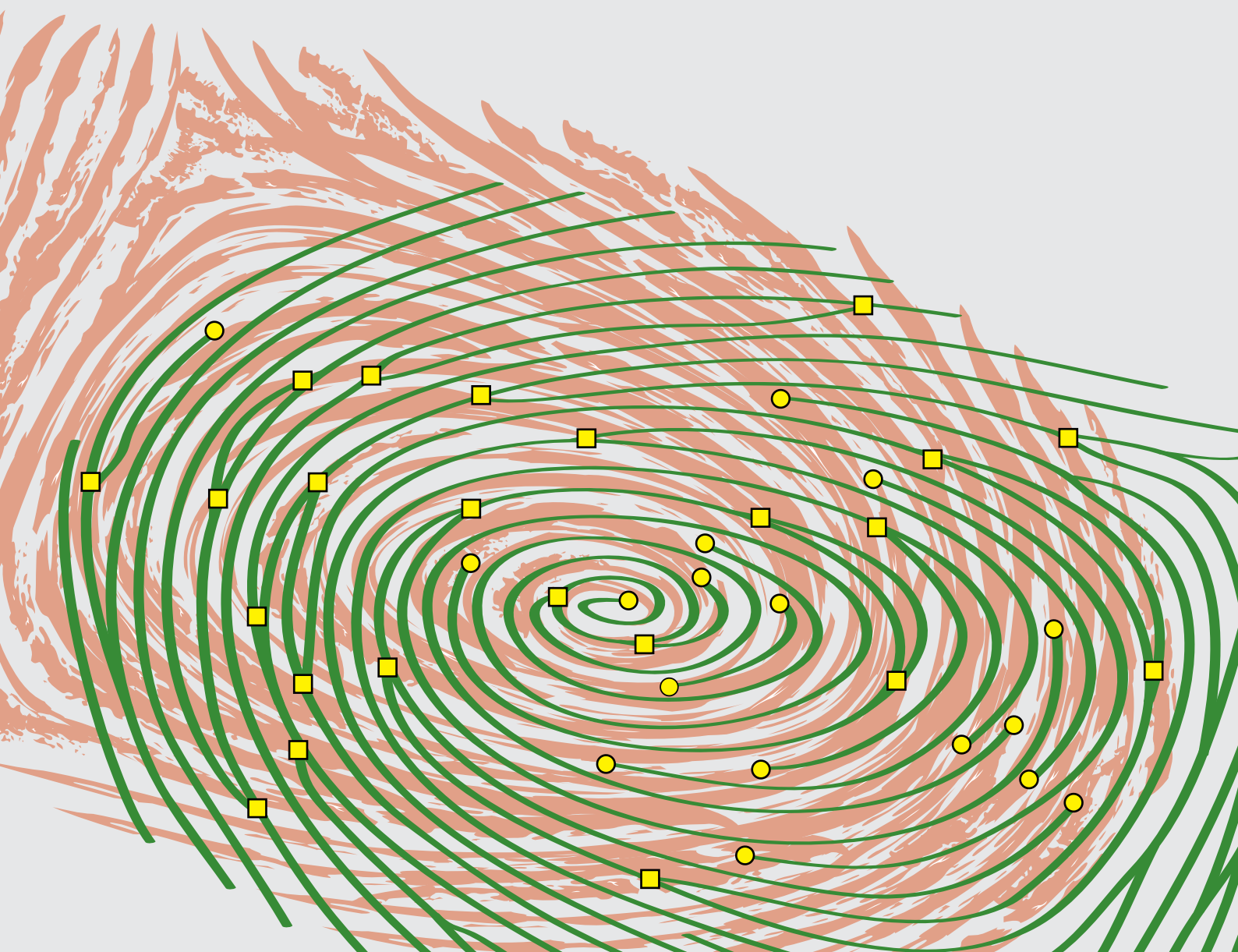# PAPILLON **AFIS**

AUTOMATED
FINGERPRINT/PALMPRINT/MULTIBIOMETRIC
IDENTIFICATION SYSTEM

PAPILLON
SYSTEMS

PAPILLON

is an advanced production and IT company, the biggest developer and manufacturer of automated biometric identification and verification systems in Russia, providing innovative software and hardware solutions to governments, law enforcement agencies and other organization worldwide.

A vertically integrated provider of biometric solutions, PAPILLON creates interoperable systems that meet diverse identity challenges, including crime investigation, and fully comply with the latest world standards for recognition, identification, verification and interchange of fingerprint/palmprint information.

Over twenty years of efficient activity in the biometric market, the company has amassed an unrivalled portfolio of multiple successfully implemented projects, including nationwide identification systems installed in Albania, Bangladesh, Kazakhstan, Mongolia, Nigeria, Serbia, Turkey and other countries. The multilevel nationwide AFIS at the Russian Ministry of the Interior is one of the largest biometric systems in the world, housing the tenprints of over 50 million subjects.

Mobile PAPILLON workstation in trial operation at Pulkovo airport (St.Petersburg) used to identify inadmissible migrants (the photo taken from www.ufms.spb.ru)

Comprehensive set of PAPILLON'S technologies covers:

▌ Electronic databases housing from tens of thousands to hundreds of millions of tenprints containing finger and palm prints, demographic data, mugshot and scar, marks, tattoo (SMT) images, and other necessary information on persons fingerprinted; and electronic collections of unsolved latent impressions, both fingers and palms, found at crime scenes (criminal justice systems).

▌ Automatic 1:N database searches for identification and 1:1 comparisons for verification: each newly entered tenprint or latent print record is compared against tenprint and latent print databases.

▌ Electronic enrollment using PAPILLON's optical livescan devices ensuring forensic-quality fingerprint and palmprint images.

▌ Advanced methods for lifting and processing latent impressions of fingers and palms found at crime scenes.

▌ Remote access to dactyloscopic databases over landline or wireless communication channels for transmitting information and conducting any type of searches including real-time identity (ID) checks.

▌ A wide range of mobile solutions enabling immediate suspect identification in the field.

▌ Modular and scalable architecture enabling construction of distributed systems and their interaction with other systems in compliance with current international standards.

PAPILLON favors a comprehensive approach to constructing high-technology software and hardware complexes. PAPILLON's fingerprint identification technologies have no 'blank spaces', and therefore do ensure uninterrupted operation and supremely effective interaction of all critical components and nodes of even most sophisticated fingerprint identification systems.

A core product, PAPILLON's Automated Fingerprint/Palmprint Identification System (PAPILLON AFIS) has gained a reputation as a system demonstrating superior recognition performance on databases of any capacity and ensuring maximum automation of all technological processes: data submission, processing, matching, storage, and transmission.

In the second half of the 90s last century, the Russian AFIS users gave their preference to PAPILLON AFIS, though young as it was. PAPILLON AFIS became the de-facto standard in Russia and entered the international market competing successfully with other Russian and foreign reputed brands.

We consciously avoid using superlative degrees when describing searching and other functional capabilities of PAPILLON AFIS, considering it to be a pointless and incorrect advertising gimmick when speaking of AFIS systems. The right to be called "the best" can be only given by the results of full-scale comparative trials on real fingerprint databases using rigorously developed testing methods which would provide absolutely equal conditions for all systems under consideration. For lack of any world practice of such testing, PAPILLON prefers to judge from it's own experience and could cite a whole number of examples when AFISs of other vendors, used by a number of criminal investigation departments in Russia, have been substituted with PAPILLON AFIS.

During this substitution, all tenprint and latent print records underwent complete revalidation, i.e. all ink tenprint cards and latent lifts, previously converted to databases of preceding AFIS systems, were submitted to PAPILLON anew, which made this revalidation analogous to 'in situ' comparative trials.

These revalidations invariably showed substantial superiority of PAPILLON's search characteristics — numerous latents were solved after they were compared to tenprints converted to PAPILLON AFIS database though they had been submitted in replaced AFISs but not identified. The findings of repeated searches were registered in protocols and showed that the reliability of each replaced AFIS was not more than 55-70% of PAPILLON AFIS's reliability.

(To get more information on replacement of AFISs, please contact 4requests@papillon.ru).

PAPILLON AFIS features a scalable architecture that can be expanded to meet any agency's database size, throughput and integration requirements, ranging from a standalone workstation to gigantic, nationwide projects having safest storage systems, hundreds of computational cores and most powerful servers servicing multimillion finger and palm print record collections, analyzing streams of data and processing queries submitted from hundreds of remote stations in non-stop mode.

