent print identification were set up. This allowed to search for the donor without depending on information relating to a particular person. The prints were classified on the basis of the specific ridge patterns of the last joints and/or the palms.

Single Fingerprint Classification



- Single-print cards, sorted into the card index according to the determined formula, which was inserted in the top right-hand corner, e.g.
  M 002
  e 12

Single Palmprint Classification



- Palm print card, the determined formula is inserted at the top and the card is sorted into the card index accordingly, e.g.
  M 002
  0 R

Historical Development

- These single-print collections, however, were only operable in an effective way if they did not exceed a certain size and could therefore be used exclusively at a regional level or for specific offences and/or groups of perpetrators.
- In Germany, some of these collections existed until the end of the last century.

Historical Development

- As technical development progressed, attempts were made time and again to optimise research possibilities.
- In 1977, the BKA introduced the Bund-Laender system, a computer-aided analysis system that made it possible to search fingermarks in a nationwide file. The time required to record a ten-print form (e-set) was approx. 45 minutes.

Bund-Laender System

Initial analyses for the Bund-Laender system

Bund-Laender System

- Standard BLS work-station in 1982.

Historical Development

- As latent palm prints account for about one third of all dactyloscopic marks recovered at crime scenes, the federal state of Saxony introduced an EDP system called „DACHS“ (Dactyloscopic Coding of Palm (Hand) Prints in Saxony) in 1994. Also in this case, the capture and analysis of data were very laborious, but equally successful.

AFIS

- Meanwhile, dactyloscopic analysis systems (AFIS) that allow the handling of both finger and palm prints have been introduced.
- These systems are operated to a large extent automatically, their capacities allow for almost unlimited expansion.

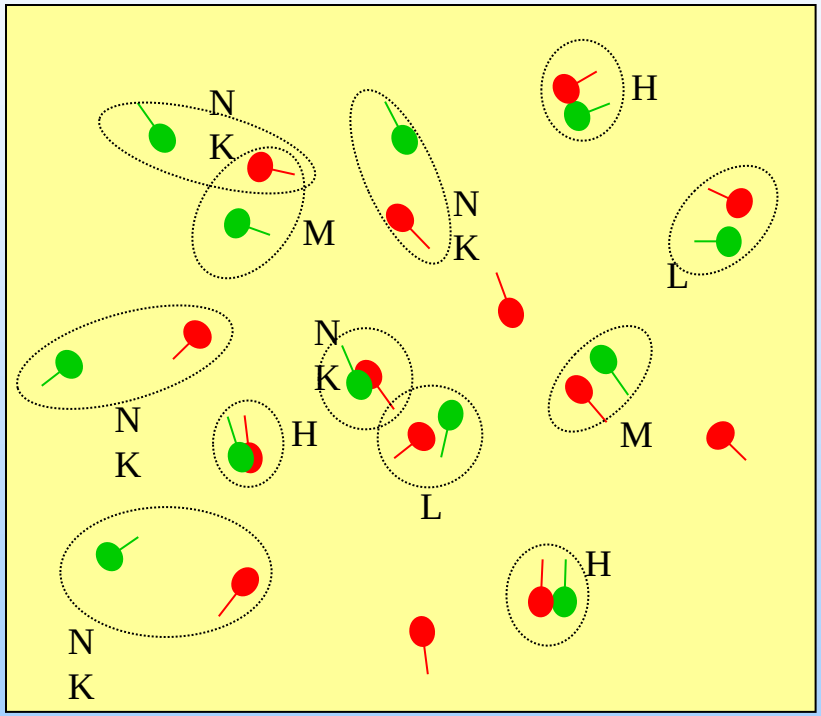
AFIS

- At present, the AFIS used at the BKA, made by a company styled Sagem/Morpho, contains the fingerprints and partly the palm prints of approx. 3.2 million persons. Recording a new set takes only a few minutes, the system defines patterns and minutiae automatically.

AFIS
Defining the Minutiae

- Fingerprint that was scanned into the system.
- The minutiae are defined automatically.
- The pattern, in this case “whorl” (W), is also determined automatically.

