NEUROtechnologija

Biometrical and
Artificial Intelligence
Technologies

About

- ● **17 years of experience**
- ● **Proven technologies**
- ● **Customers in 60+ countries**

Neurotechnologija provides algorithms and software development products for biometric fingerprint and face recognition, computer-based vision and object recognition to security companies, system integrators and hardware manufacturers. System integrators and sensor providers in more than 60 countries license and integrate Neurotechnologija's technology into their own products.

Drawing from years of academic research in the fields of neuroinformatics, image processing and pattern recognition, Neurotechnologija was founded in 1990 in Vilnius, Lithuania and released its first fingerprint identification system in 1991. Since that time Neurotechnologija has released more than 40 products and version upgrades for both identification and verification of objects and personal identity.

With a combination of fast algorithms and high reliability, Neurotechnologija's fingerprint and face biometric technologies are used for access and attendance control, computer security, banking and law enforcement applications, among others.

Neurotechnologija's fingerprint identification algorithms have shown outstanding results for reliability in several biometric competitions, including FVC 2006 and FpVTE 2003. Neurotechnologija algorithm has been certified by NIST as MINEX compliant.

Neurotechnologija also performs research in artificial intelligence (AI) and mobile autonomous robotics fields. In 2007 a technology for computer-based vision and object recognition was released to be used in a variety of applications including image search engines, security systems, manufacturing and robot and machine vision.

Technology Awards

Neurotechnologija has participated in major fingerprint technology competitions to obtain independent evaluation of their algorithms in comparison with other algorithms in the market. Neurotechnologija's fingerprint identification algorithm consistently has shown one of the best results for reliability in several biometric competitions, including the International Fingerprint Verification Competition and the National Institute of Standards & Technology (NIST) Fingerprint Vendor Technology Evaluation, where Neurotechnologija ranked among the top five companies for accuracy in single-finger tests.

- In 2007 NIST certified Neurotechnologija's MegaMatcher algorithm as **MINEX Compliant**. The Minutiae Interoperability Exchange Test (MINEX) evaluates fingerprint template encoding and matching to determine compliance with the U.S. government's Personal Identity Verification (PIV) program for the identification and authentication of Federal employees and contractors. MegaMatcher is one of only 12 algorithms worldwide to receive full MINEX certification for both fingerprint template encoding and matching. This certification puts MegaMatcher SDK into the U.S. government buyers' certified list of fingerprint recognition algorithms.

- Neurotechnologija's algorithm achieved one of the best reliability results in the Middle Scale Test among participants in the Fingerprint Vendor Technology Evaluation **(FpVTE 2003)** conducted by the National Institute of Standards & Technology (NIST) on behalf of the Justice Management Division (JMD) of the US Department of Justice .

- Neurotechnologija algorithms achieved **the highest ranking** in the Fingerprint Verification Competition **(FVC2006)** when using the most realistic benchmark for real-world biometric applications, "Average Zero FMR." Neurotechnologija also won four gold medals, two silver and two bronze medals in the FVC2006 Open Category and took second place in the FVC2006 Light Category (according to the Average Zero FMR benchmark) with one gold and four bronze medals there. Neurotechnologija had also shown perfect results in the previous competitions (FVC2000, FVC2002 and FVC2004) and had received numerous gold, silver and bronze medals there.

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MegaMatcher

- ● Reliable multi-biometric technology
- ● NIST MINEX compliance
- ● Rolled, flat and latent fingerprint matching
- ● Multiplatform scalable cluster architecture
- ● Biometric standards and WSQ support
- ● Support for webcams and 30+ fingerprint scanners

The **MegaMatcher multi-biometric technology** is designed to meet large scale biometrical identification and verification needs. The technology includes a set of specific features that make it very attractive for **large-scale face-fingerprint systems** and **AFIS** integrators:

- ● **Multi-biometrics.** Fingerprint and facial recognition engines can be used separately or together in a large-scale system for more reliable identification results.
- ● **Reliability.** The fused face-fingerprint identification algorithm assures high reliability even when using large databases.
- ● **Ready-to-use network components** are included in MegaMatcher for rapid system development.
- ● **Effective price/performance ratio.** MegaMatcher based systems use PCs with Microsoft Windows and Linux operating systems as computational units.