Our extensive experience in the provision of larger scale systems, national and regional, has proved the consistency of PAPILLON AFIS search performance on databases of any size and quality.

While many AFIS manufacturers are merely announcing a palm functionality of their systems, the PAPILLON users do not even remember that short period from 1992 to 1996 when the system could not work with palm prints and latent palm prints. Since 1997, PAPILLON AFIS in any configuration has been working with palm impressions as efficiently as with fingerprints.

▌ High level of automation, palm capability, excellent search performance, short candidate lists, convenient tools for verification and analysis of search results, friendly, easy-to-use interface for database management, flexible architecture and services provided by PAPILLON AFIS can satisfy any functional, technical, and administrative requirements when creating a new identification system or integrating fingerprint modules into already existing automated information infrastructures.

MULTIBIOMETRIC CAPABILITIES
OF PAPILLON AFIS

Depending on its mission, PAPILLON AFIS can be configured for tenprint record collections of criminal and non-criminal nature and for those keeping unsolved latent prints found at crime scenes (Criminal Justice AFISs).

For fingerprint enrollment, PAPILLON AFIS provides an ability to enter comprehensive demographic data and other descriptive information, rolled and plain impressions of ten fingers, palm prints, up to 100 photos of face (mugshots) and distinctive features (SMT images), criminal records, the subject's verbal description (a verbal portrait of the individual created using unified picklists of values). Each electronic tenprint entered to the database is authenticated with a digital signature.

Latent print images are submitted to AFIS together with all related alphanumeric data and photos associated with a latent, crime and scene.

PAPILLON fully supports efforts to establish links between AFIS systems of other vendors using ANSI/NIST standards. The following versions of data format for interchange of biometric information are supported at this time: RUS-I (Russian Ministry of Interior), Interpol, EFTS, and EBTS.

Before storage or transmission, images are compressed using PAPILLON's proprietary WSQ algorithm that is FBI certified.

Operations with tenprints and latent prints are the major but not the only functionality of the PAPILLON AFIS systems.

A new generation of PAPILLON AFIS is a multibiometric system allowing to enter multiple biometric identifiers of a person and to conduct automatic searches by these identifiers for possible identity. The innovative, extended format of AFIS database records enables the entry and storage, in addition to the above mentioned, the samples of handwritten signatures, two-dimensional full face images that fully comply with ISO/IES 19794-5:2005 and GOST R ISO/IES 19794-5, and images of iris patterns. Moreover, there is a capability to enter into electronic tenprint files specimens of handwriting and voice, three-dimensional facial images and other personal biometric characteristics.

The facial recognition module integrated into PAPILLON AFIS software makes it possible to encode facial images ('coding' means to set manually or automatically markers on basic anthropometric points) and then search them against galleries of mugshots and facial composites.

PAPILLON iris scanners and relevant software can also be integrated into AFIS and used for capturing iris pattern images that will then be coded and stored in the database.

For new tenprints containing the coded facial and/or iris pattern images, relevant searches are conducted parallel to finger and palm print searches.

PAPILLON AFIS is capable of exchanging iris and facial image data with systems of other vendors.

PAPILLON FK-2 station for full-face photography in compliance with ISO/IES 19794-5:2005 and GOST R ISO/IES 19794-5 requirements

AUTOMATION
OF DATA ENTRY

PAPILLON AFIS provides maximum automation of operations relating to tenprint and latent print data acquisition and submission to AFIS databases.

All images on the tenprint card are coded automatically. The list of operator's tasks now includes:

▎ Entry of demographic data and other text information associated with tenprints (the available picklists of values saves time, allowing the operator to avoid mistyping and to provide uniformity of input information)

▎ Acquisition of all images from tenprint cards by means of a flatbed scanner or from graphic files (TIFF, JPEG, BMP, PDF)

▎ Setting of limiting frames and longitudinal axes on fingerprints, slap impressions, and palm prints. PAPILLON AFIS does not require from the operator to determine the fingerprint pattern type, the location of cores and deltas, coordinate system, and flexure line.

The system automatically checks the sequence and accuracy of rolled impressions by comparing them to plain prints ('slaps') providing tools that allow the operator to correct mistakes that might occur such as misplaced prints, swapped hands, same impression for different fingers, etc. In addition, the system evaluates the quality of images allowing, for example, to replace poor rolled impressions with relevant slap prints.

Forensic-quality electronic tenprints signed by persons fingerprinted and officials who take fingerprints are created and exported by means of enrollment workstations of PAPILLON Live Scanner, either stationary or mobile. The exported tenprints including those transmitted in a remote access mode are entered into AFIS databases automatically, without operators' assistance.

Tenprints imported from dissimilar systems in ANSI/NIST (RUS-I, INT-I, FBI EFTS) format are automatically converted to PAPILLON format and then, upon the location of fingerprint axes, are entered into the database.

PAPILLON AFIS supports the entry of latent finger and palm print images with a flatbed scanner, digital video or photo cameras, and from graphic files (BMP, TIFF, JPEG).

The system provides a full range of on-screen, mouse-controlled image enhancement tools that simplify the interactive step of latent print coding as much as possible, having reduced it to the following:

▎ Specify a latent print type: finger or palm

▎ Determine the orientation of the print in consideration of tolerances

▎ Crop the usable print to cut away unwanted areas where the ridge pattern is not completely distinguishable because of smudges, scars, overlapping impressions, and where the location of minutia is doubtful

▎ Generate a skeleton image of the print

The competently designed interface and easy-to-use tools streamline the encoding process saving the operator's time and effort.

The skeleton of the ridge flow is used by the system to precisely determine the location, the direction and other characteristics of minutiae and to generate a minutiae record (mathematical template) for matching. In most cases, the skeleton is extracted automatically and then just reviewed and edited, if needed, by the operator. The degree of human intervention into this process depends upon the quality of the latent print image under consideration.

For good and average quality latents, which feature distinguishable ridge pattern not overlapped by other latents, the automatic skeleton extraction ensures that 80% of minutiae points are correctly located.

▎ PAPILLON AFIS has been proven by experiments to identify 80 of 100 good and average quality latent prints in completely automatic mode, i.e. without the operator's assistance.
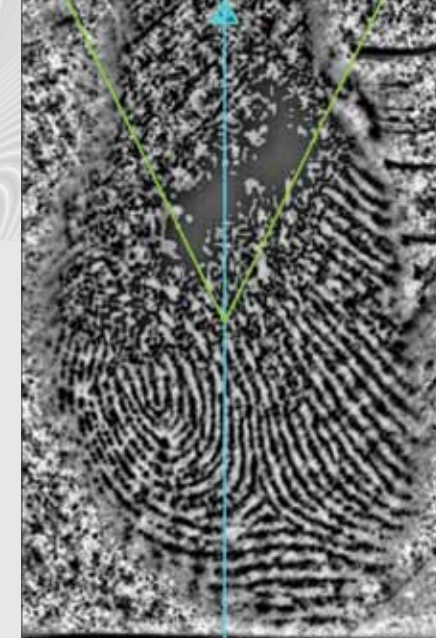
The axis determines orientation of a latent fingerprint
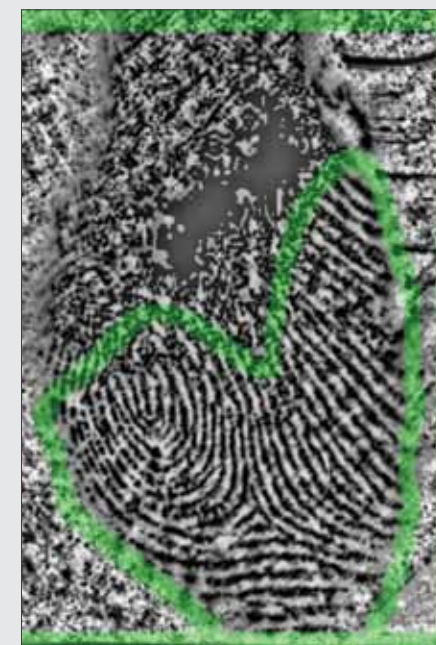
The usable area is outlined

Automatic skeleton extraction

Any latent fingerprint can be submitted to PAPILLON AFIS for automated search, if it has at least 4 minutiae distinguishable on its ridge pattern, and any latent palmprint if having at least 6 minutiae visible.