AFIS
Determining the Score

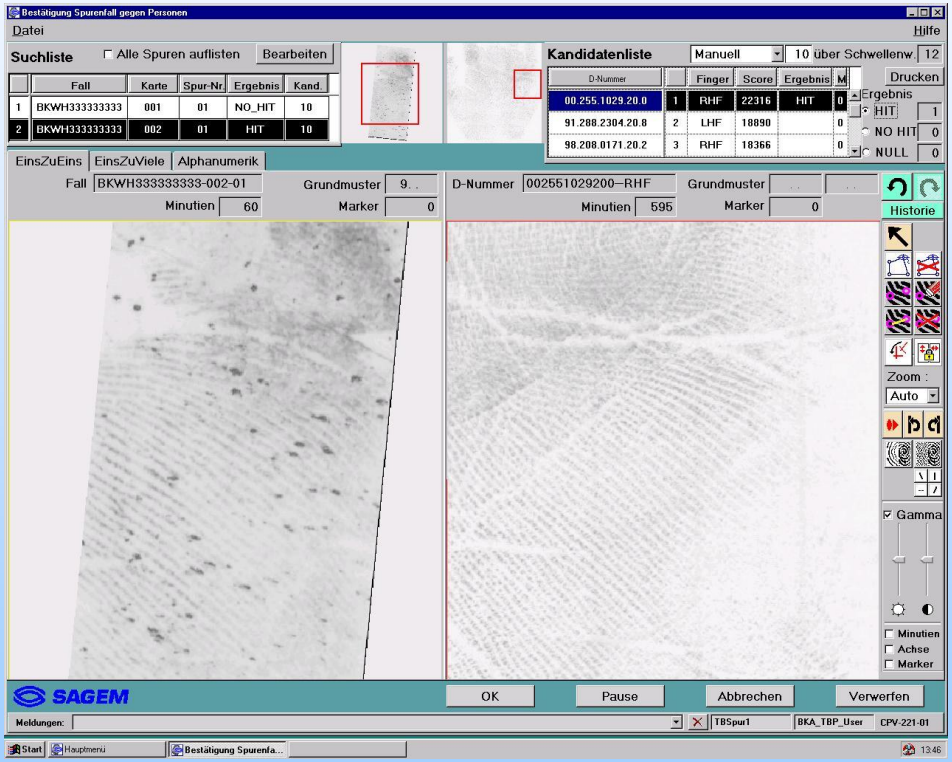


- A total score is determined by comparing the minutiae of the unknown set and the exemplar.
- The candidates are listed according to score and offered to the latent print examiner for comparison.

Minutiae of the unknown finger

Minutiae of the candidate

AFIS
Visual Comparison



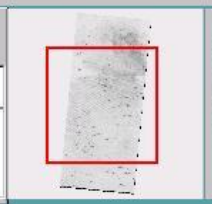
- The decision of whether the impressions are identical is made by the latent print examiner on the basis of the ridge patterns offered.

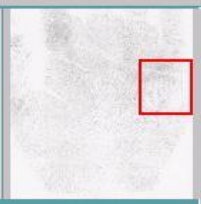
Bestätigung Spurenfall gegen Personen

Datei | Hilfe

Suchliste ☐ Alle Spuren auflisten [Bearbeiten]

	Fall	Karte	Spur-Nr.	Ergebnis	Kand.
1	BKWH333333333	001	01	NO_HIT	10
2	BKWH333333333	002	01	HIT	10





Kandidatenliste Manuell | 10 über Schwellenw. 12 [Drucken]

