Brief History of ADIS Papillon

Neural Network Analysis of Recommendation Lists in ADIS Papillon-9

Modernization Period

Average fingerprint match rate per year: - ADIS-7 → Baseline - ADIS-8 → +10–11% increase in trace identifications

Transition to Papillon-8 software increased search efficiency at unchanged operating cost.

Brief History of ADIS Papillon

The first version appeared in 1992. By the late 1990s, it was already recognized in Russia and entered the international market.

Despite being almost ten years younger than foreign AFIS systems, Papillon quickly became a competitive global player — often outperforming older systems by key identification metrics.

To achieve this, developers: 1. Used a complete topological method for describing papillary patterns. 2. Created high-precision algorithms for fingerprint encoding and comparison. 3. Provided full compensation for deformations and scale changes. 4. Achieved the maximum possible automation for data input. 5. Applied distributed computing technology for searches.

Over 30 years of continuous improvement, several milestones mark qualitative leaps in effectiveness.

1997 — ADIS Papillon-7 The world’s first AFIS working with palmprints as well as fingerprints.

Worked under Linux OS with scalable architecture and remote access. Recommended by the Russian Ministry of Internal Affairs (MIA) as the standard regional AFIS. Transition from fingerprint-only to palm-enabled AFIS increased efficiency by 20–35%.

ADIS-7 formed the foundation for Russia’s national AFIS system: - Full automation of MIA fingerprint records (2002–2007) - Integrated AFIS-MIA network (2008–2011) → 82 AFIS complexes, 155 million fingerprint cards, 5 million traces → 18–20% of all input traces identified annually (~120,000 matches)

In 2001, remote real-time identification technology was added.

2011 — ADIS Papillon-8 Summed up 10+ years of R&D;, adding: - Full automation of fingerprint card encoding - Simplified trace encoding - New algorithms for deceased-person fingerprint cards - Faster real-time checks

By 2020, ADIS-8 included: - Multibiometric format (fingerprints, face, iris, signature, reserve fields) - New algorithms for papillary pattern encoding/comparison - New search type: comparing latent traces to reference impressions

Modernization projects showed +10–11% improvement in search results after migration from ADIS-7 to ADIS-8 software.

2017 — ADIS Papillon-9 Inherited all strengths of ADIS-8 and added: - More advanced encoding/comparison algorithms - Much faster automated comparisons - Automatic encoding of palmprints - New search types: - Palm–palm - Face–face - Iris–iris - Real-time checks by: - Fingerprints - Face - Iris - Hand traces - Neural network–based Recommendation List Reduction Module (KSR) — “Papillon-ADIS-9-NeuroExpert”

Application of neural network algorithms on live AFIS databases achieved a new level of automation and effectiveness.

AI technology solidified Papillon’s leadership in the global AFIS market. No evidence exists of similar AI integration in competitors’ systems.

Recommendation List Reduction (KSR) in ADIS-9

The KSR module (Papillon-ADIS-9 NeuroExpert) allows: 1. Huge reduction of operator workload in reviewing lists 2. Minimization of missed genuine matches (“native candidates”) 3. Discovery of missed genuine matches beyond visible list parts 4. Increased identification rates for poor-quality or complex traces

How it works: - Runs after ADIS search completes. - Compares the query with all ADIS candidates $\rightarrow$ generates a neural index. - A positive index = high likelihood of kinship; absence = non-match. - Neural net analyzes the entire list, including deep hidden parts. - Modified list marks likely matches with neural indices.

Efficiency

Use of the KSR module: - Increases ADIS-9 performance by 6–7% - Reduces expert time per identification dozens of times

Statistical summary: - ≈99.5% of true matches retained in visible lists (miss rate ≤0.5%) - Traditional operator accuracy ≈98% - True-to-false ratio: 1:2 with KSR vs 1:50–1:100 traditionally - Adds 3.5–5% new matches found in hidden list history (up to 256th position)

ADIS-9 with neural add-on provides dual automatic control: - Produces extended candidate lists (hundreds or thousands) - Neural net auto-reviews lists, ensuring selectivity - Operator handles only the final stage (high-probability candidates)

Next goal: increase gain to 12–13% by: - Reducing missed true matches to 0.1% - 10× deeper history analysis

Future ADIS-10 will include these neural technologies by default — AI will perform expert-level tasks autonomously.

ADIS-9 + NeuroExpert in Russian MIA (Republic of Crimea)

Implementation: - Delivered end of 2022 - Results analyzed Feb 2023

During 1.5 months: - 500 latent traces processed - Experts reviewed ~7,500 pairs (15 per trace) → 136 matches - Neural net reviewed visible lists + hidden histories → flagged 327 pairs - Experts reviewed those → 141 matches total (+3.7%) - No missed true matches - False candidate review time reduced 40×

Conclusion: NeuroExpert enabled a 40-fold reduction in manual review time with a 3.7% performance gain.

Examples of Matches Found by Neural Net Beyond Visible Lists

- Trace divided into three small fragments; genuine match at 167th position. - Poor-quality trace with six false features out of 17 encoded; match at 26th position. - Deformed trace with wrong orientation; match at 56th position.

Expert Opinion (MIA Chelyabinsk Region): “With KSR, an expert can rely on the neural index as an independent authoritative opinion — especially valuable for complex or ambiguous cases. Previously, such cases required consulting a second expert.”

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