About 40% of latent impressions kept in PAPILLON AFIS databases throughout Russia have less than 15 minutiae.

The simple logic of ridge flow tracing, void of any subjectivity, and the ability to create alternative variations of the skeleton image for complicated cases, make it possible to submit and match even those latents that seem unidentifiable.

The quality of latents to be submitted to AFIS can be considerably improved if you use PAPILLON ExpertLab which is designed for detecting, reproducing and photographing latent prints on objects under different light conditions.

The crime scene/latent print technician will appreciate the mobile kit of PAPILLON-FOSKO which enables in-the-field photography of material evidence and latents that are unliftable or difficult for lifting (bloody or volumetric, for instance) in various illumination conditions. FOSKO is configured with the built-in PAPILLON LATOP application that ensures immediate transmission of captured images together with relevant text information over Wi-Fi or GSM 3G wireless networks for AFIS searches.

To facilitate the operator's tasks, the most difficult prints, before they are entered into AFIS, can be enhanced with the use of powerful tools and filters available in PAPILLON RASTR.

The ample set of capabilities this program provides can be used to amplify the ridge pattern, to separate overlapping latents, to suppress or completely eliminate any noise caused by background texture, dirt and other negative factors, thereby minimizing the quantity of unidentifiable latents.
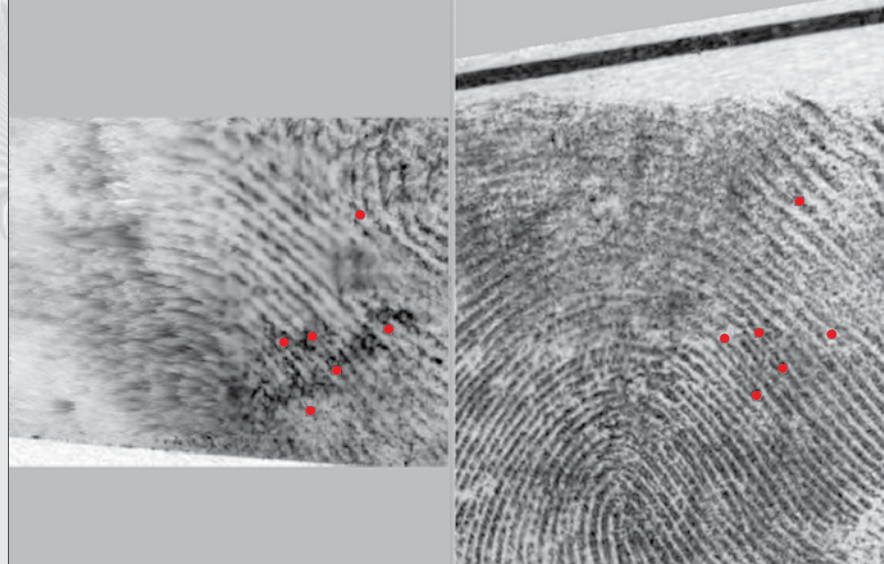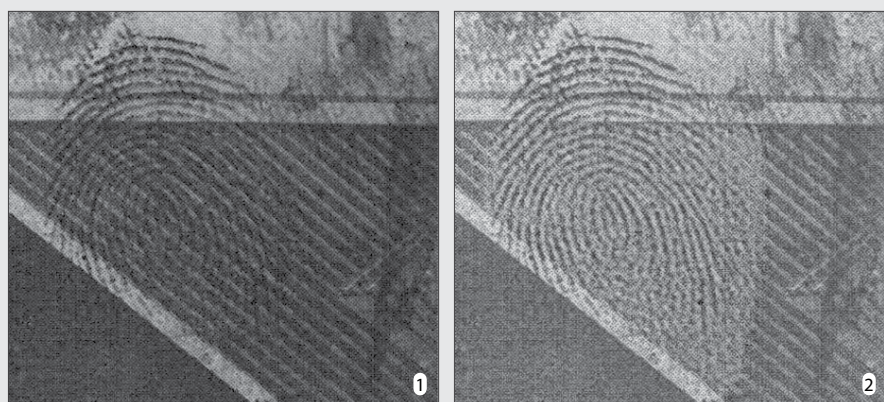

Low-quality latent print identified by 6 minutiae
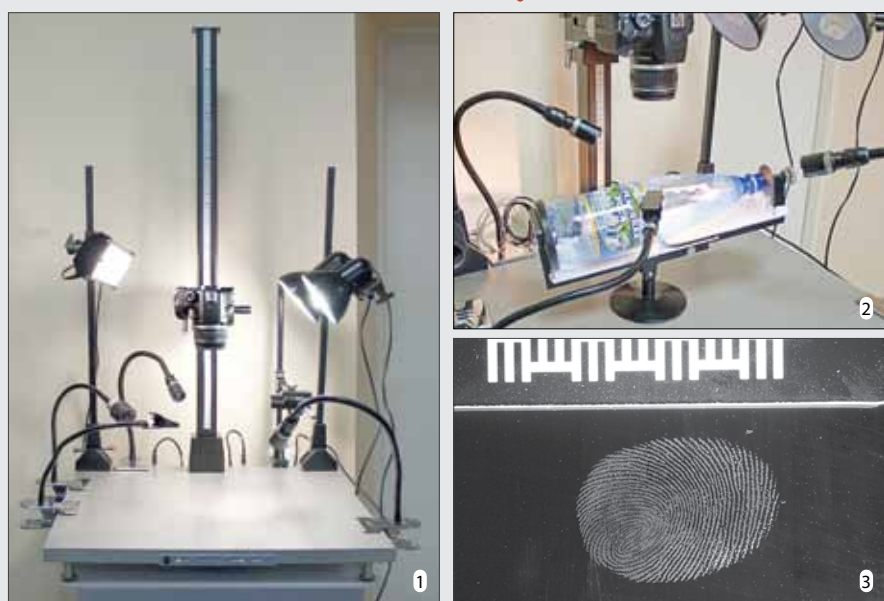
1 – PAPILLON ExpertLab, 2 – Fixing objects for examination and taking photos, 3 – Darkfield imaging of an undeveloped latent print

1 – PAPILLON-FOSKO, 2 – Fingerprint left on a mirror

1 – A latent print on a pack of cigarettes, 2 – Resultant image after processed with RASTR tools (FFT filter)

AUTOMATIC SEARCHES IN PAPILLON AFIS

PAPILLON AFIS ensures the highest indices of search reliability and matching selectivity, producing sustainable and consistent results on databases of any size without any preselection of tenprints and latent prints by quality while reducing the number of candidates to be compared with, thereby saving the operator's time and effort to verify search results and to make final decisions.

PAPILLON dactyloscopic identification technology is empowered by a proprietary matching algorithm that uses the most comprehensive description of fingerprint patterns. This algorithm allows AFIS to separate the ridge pattern from any random noise and to use only "clear zones", thereby reducing the number of false minutiae and creating the most advanced mathematical templates for matching.
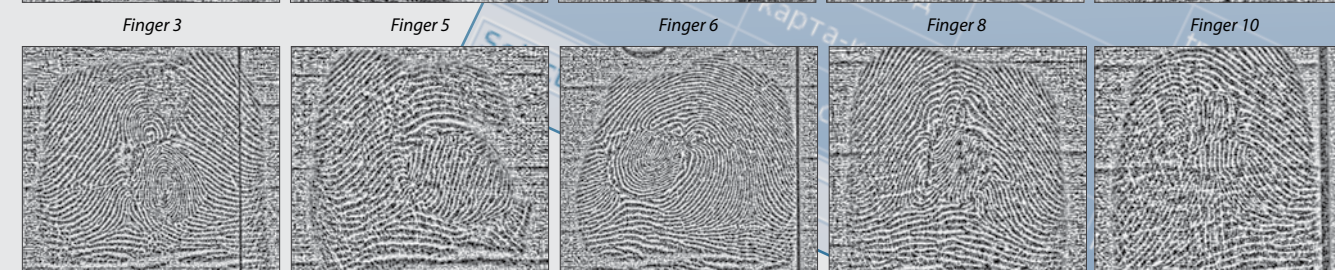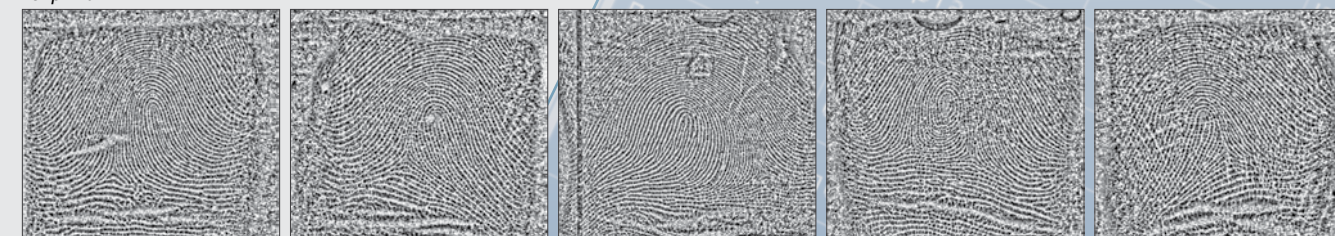
By encoding not only friction ridge flows and minutiae but also topological properties and relations, that is the relative position of neighboring minutiae across and along the ridge flow, PAPILLON AFIS provides the most powerful matching criteria. This topological approach that provides very high matching selectivity distinguishes PAPILLON's AFIS technology from that of our competitors who take into account only the ridge pattern structure and/or location and direction of ridge details.