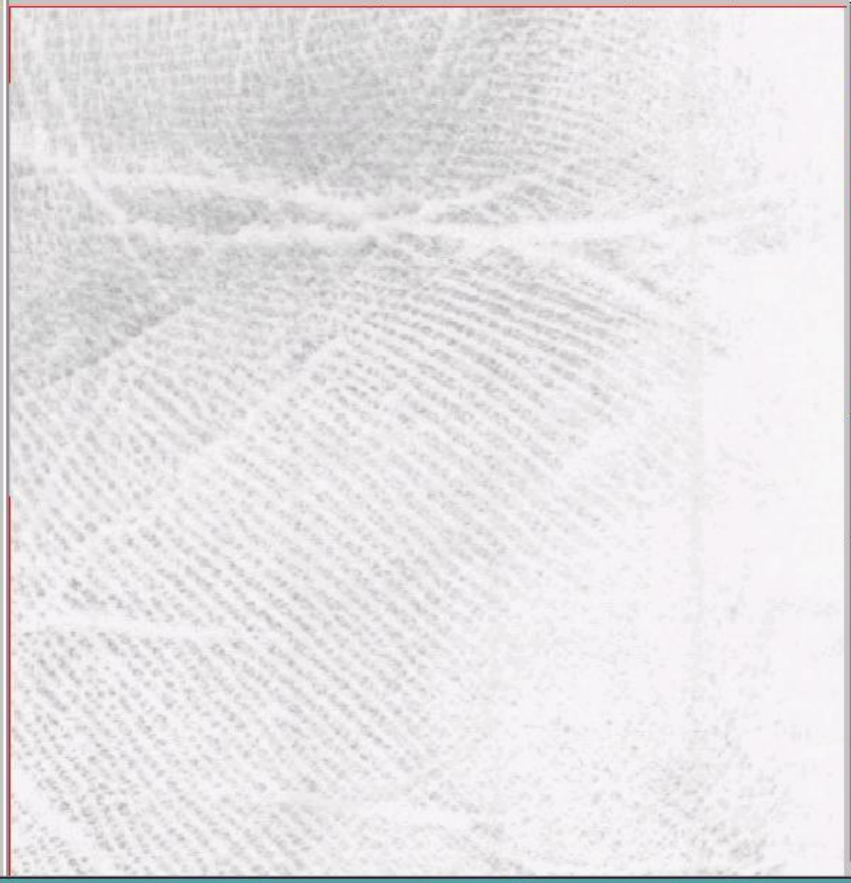
D-Nummer		Finger	Score	Ergebnis	M
00.255.1029.20.0	1	RHF	22316	HIT	0
91.288.2304.20.8	2	LHF	18890		0
98.208.0171.20.2	3	RHF	18366		0

Ergebnis
- (•) HIT 1
- ( ) NO HIT 0
- ( ) NULL 0

EinsZuEins | EinsZuViele | Alphanumerik

Fall BKWH333333333-002-01 Grundmuster 9. .
Minutien 60 Marker 0

D-Nummer 002551029200—RHF Grundmuster . . . .
Minutien 595 Marker 0



Historie

Zoom : Auto

☑ Gamma

☐ Minutien
☐ Achse
☐ Marker

SAGEM

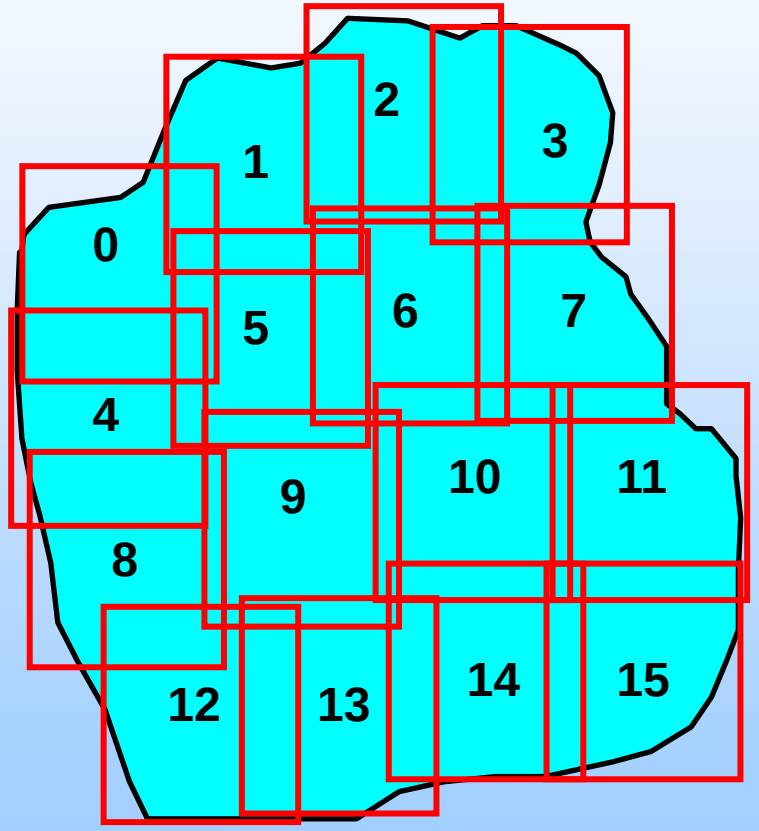
[OK] [Pause] [Abbrechen] [Verwerfen]