Specifications

Fused face-fingerprint identification algorithm	
Matching speed	up to 400,000 persons per second*
Size of one record in database	300-6,000 bytes for each fingerprint, 2,284 bytes for each face
Maximum database size	unlimited

Facial recognition engine	
Minimal face image size	640 x 480 pixels
Single face processing time	about 0.2 seconds*
Matching speed	up to 500,000 faces per second*

Fingerprint recognition engine	
Fingerprint resolution	500 dpi
Single fingerprint processing time	0.2-0.4 seconds*
Matching speed	up to 60,000 fingerprints per second*

* All speeds are given for a single PC with Pentium4 CPU running at 3GHz

MegaMatcher SDK

MegaMatcher SDK provides a set of tools
for the development and integration of scalable network-based and web-based biometrical identification systems, including:

- Web banking systems
- Border control systems
- Forensic systems
- National-scale voting systems
- And other systems where fast and accurate authentication is required

MegaMatcher SDK is multiplatform and supports Microsoft Windows (32 and 64 bit) and Linux (32 and 64 bit) operating systems. Available SDKs:

- **MegaMatcher 2.0 Light SDK** for developing a client/server based multi-biometric face-fingerprint identification product.

- **MegaMatcher 2.0 SDK** for developing a large-scale network-based AFIS or multi-biometric identification product.

SDK component	MegaMatcher Light SDK	MegaMatcher SDK
MegaMatcher 2.0 feature extraction and matching algorithm	+	+
Ready-to-use software		
MegaMatcher Cluster Server and Cluster Node software		+
MegaMatcher Server software	+	+
Development tools, components and samples		
MegaMatcher Client components	+	+
Fingerprint segmentation, classification and template conversion modules	+	+
Database and fingerprint scanners support modules	+	+
Sample applications	+	+

MegaMatcher SDK 30 days trial is available at **www.neurotechnologija.com**

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VeriFinger

VeriFinger algorithm follows the commonly accepted fingerprint identification scheme, which uses a set of specific fingerprint points (minutiae). However, VeriFinger also contains many proprietary algorithmic solutions that enhance the system performance and reliability:

- **Adaptive image filtration** algorithm eliminates noises, ridge ruptures and stuck ridges, and enables the reliable extraction of minutiae even from poor quality fingerprints.
- **Tolerance to fingerprint translation, rotation and deformation.**
- **Fast identification** (1:N) and verification (1:1).
- **Features generalization** during enrolment for even more reliable identification.
- **Algorithm optimization** modes for 30+ fingerprint scanners.

- **Fast fingerprint identification technology for PC and Mac**
- **NIST and FVC2006 proven reliability**
- **Support for 30+ fingerprint scanners**
- **Multiplatform**
- **Programming samples for numerous languages**

Specifications

Fingerprint resolution	> 250 dpi 500 dpi recommended
Fingerprint processing time	0.2 - 0.4 sec*
Matching speed	40,000 fp/sec*
Template size	150 bytes – 1.8 kbytes
Database size	unlimited

* for a PC with 3GHz Pentium 4 processor

VeriFinger SDK

VeriFinger SDK provides tools for developing and integrating a wide range of fingerprint identification systems, including:

- Access control
- Attendance control
- Customer relationship management (CRM)
- PC biometrical logon
- Identity verification

VeriFinger SDK is intended for biometric system developers and integrators. It allows the rapid development of biometric applications for **Microsoft Windows**, **Linux** and **Mac OS X** platforms. VeriFinger can be easily integrated into a customer's security system. The integrator completely controls SDK data input and output; therefore, SDK functions can be used in connection with **any scanner, any database** and **any user interface**.

SDK component	Windows	Linux	Mac OS X
VeriFinger feature extraction and matching algorithm	+	+	+
Fingerprint scanner drivers	+	+	+
C/C++ programming samples	+	+	+
Sun Java 2 programming sample	+	+	
C#, VB 6, VB .NET, VBA, Delphi 6 programming samples	+		

Supported fingerprint scanners under Microsoft Windows: DigitalPersona U.are.U 2000 and 4000; Cross Match Verifier 300; Identix DFR 2080, 2090 and 2100; Green Bit DactyScan 26; TST Biometrics BiRD 3; Futronic FS80 and eFAM (FS84); NITGEN Fingkey Hamster I and II; SecuGen Hamster III, IV and Plus; BioLink U-Match MatchBook; Testech Bio-I; Digent Izzix 1000; UPEK TouchChip TCRU1C and TCRU2C; LighTuning LTT-C500; Atmel FingerChip; Tacoma CMOS; BiometriKa FX 2000, FX 3000 and HiScan; Startek FM200; AuthenTec AF-S2, AES4000 and AES2501B; Fujitsu MBF200.