The elaborate automatic processing and highly precise coding of fingerprint images are running in the background unnoticeably to the user allowing him to perform another task.

When coding is completed, the system automatically initiates a search of the database — no input from the operator is needed.

Interesting 'Idents' Made by PAPILLON AFIS

Tenprint-to-tenprint identification revealed the fact of willful concealment of identity through forging of ID documents and plastic surgery of ridge patterns.
The period of time between the first and the second tenprints is 26 years.
To falsify the ridge patterns, the central portions of skin on the finger tips were transplanted as follows: 1 to 10, 2 to 9, 3 to 8, 4 to 7, 5 to 6 (rotated by 180°).
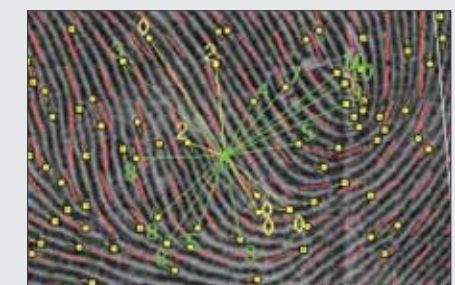
Tenprint 1

Finger 3   Finger 5   Finger 6   Finger 8   Finger 10

Tenprint 2

The ultimate automation of tenprint and latent entry not only saves operators' time and effort but also safeguards the inherent matching talent of PAPILLON AFIS against possible risks of subjective interpretation of incoming information, making it independent of the human factor.

PAPILLON AFIS allows the following types of searches:

- *tenprint to tenprint*
- *latent to tenprint*
- *tenprint to latent*
- *latent to latent.*

Additionally, *express identity checks,* a specific high-speed type of search, can be also conducted.

The average length of candidate lists automatically generated against a database of 50 million tenprint records is as follows:

- *Tenprint-to-tenprint search*: 1 or 2 candidates with the true candidate on the first place in 100% of cases, 100% hit rate.
- *Latent-to-tenprint search*: default number of candidates is 20, the true candidate being on the first place in 85% of cases and in the top five (5) in 90-95% of cases, 85% hit rate.
- *Tenprint-to-latent search*: 2 or 3 candidates with the true candidate on the first place in the overwhelming majority of cases, the hit rate is not less than 85%.

The topical for most of criminal justice AFIS systems problem of low hit rates for *tenprint-to-latent* searches is successfully and most efficiently solved by PAPILLON AFIS.

The said problem is exhibited on large-size databases as inadmissibly long *tenprint-to-latent* candidate lists, unforeseeable position of the true mate thereon, huge expenditure of time and human resources on reviewing all candidates in order to "separate the wheat from the chaff". In case of intensive inflows of tenprint data, this makes the AFIS users refuse to verify *tenprint-to-latent* candidate lists while giving preference to initiating from time to time a repeated *latent-to-tenprint*

search for all latents stored in their databases ("reactivation" of latents), which also causes huge labour costs and, what is more, the lack of immediate responsiveness in solving crimes.

The patented method PAPILLON AFIS offers to solve this problem provides the shortest possible *tenprint-to-latent* candidate lists with true candidates found in the top positions and ensures the complete symmetry of *tenprint-to-latent* and *latent-to-tenprint* searches at all points:

- reliability and accuracy
- number of true and false candidates per million of comparisons
- amount of time needed to verify candidates.

PAPILLON AFIS removes the need for periodic "reactivation" of latents since its cutting-edge technology of *tenprint-to-latent* searches enables the operator to get rid of time-consuming tasks. This technology enables the AFIS to accomplish its number one mission – reliable identification of dangerous criminals and their complicity in crimes.

Latent finger/palm prints identified through *latent-to-tenprint* and *tenprint-to-latents* comparisons (solved latents) are automatically relocated to dedicated database segments and no longer participate in new searches.

Interesting 'Idents' Made by PAPILLON AFIS
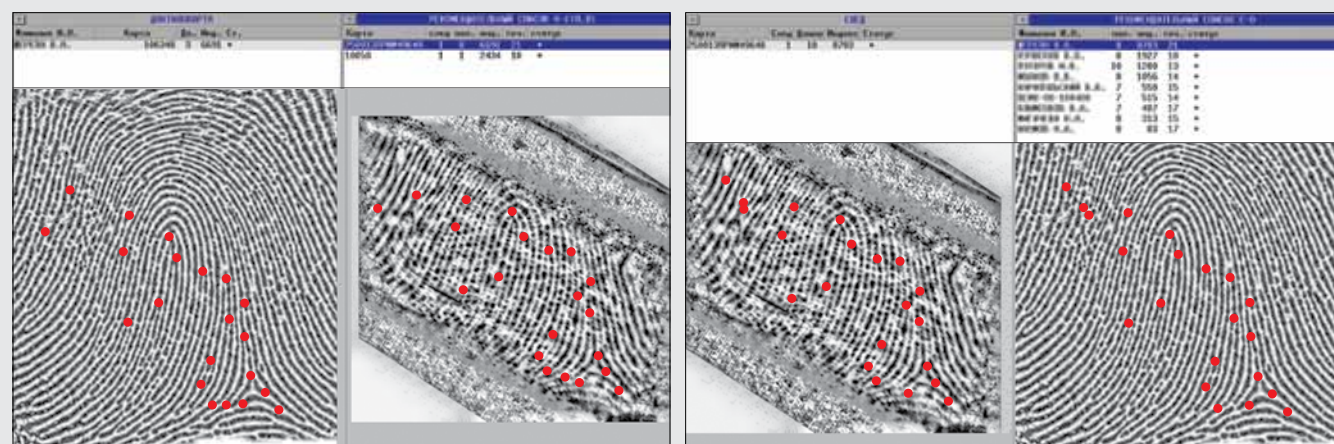
Furthermore, the patented Auto-Scaling technology ensures success in matching prints which are non-uniformly scaled, i.e. those photographed non-life sized or acquired from unknown sources. It also eliminates errors that may occur from age, death, disease, trauma or other size change issues.