Meldungen: | TBSpur1 | BKA_TBP_User | CPV-221-01

Start | Hauptmenü | Bestätigung Spurenfa... | 13:46

AFIS

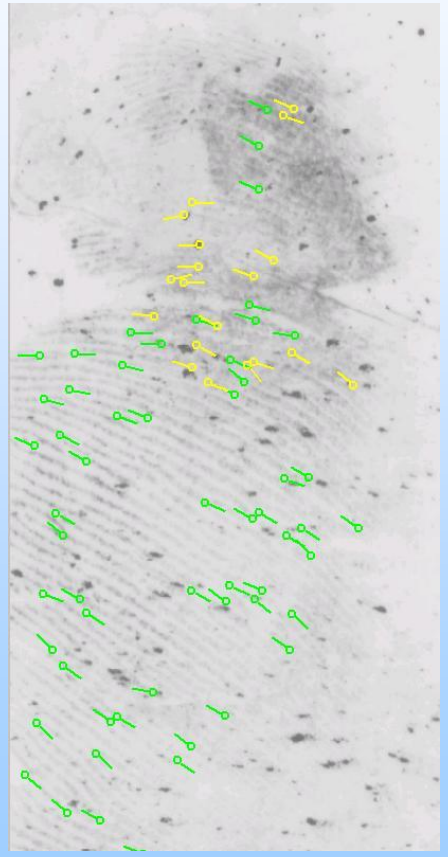
Coding of Palm Prints



- When recording fingerprints in the AFIS used at the BKA, each last joint is coded as one area, whereas the recording of a palm print requires 16 areas to be coded and saved.
- That means more than the triple amount of data has to be searched per person when comparing latent palm prints.

AFIS

Latent Print Search



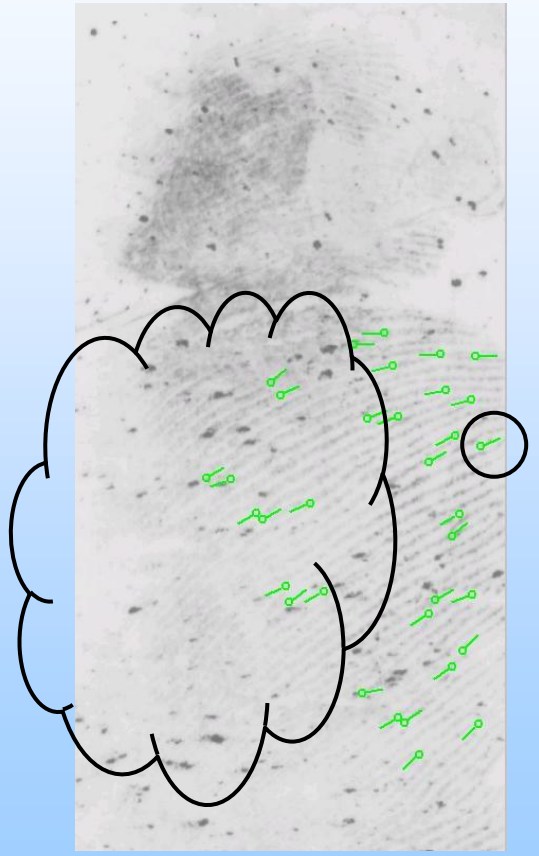
- In prinicple, it is possible to have a latent print coded automatically and to search for matches without making further specifications.
- However, the time and effort needed for searching can be reduced considerably if the palm print examiner is able to define further parameters.

