A Comparative Performance Test of A New Ballistic Analysis System

BALISTIKA

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Outline

- What is BALISTIKA?
- History
- Test background information
- Tests conducted
- Test results
- Conclusions

What is BALISTIKA?

- **BALISTIKA is a ballistic image analysis and recognition system.**
- **It is:**
  - **High performance**
  - **User friendly**
  - **Scalable**
  - **Working on LAN**
  - **Depends on Client-Server architecture**
  - **Uses 3-Dimensional data!**
  - **Has a relational database that relates bullets, cartridge cases, incidences and individuals**
- **Product of TUBITAK BILTEN**

TUBITAK BILTEN

- Information Technologies and Electronics Research Institute of Scientific and Technological Research Council of Turkey
- Research areas:
  - Electronics
  - Information Technologies
  - Signal processing (image, video and voice)
  - IC design
  - Satellite technologies
- Has a staff of:
  - 150 research staff
  - 40 administrative staff

History

- Beginning of studies goes back to 1995
- Studies started with General Command of Gendarme, Criminal Laboratories Department (CLD)
- First a cartridge case and bullet archive system was developed
- Later, a project was started to design and implement ballistic image analysis and recognition system, with CLD
- BALISTIKA was born!
- With the help of CLD, BALISTIKA improved

History

- For the last 18 months, Police Criminal Laboratories of Security Department of Ministry of Interior Affairs (CPL)
- Extensive tests have been carried out, (the results will be give in another presentation)
- With the last touches, BALISTIKA became a state-of-the art product

Test Background

- BALISTIKA was ready
- A test was needed to measure the matching performance
- A reference was required
- Another widely used successful ballistic image analysis and recognition system was chosen to be the reference system

Tests Conducted

- Only cartridge cases have been tested
- Two calibers tested:
  - 7.65
  - 9x19 (Parabellum type)
- Primary importance was given to cartridge case tests
- Bullet tests were planned but not completed at the time of abstract submission

Test Preparation

- Test cartridge cases have been selected by ballistic experts
- The number of cartridge cases used:
  - 9x19: 694 individual (347 pairs)
  - 7.65: 706 individual (353 pairs)
- Cartridge cases have been recorded to both ballistic image analysis systems by certified users (training period was about two hours for BALISTIKA)

Test Evaluation

- The matching procedures run on both systems
- The results recording according to the following rankings:
  - Breech face
  - Firing pin
  - Ejector mark
- BALISTIKA had another ranking class named "combined evaluation", which combine breech face, firing ping and ejector mark evaluation results to obtain a better ranking of cartridge cases

Test Evaluation

- The ranks of the correct matches for each ranking class have been recorded
- In order to evaluate the overall performance of the systems, the number of unsuccessful matches, that is "misses" have been counted
- If a cartridge case cannot take place in first ten, in any ranking class, then it was deemed to be a "miss"

Test Results

9x19 Parabellum Type, number of misses (347 pairs):

	BALISTIKA	Reference Sys.
Breech Face	112	169
Firing Pin	165	171
Ejector Mark	274	219
Combined Eval	103	----
Overall	*64*	*61*

Test Results

9x19 Parabellum Type, percent of misses (347 pairs):

	BALISTIKA	Reference Sys.
Breech Face	%32	%49
Firing Pin	%48	%49
Ejector Mark	%79	%63
Combined Eval	%30	----
Overall	*%18.4*	*%17.6*

Test Results

7.65 Caliber, number of misses (353 pairs):

	BALISTIKA	Reference Sys.
Breech Face	120	250
Firing Pin	87	116
Ejector Mark	275	276
Combined Eval	59	----
Overall	*39*	*76*

Test Results

7.65 Caliber, percent of misses (353 pairs):

	BALISTIKA	Reference Sys.
Breech Face	%34	%71
Firing Pin	%25	%33
Ejector Mark	%78	%78
Combined Eval	%17	----
Overall	*%11.0*	*%21.5*

Conclusions

- BALISTIKA has a high matching performance
- It is interesting to observe that, different systems have similar tendencies in matching different cartridge types
- For different calibers, different matching strategies can be used
- Although more tests were conducted later (after the submission of abstracts), we plan to make more tests on different calibers
- We are ready to join other comprehensive tests that can be offered by users

Thank You!

Questions and Comments ☺

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