PAPILLON AFIS users have already got accustomed to cases when latents found at crime scene are identified with tenprints created as far back as several decades before the incident, when a person was fingerprinted in his youth. This capability also allows the AFIS to match fingerprints that have undergone some catastrophic geometric and qualitative changes.
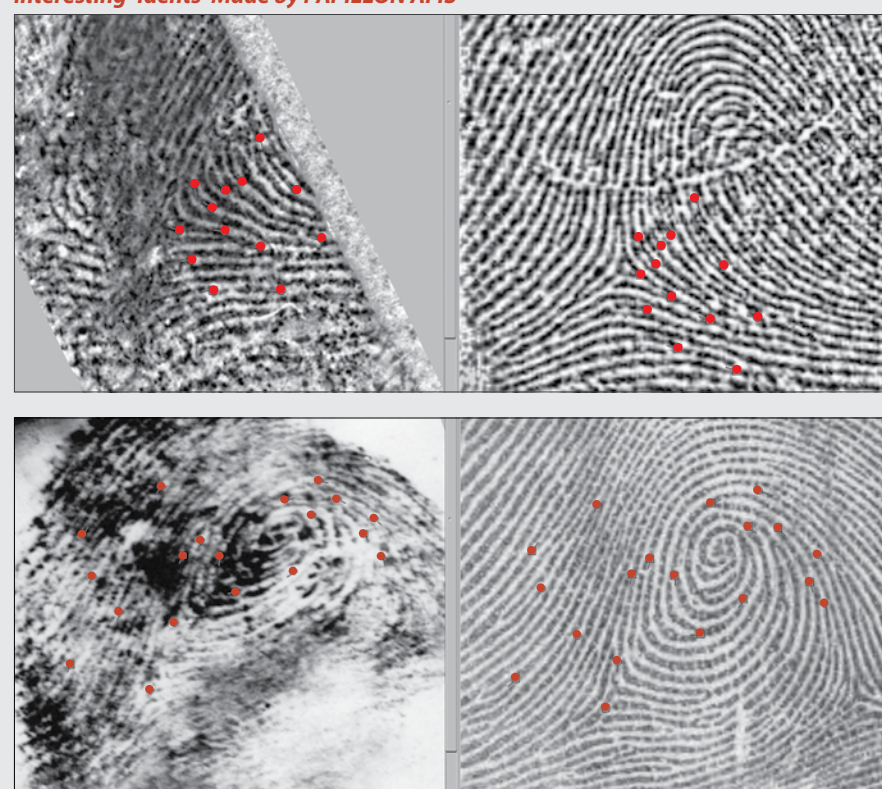
Identification of latent fingerprints that have heavily distorted ridge patterns

PALM PRINT ANALYSIS

PAPILLON has consistently tweaked its AFIS technology to make palmprint analysis as automatic, reliable and accurate as that of fingerprints.

PAPILLON AFIS allows the entry and storage of:

- full hand impressions (from the fingertips to the carpal crease)
- lower and upper palm impressions (from the wrist bracelet to the top of the interdigital area and from the bottom of the interdigital area to the upper tips of the fingers)
- writer's palms.

High-quality palmprint images can be captured with PAPILLON live-scan devices certified by FBI (USA) to meet the IQS requirements.

Palmprint images included into tenprint records are coded automatically. No restrictions on the size of impressions are imposed, and no fragmenting into smaller portions is required.

Expert examiners highly appreciate PAPILLON's AFIS capability to automatically extract precise ridge structure and details, including minutiae in such critical areas as thenars that feature a large number of creases and wrinkles.

For latent palmprints, the same coding technique is applied as that used for latent fingerprints.

No matter whether or not the operator has defined the hand (right or left) and the portion thereof represented on the latent print image, and its orientation relative to the bottom of the palm. The efficiency of latent palmprint searches does not depend upon that.

If doubting upon the type of a latent being examined, the operator can submit it to the AFIS database in two copies — one as a finger, the other as a palm — each will be searched against relevant database segments.
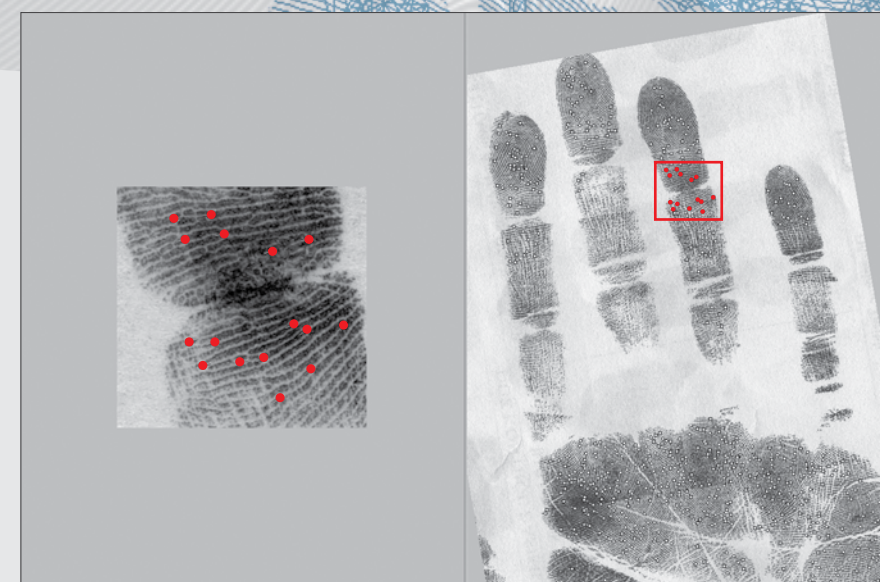
A latent lift that is a fragmentary impression of nail and middle phalanxes near the flexure line was identified with a full hand image coded automatically.
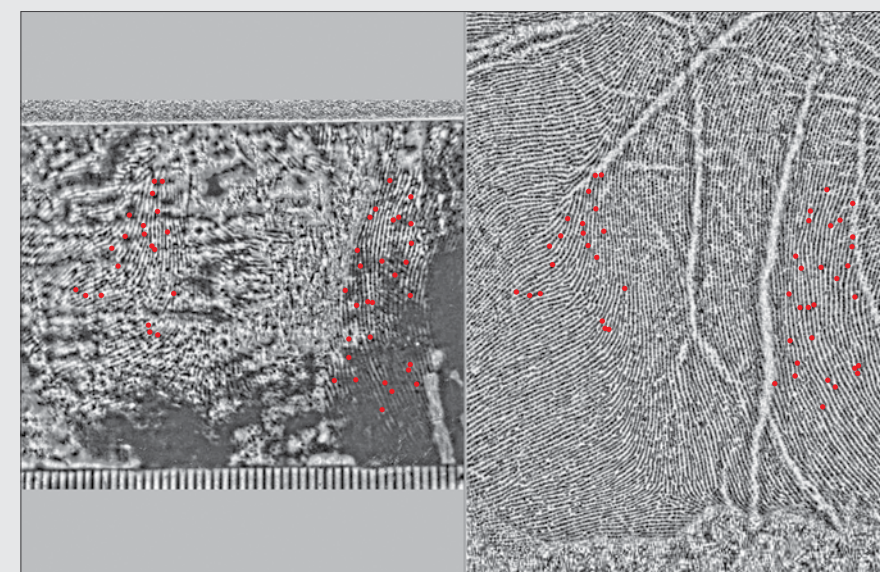
Identification of a low-quality palmprint. Isolated groups of matching minutiae are on the opposite sides of the 'bad' area.
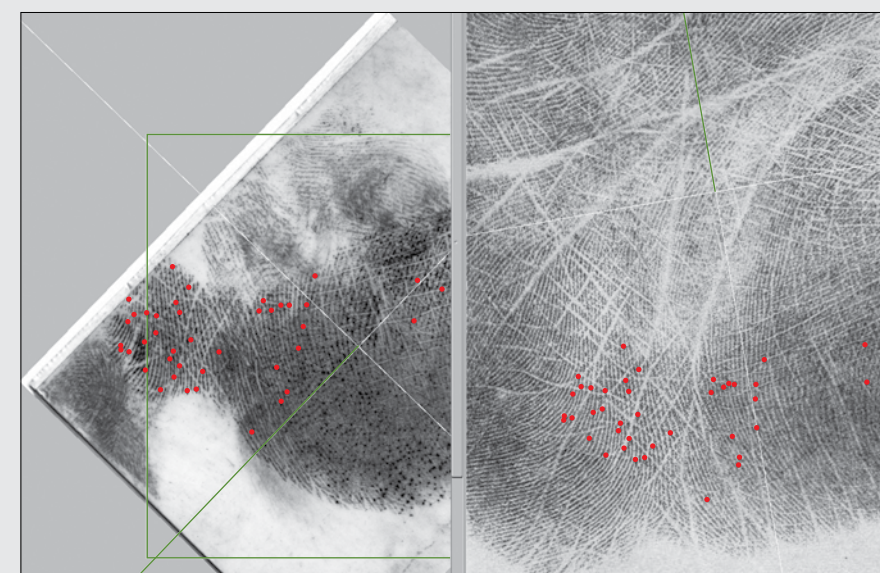

Identification of a latent palmprint of unknown orientation. Both the latent and the known print are of low quality.

IDENTIFICATION OF THE DEAD

Establishment of correct identity of the dead is one of indispensible duties that the AFIS is required to perform.