AFIS

Latent Print Search (Example)

- By defining a finger, e.g. right thumb (RT), the amount of data to be searched is reduced to one tenth, by determining the pattern, e.g. whorl (W), this amount can again be reduced to one third.
- In addition, the selection of minutiae can be optimised manually.
- These specifications in their entirety increase the probability of finding matches and reduce the time needed to search/find matches, thus sparing capacities and saving costs in the end.

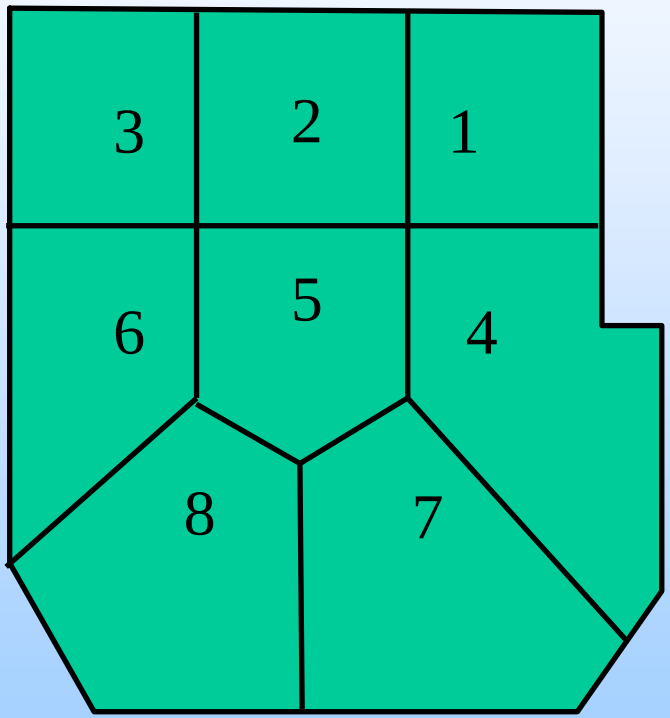
AFIS
Latent Print Search (Palm)



- Experience has shown that large latent palm prints should be searched with the help of a **“minutiae cloud”** in order to optimise the probability of finding a match.
- These characteristics were selected by the palm print examiner, the characteristics marked automatically were removed.

AFIS

Latent Print Search (Palm)



- The palm print examiner has eight search classes per palm at his/her disposal.
- By defining the search class and the hand that caused the latent print, the amount of data to be searched can be reduced to one sixteenth (approx. 6 %).

AFIS

Latent Print Search (Palm)

- In addition, the orientation of the latent (direction from which the print was caused) can be determined, which reduces the amount of data again.
- Tests at the BKA revealed that using these search parameters increases the hit ratio from 48.8 to 65.1 compared to automatic search.
- Also, the average time needed for the matching process decreased from 30 to 40 minutes to 4 to 5 minutes in the testing phase.
- Compared to this, an intensive use of all parameters will require a processing time of about 7 minutes.

AFIS
Latent Print Search (Palm)

- In the testing phase, 87.3 % of the hits referred to the first person on the list of candidates, 4.3 % to the second. 15 candidates were compared each time.
- The number of minutiae in the search sets was between 5 and 544, the lowest number of minutiae in a hit case was 15.
- Attempts to optimise the search by sketching the friction ridge flow with the help of fictitious minutiae were also successful, but involve the risk of the potential hit dropping to the bottom of the list of candidates or disappearing completely from it.