Supported fingerprint scanners under Linux: Futronic FS80 and eFAM (FS84); SecuGen Hamster III; BioLink U-Match MatchBook v.3.5; Tacoma CMOS; BiometriKa FX 2000, FX 3000 and HiScan; Startek FM200; AuthenTec AF-S2 and AES4000; Fujitsu MBF200.

Supported fingerprint scanners under Mac OS X: Futronic eFAM (FS84); Tacoma CMOS; Startek FM200; AuthenTec AF-S2 and AES4000; Fujitsu MBF200.

VeriFinger Algorithm demo and 30 days SDK trial are available at **www.neurotechnologija.com**

VeriLook

- **Face identification technology**
- **High speed and reliability**
- **Multiple face processing**
- **Support for most cameras and webcams**
- **Multiplatform**

The **VeriLook** face identification algorithm and Software Development Kit are designed for biometric system integrators. VeriLook offers capabilities of the most advanced and convenient face identification systems at a reasonable cost:

- Fast and accurate face localization for reliable detection of **multiple faces** in **still images** as well as in **live video streams**.
- **Simultaneous multiple** face processing and identification from a single frame.
- **Fast matching** of face templates for handling identification task with large databases of faces.
- **Small face template size** for VeriLook-based applications to handle large databases of faces.
- **False Rejection Rate varying from 1% to 5%**, depending on configured FAR, camera type and lighting conditions.
- **Features generalization mode** for combining features from several templates to improve the reliability of matching without affecting the template size.

Specifications

Faces' detection time	less than 0.1 sec*
Features' extraction time	less than 0.2 sec*
Matching speed	100,000 faces/sec*
Face template size	2.3 Kbytes

*   For a PC with 3GHz Pentium 4 processor

VeriLook SDK

VeriLook SDK provides tools for developing and integrating a wide range of facial identification systems, including:

- Access control
- Attendance control
- Customer relationship management (CRM)
- PC biometrical logon
- Identity verification

VeriLook SDK allows rapid development of the biometric applications using functions from the VeriLook library for **Microsoft Windows**, **Linux** and **Mac OS X** platforms. VeriLook can be easily integrated into a customer's security system. The integrator has complete control over SDK data input and output; therefore, SDK functions can be used in connection with **any camera** and **any database**. The integrator could develop **any user interface**.

SDK content:

- Interfaces for image input from files and cameras
- Camera Manager library for simultaneous capture from multiple cameras
- Sample applications with source code for:
  - C/C++
  - C#
  - Visual Basic 6
  - Visual Basic .NET
  - Delphi 7
- Documentation

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Embedded

For embedded environments Neurotechnologija created the FingerCell algorithm for fingerprint recognition and the FaceCell algorithm for facial recognition. Both algorithms are designed for use in various embedded or mobile hardware, smart phones, PDA, handheld computers and other devices.

- **Fast identification**
- **Low system requirements**
- **Multiplatform**
- **Ability to use in multibiometric applications**
- **Suitable for mixed PC and embedded solutions**
- **Portable code**

Key features of the FingerCell algorithm:

- **Low speed processors are supported**
- **Identification capability**
- **Image processing speed**
- **Compact software**
- **Portable ANSI C code**

Key features of the FaceCell algorithm:

- **Identification capability**
- **Simultaneous multiple face processing and identification**
- **Easy integration**
- **Portable ANSI C code**

Specifications

FingerCell	
Enrolment time	< 1 sec *
Verification time	0.5 sec *
Matching speed	up to 700 fp/sec *
Template size	300–600 bytes
Minimal processor speed	75 MHz
RAM required for code and data arrays	400 kilobytes

* For a device with 200 MHz ARM family processor

FaceCell	
Minimal image size	320 x 240 pixels
Minimal face size	150 x 150 pixels
Enrolment time	1-2 seconds*
Verification time	1-2 seconds*
Matching speed	3,000 faces/sec*
Database record size	2.3 Kbytes

* For iPAQ Pocket PC with XScale PXA270 processor running at 416 MHz

Embedded products

FingerCell EDK (Embedded Development Kit) enables developers to create embedded or heterogeneous embedded/PC fingerprint identification solutions. FingerCell EDK is available as several types of development kits for small or large-scale projects:

- **FingerCell Library EDK** - intended for embedded or mobile biometric system projects using hardware, based on ARM processors.

- **FingerCell Source Code EDK** - intended for embedded or mobile biometric system projects using third party or custom hardware. This EDK includes FingerCell algorithm source code that is written in ANSI C and can be easily ported to other platforms.