PAPILLON AFIS utilizes a differential approach to the process of submitting and comparing tenprints which contain finger impressions of live persons and those created for the deceased. This meticulous approach allows us to achieve maximum efficiency at matching for both.
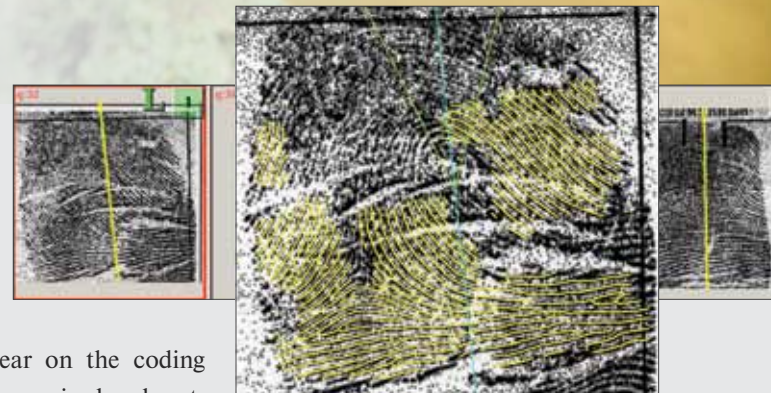
Generally speaking, due to some objective reasons the fingerprints of deceased persons are often of a very poor quality like that of latents lifted at crime scenes.

That is why the *tenprint-to-tenprint* search may be unproductive since the algorithm of this type of searches is optimized for speedy handling of automatically coded impressions from regular registration tenprint cards.

To assure reliability of searches performed for tenprints of unknown dead, PAPILLON AFIS uses additionally two fingerprints, mostly of the best quality, which are coded and treated as latent prints ("quasi latents" in PAPILLON's terminology).

These quasi latents are kept within the tenprint card file and also saved as independent objects for which *latent-to-tenprint* searches are conducted.

Thus the tenprint of the unknown dead participates in searches of two types and therefore has candidates determined by both *tenprint-to-tenprint* and *latent-to-tenprint* matching processes.

The procedure of coding quasi latents is similar to that of regular latent prints and consists in creating a skeleton image of the ridge pattern, though this operation is less time-consuming for the expert since the images have already been automatically processed once the tenprint was scanned.

❙ Quasi latents appear on the coding screen with a reference axis already set, 'bad' zones excluded and a skeleton extracted. The operator has only to review the results of this automatic coding and to revise if necessary.

This special approach to the identification of deceased persons provides an effective and reliable medium for establishing a conclusive and positive identification against fingerprints of these individuals stored in AFIS databases, without adding more complexity to the matching algorithm, thereby maintaining the highest speed of automatic *tenprint-to-tenprint* regular searches.

Interesting 'Idents' Made by PAPILLON AFIS
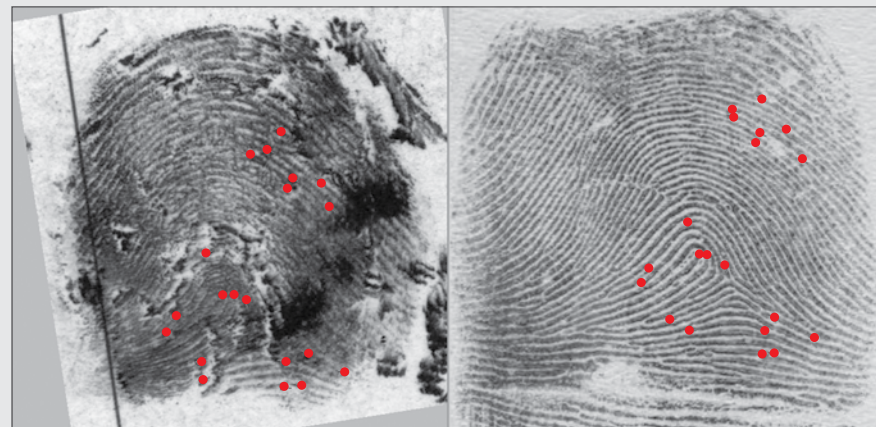
❙ *Fingerprints of a dead body found in a bog were identified with the individual's tenprint made 22 years ago when the man was young. The impression of the 7th finger was submitted as a quasi latent.*
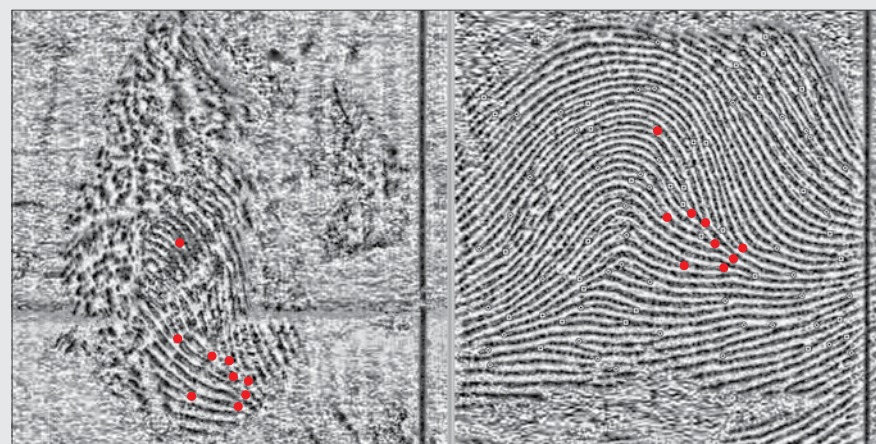
❙ *The dead body of a gunman shot during a special counter-terrorist operation was identified by file search of his fingerprints.*

EXPRESS ID CHECKS – A DEDICATED TYPE OF FINGERPRINT SEARCHES

Express ID check is a software application integrated with PAPILLON AFIS to provide fast, accurate and proven identification of fingerprints submitted from remote locations through IP communication channels.

In-the-field identity check using portable PAPILLON DPP-6p

A search inquiry submitted for rapid identification contains live-scan fingerprints of a person in question.

The express ID check capability allows law enforcement officers to immediately identify persons suspected in crimes or those who are unwilling or unable to provide details of themselves. It is also used to identify wanted criminals and those who use forged ID documents, to verify on-the-spot the identity of refugees, migrants and other categories of citizens as well as the authenticity of personal data they produce.

Neither special knowledge nor skills in fingerprinting are required to conduct express ID checks. This job can be done by any officer duly authorized.

PAPILLON's Express ID Check application automatically packages and transmits fingerprint data to AFIS databases for matching, generates search results and transmits them back to the requestor. In case of positive fingerprint identification, the feedback delivers valuable information, including demographics and mug shots (if any) from all tenprints found in the AFIS database as associated with the person in question.

The Express ID Check technology has been developed since 2001. The advanced matching algorithm implemented in the latest PAPILLON AFIS release has boosted the speed of express search tenfold as compared to its previous version.

In large-scale PAPILLON AFISs, there is a dedicated module which is responsible for fast processing of express ID check inquiries. Its computational power is calculated so that the entire procedure of express ID checking — from fingerprint capture to receiving of search results — be completed within 1-3 minutes it normally takes to check documents attesting identity, provided that up-to-date fast communications are used.

To date, nearly 2,000 PAPILLON's terminals throughout Russia are used to conduct express ID checks against national, regional and interregional AFIS databases accommodating hundreds of thousands to tens of millions of tenprint records.

Ever since the Express ID Check technique was put in operation, no case of false identification has occurred, i.e. when the individual's fingerprints would be identified with somebody else's tenprint, which proves high selectivity of this search type.

Data can be transmitted to AFIS databases over existing communication channels running IP:

❙ LAN

❙ Dial-up

❙ Cellular (GSM, UMTS (3G))

❙ Synchronized uplink

❙ WiFi

❙ Bluetooth

The PAPILLON Express ID Check software is designed to run independently or to be integrated with other biometric applications on devices of the following series:

❙ Livescan Enrollment and Express ID Check Station on the base of PC and PAPILLON fingerprint scanner

❙ Multifunctional Livescan Station PAPILLON MDS 45

❙ Portable Livescan Station for Fingerprint-based Booking and Express ID Checks PAPILLON MKDS

❙ Portable Biometric Terminal PAPILLON DPP-6p

❙ Handheld mobile devices PAPILLON DPP-4.5/4.5M

PAPILLON AFIS is ready for further advances in the Express ID Check technology – automatic reception of fingerprints (captured, for instance with PAPILLON DPP-6p mobile terminals) for not only to provide real-time identification of individuals in the field but to vet people for their complicity in any crime by conducting high-speed searches against databases of unsolved latents.