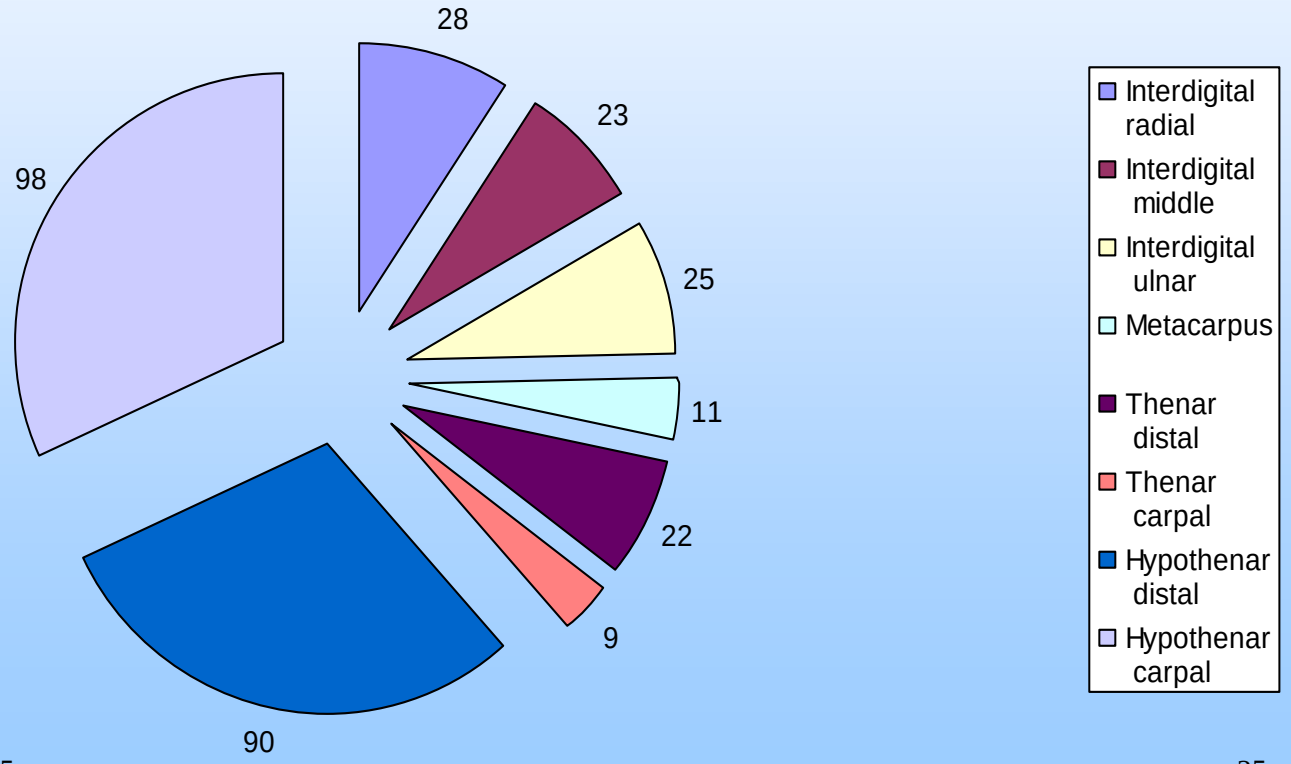
AFIS
Latent Print Search (Conclusion)

- In conclusion, we can say that the deployment of qualified finger and palm print examiners when analysing and evaluting latent prints helps
  - increase the percentage of hits and
  - reduce the time needed for the matching process, thus optimising the use of the system capacities with a minimal amount of time required.
- Good luck!