FaceCell EDK (Embedded Development Kit) enables developers to create embedded or heterogeneous embedded/ PC face identification solutions. FaceCell EDK is available as several types of development kits for small or large-scale projects:

- **FaceCell Library EDK** - intended for embedded or mobile biometric system projects using hardware, based on ARM processors.

- **FaceCell Source Code EDK** - intended for embedded or mobile biometric system projects using third party or custom hardware. This EDK includes FaceCell algorithm source code that is written in ANSI C and can be easily ported to other platforms.

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Smartcard

- Fast verification
- Enhanced security
- Standards support

A common fingerprint or face recognition system stores, retrieves and matches biometric information on the biometrical sensor side of the system. Fingerprint and face matching on smartcard technology stores the original unique template on the smartcard and performs template matching in a microprocessor embedded in the card. This method ensures that personal biometric information does not transfer to an external computer as it would in a more basic template-on-card system.

Finger and face matching on smartcard provides a number of advantages over simple smartcard or fingerprint/face identification systems:

- **Enhanced security.** Two-factor authentication checks both the validity of the smartcard and the identity of the person presenting the card.
- **Privacy.** The original template remains on the smartcard, providing a safeguard against misuse of information or fraudulent scanning systems.
- **Fast verification.** The matching algorithm performs verification on the card in few seconds.
- **Configurable algorithm.** The algorithm can be configured to give priority to accuracy or speed and memory usage.
- **Multiplatform.** PC-side development components for Microsoft Windows and Linux platforms are available.
- **Easy integration.** Implementing the system will not require major overhauls of existing infrastructure, as the add-on is developed utilizing a set of ISO/IEC standards (7816-3, 7816-4, 7816-11 and 19794-2) to enable interoperability with and easy integration into existing smart card and/or biometrical systems.

Smartcard products

The **Smartcard Finger-Match Add-On** allows to integrate storage and verification of fingerprint templates on a JavaCard to existing biometric systems based on **VeriFinger SDK** or **MegaMatcher SDK**.

The **Smartcard Face-Match Add-On** allows to integrate storage and verification of face templates on a JavaCard to existing biometric systems based on **VeriLook SDK** or **MegaMatcher SDK**.

The add-ons are developed utilizing a set of ISO/IEC standards to enable interoperability with and easy integration into existing smart card and/or biometrical systems.

Add-ons include the following components:

- JavaCard components:
  - On-card fingerprint/face biometric APIs.
  - Off-card terminal sample.

- PC-side development components:
  - Library for communication with a smartcard. Wrapper for .NET is included.
  - Only Smartcard Finger-Match Add-On: library for fingerprint template conversion between VeriFinger and ISO/IEC 19794-2:2005 Finger Minutiae Card formats (MegaMatcher SDK already includes such library). Wrapper for .NET is included.
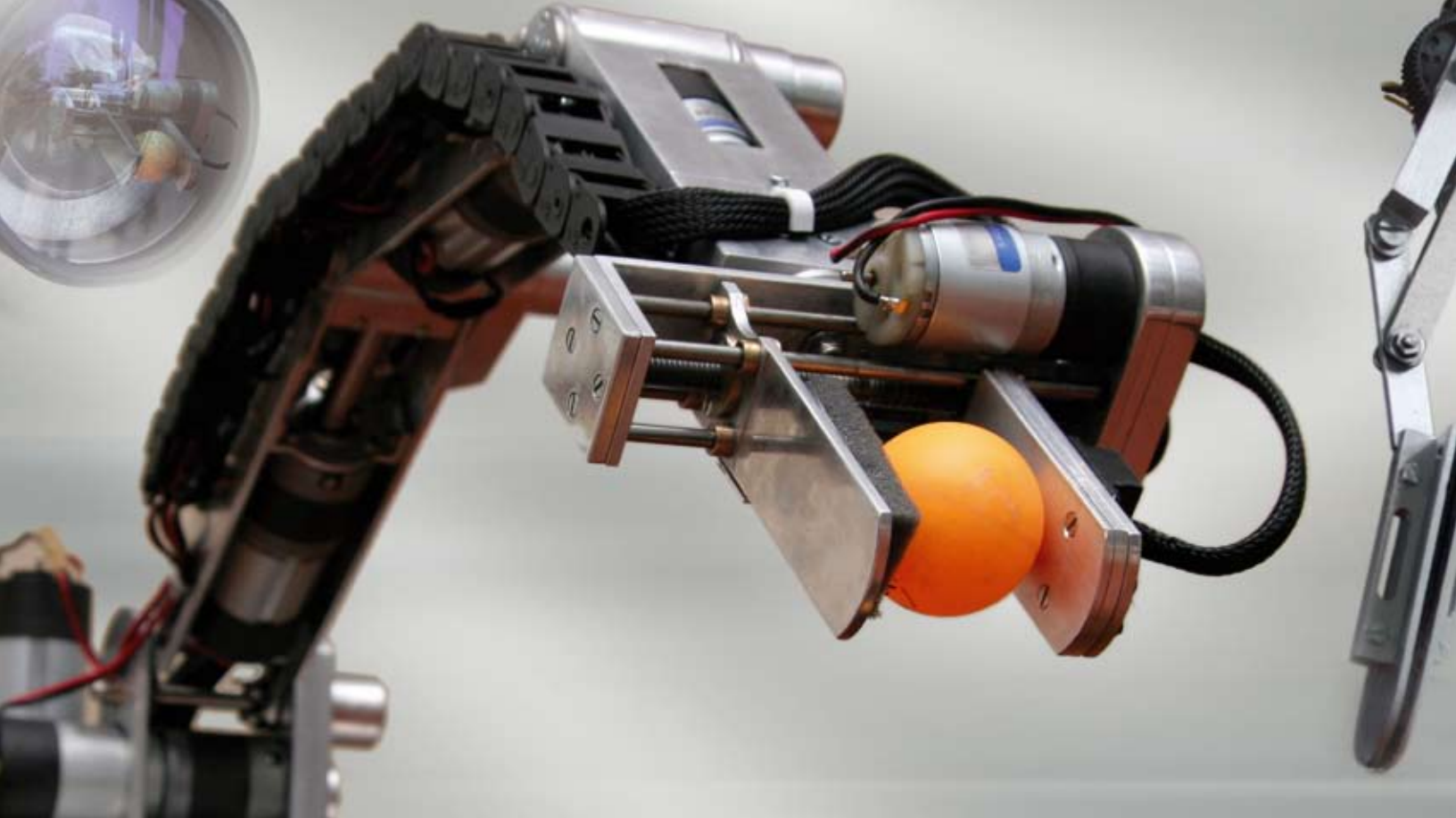 - Samples showing how to perform fingerprint/face enrollment on and verification with a smartcard:

    Samples for Microsoft Windows:
    - Enrollment sample console application (written in C).
    - Verification sample console application (written in C).
    - Enrollment and verification sample GUI application (written in C#).

    Samples for Linux:
    - Enrollment sample console application (written in C).
    - Verification sample console application (written in C).

- Documentation

SentiSight

Neurotechnologija's SentiSight technology is intended for developers who want to use computer vision-based object recognition in their applications. SentiSight enables the learning of objects and searching for learned objects in the images from almost any camera, webcam, still picture or live video. Some of the potential applications for SentiSight technology include:

- **Object recognition technology**
- **Suitable for robotic vision**
- **Real time processing**
- **Webcam capable**

- Search engines that recognize objects in picture files (either local or on the Web)
- Security systems
- Parts recognition in production lines
- Robot vision
- Road sign recognition
- Machine vision

Key features of SentiSight technology:

- **Universal.** The SentiSight algorithm is designed to be as universal as possible. It can support web cameras, surveillance cameras and can input images from the picture. It is tolerant to object scale, rotation, pose etc.

- **Fast.** SentiSight can process video streams in real time, so it can be used for real-time applications.

- **Webcam capable.** Though high quality cameras will provide better recognition quality, a simple webcam is enough for SentiSight operation.

Specifications

Recommended image size	320 x 240 pixels
Static background extraction and object mask separation	20 frames/sec
Learning: processing of single objects' frame	0.05 sec
Recognition speed from image frame for single object model (including processing of the image)	~ 10 frames/sec
Recognition speed from image model for single object model (excluding processing of the image)	~ 20 models/sec

* All performance evaluations were performed using a PC with 2.4 GHz Intel Core2 Duo CPU

SentiSight SDK

SentiSight SDK is intended for developers who want to use computer vision-based object recognition in their applications. SentiSight SDK enables manual and fully automatic object learning as well as simultaneous multiple object detection and recognition in an easy, yet versatile, way.

SentiSight can be easily integrated into a customer's system. The developer has complete control over SDK data input and output; therefore SDK functions can be used in connection with most cameras (including webcams), with any database and with any user interface.

SentiSight SDK includes Camera Manager Library for Microsoft Windows that allows simultaneous capture from multiple cameras. The SDK also includes a library to aid in handling video files.

SentiSight SDK includes:

- SentiSight learning and recognition algorithm;
- C/C++ programming tutorials and sample;
- C# programming tutorials;
- SentiSight SDK documentation.