SYSTEM ARCHITECTURE

The architecture of PAPILLON AFIS is based on the client-server model that allows workstations to independently request the server for service functions.

Distributed computing underlies the matching process, thereby enabling the efficient solution of large computational tasks.

In large-scale systems, the server's jobs such as data acceptance and storage, searches and communication are distributed between:

- Main AFIS server and matchers
- Data storage subsystem
- Communication server
- Express ID check server and matchers

For systems with modest throughput requirements, the server's functions are performed by a single server or distributed among workstations.

The data storage subsystem comprises a requisite number of disk storage units and an Oracle server intended to extract text data from the AFIS database and to keep it in a separate database that is open for interacting with external SQL systems over web browsers.

The sever software runs under the Linux operating system. Developed with the Qt widget toolkit, the client software is designed as a cross-platform application to be run on both Linux and Windows. UTF-8 is used as a default character encoding which makes the localization to other languages fast and easier, avoiding the need of code page switching.

PAPILLON AFIS runs in a wide variety of hardware configurations, which relies on a database size, expected throughput capacity and the number of remote terminals that would communicate with the AFIS asking for services.

When designing new projects, only most reliable equipment produced by reputed manufacturers and the latest achievements in data storage, information security and process control are used.

Vast experience gained for two decades in system design allows PAPILLON to offer solutions that are optimal in terms of cost and functionality. These solutions ensure the most efficient use of computing resources as well as system scalability and upgrades at a minimal cost.

Twenty-four-hour unattended operation is made possible owing to the fault-tolerant technologies which allow for redundancy of critical components and enable automatic data backup.

PAPILLON's backup strategy ensures automatic recovery of databases and search results after any data loss event and in cases of emergency including power blackouts.

PAPILLON AFIS system administrator's responsibilities include:

- User management
- Database access control (including remote access privileges)
- User's activities monitoring
- Database management
- Search processes monitoring
- Security management
- Data import/export monitoring
- System routine audits and statistics gathering
- Creating and updating picklists of values used to ensure accuracy and uniformity while entering text data.

PAPILLON AFIS supports connectivity via secured TCP/IP networks with:

- Remote PAPILLON AFIS workstations and systems capable of maintaining their local databases and transmitting data to central AFIS for matching
- Fingerprint systems of other vendors to exchange data with PAPILLON AFIS in ANSI/NIST format
- Stationary or mobile terminals for fingerprint enrollment and express ID checks
- Portable handheld terminals for rapid identification by flat or rolled finger impressions
- Mobile devices for in-the-field identification of latent prints.

DATABASE OPERATIONS

Although any or all resources and information stored in the PAPILLON AFIS database can be fast and easily accessed through a dedicated application interface, the access thereto, for security reasons, is restricted with privilege levels assigned to users by the system administrator.

The database is segmented into divisions according to the types of objects saved therein. The user can select segments of interest provided that he has relevant permissions.

Upon completion of a user session, the system saves the status of the window and restores it next time the user opens a new session.

The on-screen lists of database objects as well as candidate lists and hit logs are refreshed immediately the user chooses the update option, thereby retrieving the most actual information anytime.

PAPILLON AFIS provides a comprehensive set of tools for making various selections, for filtering and sorting objects and seeking for any information stored in the database.

There is also a capability to edit text data associated with a tenprint or latent, to return any object for re-coding and re-matching, if needed. The history of all changes ever happen is saved together with objects.

The authorized user can print out or save in a file any text or image data from the database, gather statistics for the number and quality of objects in the database, and initiate export operations to transmit data to other AFIS systems that support PAPILLON's or ANSI/NIST formats.

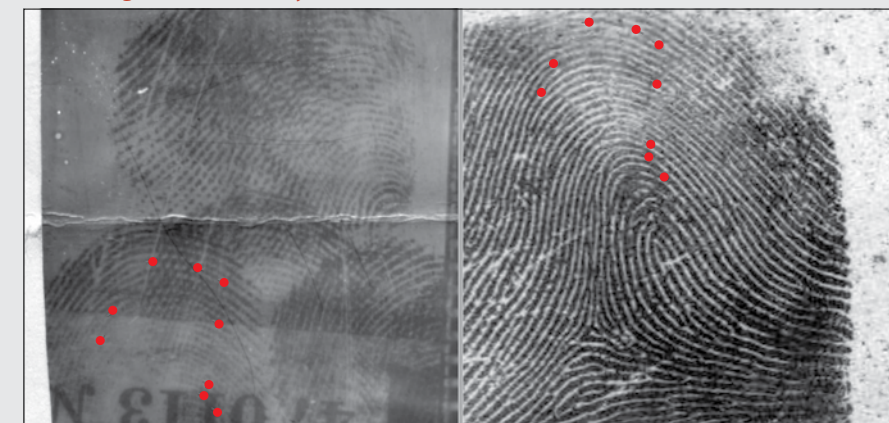Results of *tenprint-to-tenprint* searches include every match found by the matching process, i.e. cases when both demographics and fingerprints are matched, when only fingerprints or only demographics are matched with the submitted tenprint. This helps to reveal facts of deliberate distortion of personal data, to solve cases of identity theft, to find duplicated tenprints and also to correct other data-entry errors.

During verification, the search print is displayed beside each candidate print for visual analysis, both images being automatically rescaled and oriented uniformly. Using handy tools provided for side-by-side comparison, the fingerprint expert needs the minimum of time to examine short candidate lists and to decide whether or not it is a true match (a Hit).

Mobile versatile professional station PAPILLON-M coming with PAPILLON AFIS software enables remote access to AFIS databases using wire or wireless communication lines.

Interesting 'Idents' Made by PAPILLON AFIS

Identification of a latent fingerprint containing overlaid fragments of other latents and some alien image
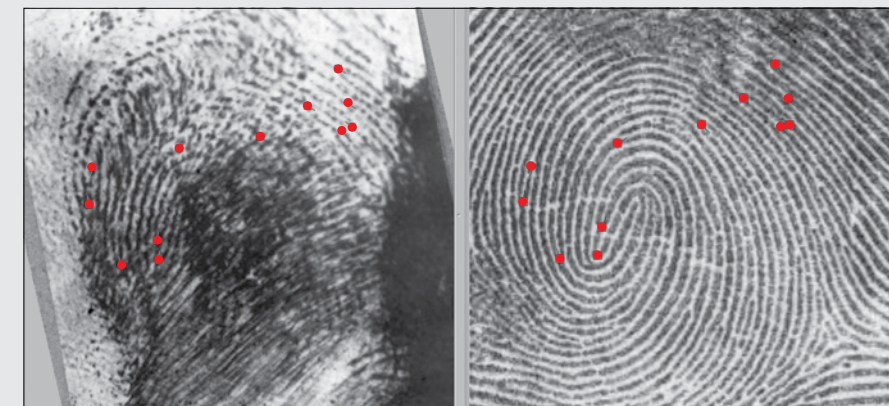
A latent fingerprint identified by a small legible fragment of the ridge pattern that is almost wholly smeared

"BULK" INPUT
TECHNOLOGY

When implementing an AFIS, the customer may hit a bottleneck – the necessity to convert a great number of paper tenprints accumulated for years into electronic format. It is a rather costly task that requires mobilization of enormous manpower and technical resources.

PAPILLON has developed, and now successfully uses, methods of stream scanning, allowing bulk conversion of paper cards into electronic tenprints.

This bulk technology is based on ad hoc high-speed scanners fitted with automatic document feeders and capable of scanning both sides of the paper simultaneously (duplex scanning). With PAPILLON's special software application, the image files captured in such a way are then automatically distributed among operators' workstations for further processing and insertion into the database.

High productivity of these scanning stations allows data-entry operators to avoid loss of time they sustain when using flatbed scanners. This software-based solution ensures the balanced workload of the agency's staff, thereby enabling electronic databases of any size to be created within the shortest possible time.

Images of latent impressions and tenprints of the dead (those taken by means of special postmortem record strips) are acquired with flatbed scanners bundled with PAPILLON AFIS workstations.

This bulk entry technology has allowed the PAPILLON company to convert 50 million tenprint cards within the shortest time and to create the world's biggest database as part of the nationwide project for a computerized fingerprint data bank implemented by the Russian Ministry of the Interior.

The breakthrough technology of bulk entry of tenprint data brings advantages to PAPILLON AFIS customers from the very first days after installation, because the systems are put into operation with ready-made databases and candidate lists produced at the time of conversion.