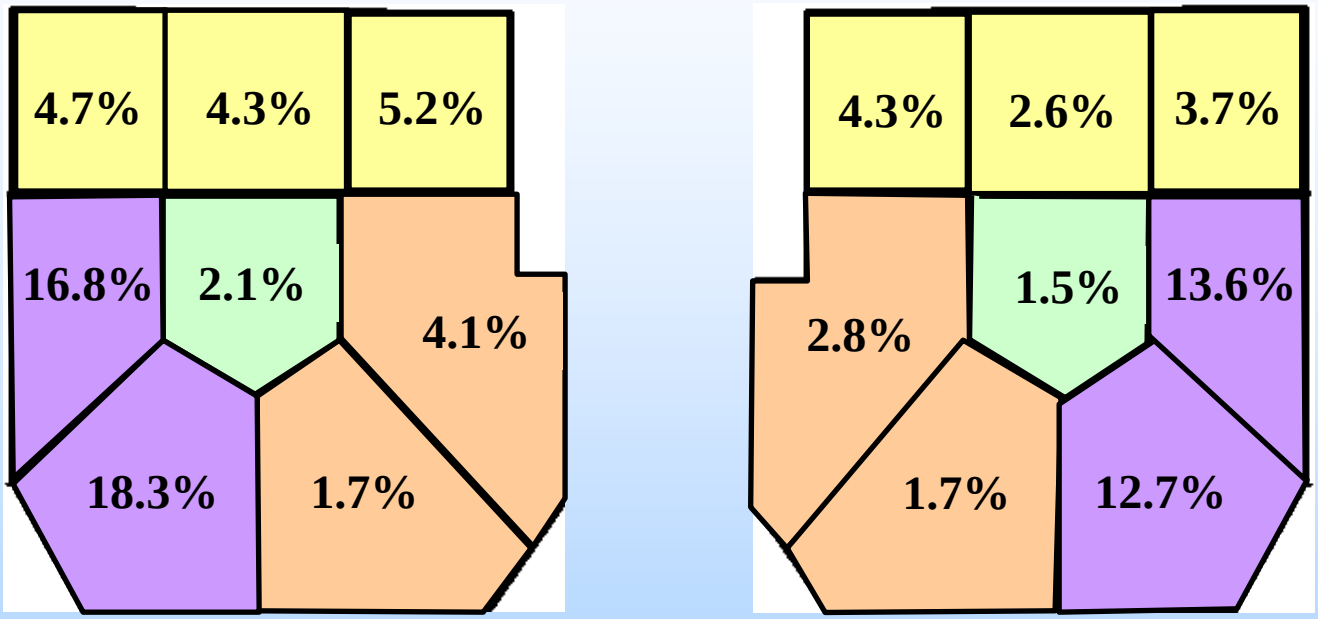
AFIS

Hit Statistics (Palm)

Distribution of 536 Latent Palm Print Hits



AFIS
Hit Statistics (Palm)



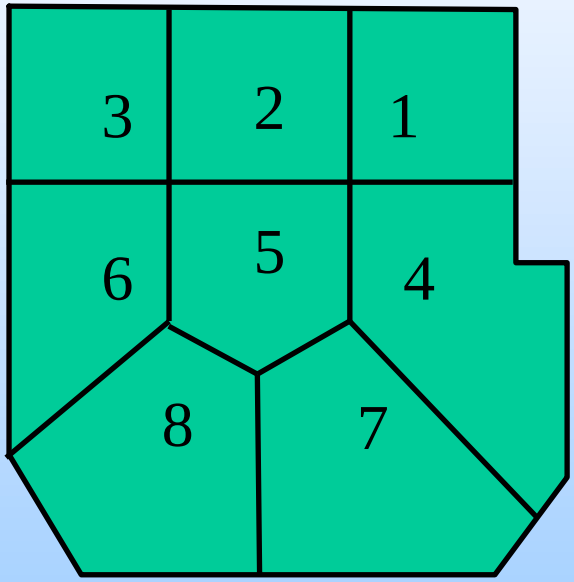
Interdigital total: 24.8%

Thenar total: 10.3%

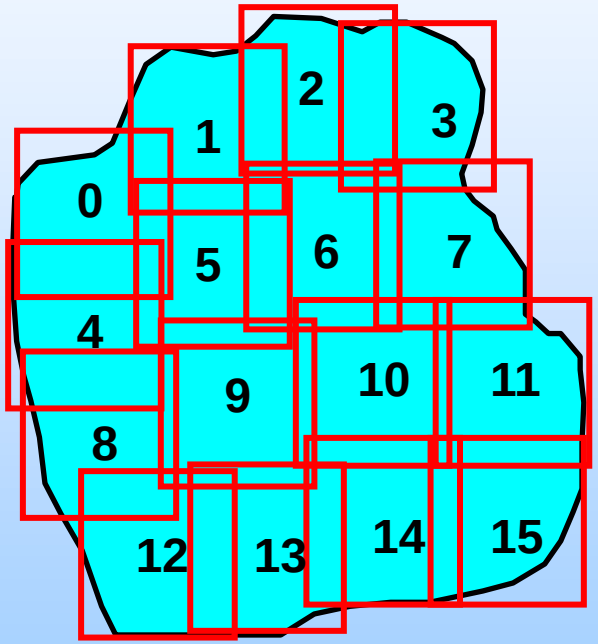
Metacarpus total: 3.5%

Hypothenar total: 61.4%

Palm Print Classification Model



User



System

To be continued.....

Thank You!