Interesting 'Idents' Made by PAPILLON AFIS
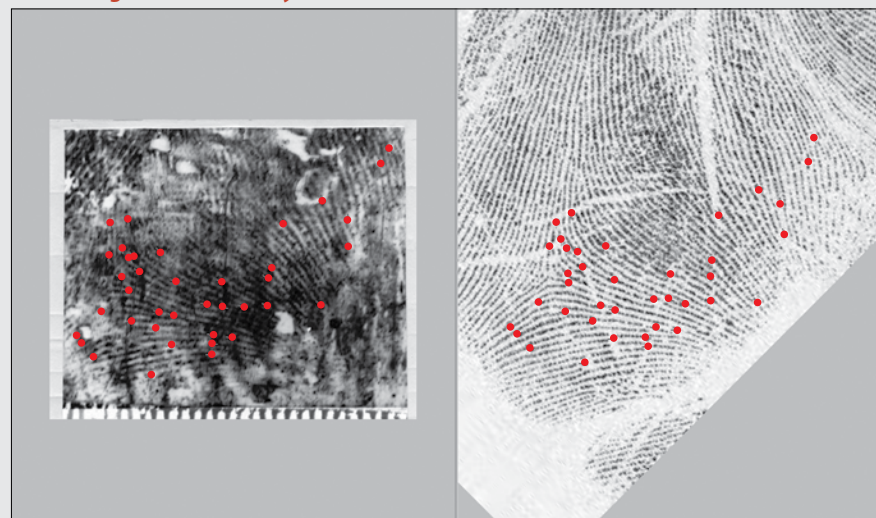
A latent palmprint that deceptively looks like a fingerprint was identified owing to submitting it in two copies – one as a latent fingerprint, the other as a latent palmprint
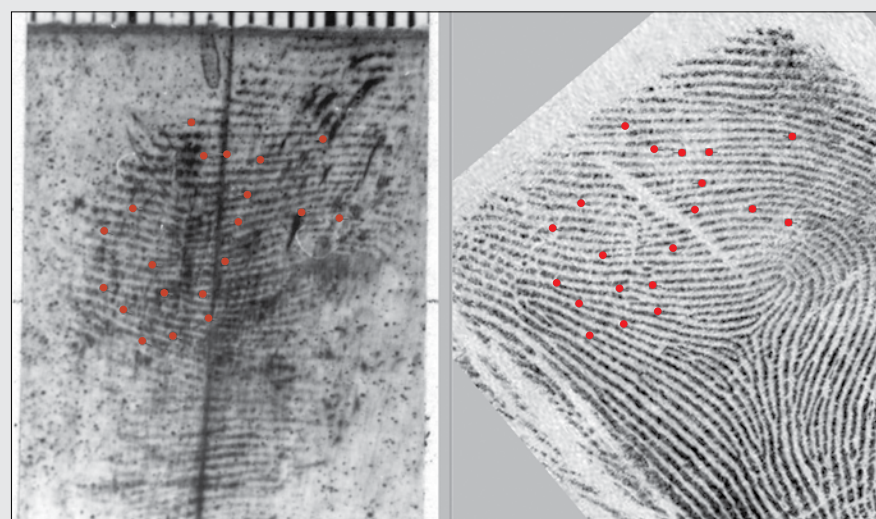
A latent fingerprint that deceptively looks like a palmprint was identified owing to submitting it in two copies – one as a latent palmprint, the other as a latent fingerprint
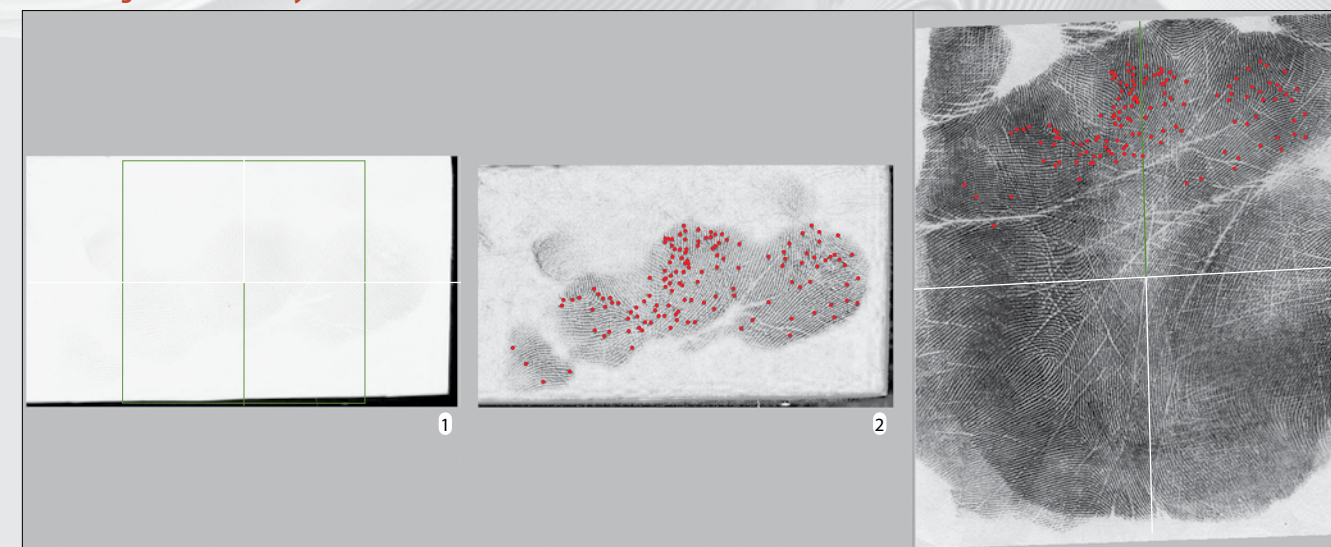
Identification of a latent palmprint having indefinite vertical aspect. The source image (1) is hardly visible. The image was enhanced by use of tools the AFIS provides for the process (2).

DACTYLOSCOPY HAS A SPECIAL STATUS
IN THE RAPIDLY DEVELOPING BIOMETRIC ENVIRONMENT.

IT IS AS OLD AS THE WORLD AND ALWAYS IN DEMAND, NOW EMBODIED IN MODERN AFIS TECHNOLOGIES.

Emerged as forensic systems for solving crimes, AFISs are now more widely used in document fraud applications, physical access control and other biometric projects.

In the foreseeable future, no other biometric technology can compare with dactyloscopy by the amount of accumulated information, by the relative simplicity of creating automated data banks and versatility of their applications.

War on terrorism, border and migration control, passport and visa issue services, transport safety, voluntary fingerprint registration of citizens, election campaigns, social security programs, identification of victims after anthropogenic, natural and military disasters, and other problems of contemporary society dictate the necessity to use AFIS technology for accurate and rapid identification and verification of identity.

In Russia, PAPILLON's AFIS technology was chosen as the basis for integrated multi-level nationwide system of fingerprint records by the Ministry of the Interior (AFIS-MOI), solving in addition to the forensic tasks those of voluntary and compulsory fingerprint enrollment.

This national AFIS comprises a central site (federal level) that maintains a database of more than 50 million tenprints, 80 complexes of interregional and regional level and more than 2000 peripheral AFIS sites and stations for electronic fingerprinting and express ID checks. In 2012-2013 alone, the AFIS-MOI helped Russian law enforcers to identify more than 200,000 individuals involved in committing crimes and to establish identity of more than 20,000 unidentified corpses.

PAPILLON AFIS systems are installed in central offices and departments of the Russian Federal Migration Service, Federal Penitentiary Service, the Federal Customs Service, the Federal Drug Control Service, the Federal Security Service, the Ministry of Defense of Russia.

Each AFIS project implemented by PAPILLON in Russia or abroad is unique, and it is impossible to provide a detailed description of each of them in the limits of this informational-advertising material.

What is common to all projects implemented by PAPILLON is close and effective cooperation with its customers, successful adaptation of AFIS technology to any specific requirement, and enrichment of PAPILLON's arsenal with new unconventional engineering and programming solutions.

And, of course, the highest possible efficiency of searches surpasses all users' expectations. It is not at all surprising for us that forensic experts sometimes refuse to believe their own eyes when they obtain superb identification results for absolutely unidentifiable latents, exclaiming: «It's not possible!».

Possible!

If you use PAPILLON AFIS...

CONTENTS

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