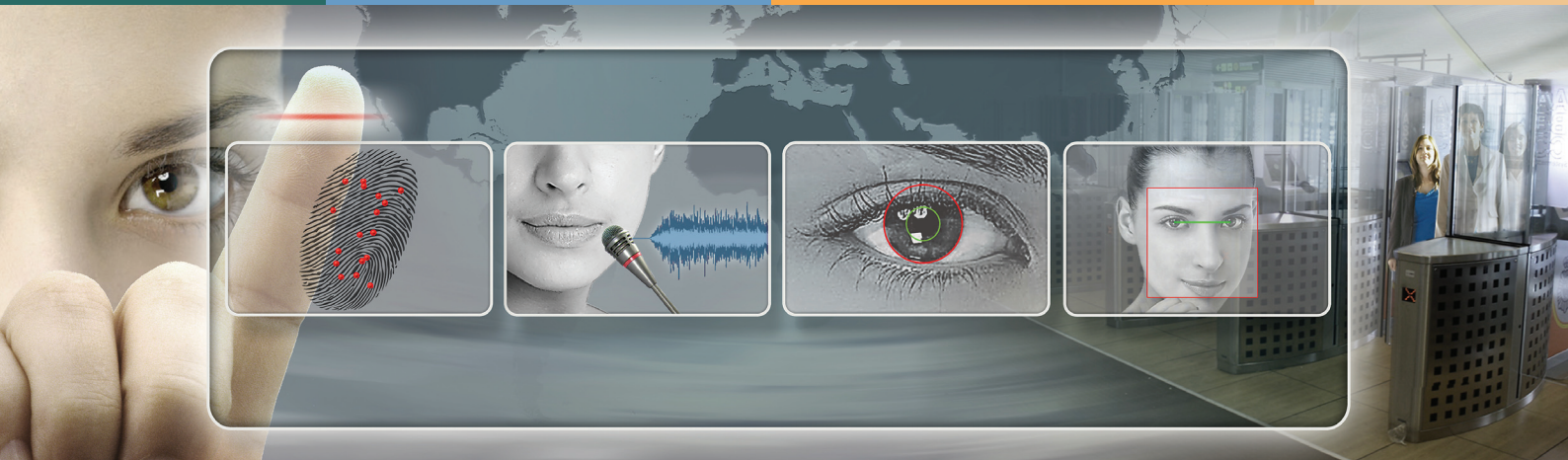




NEUROtechnology



Large-scale
AFIS and
multi-biometric
identification

MegaMatcher SDK



MegaMatcher SDK

Large-scale AFIS and multi-biometric identification

Document updated on **February 8, 2017**

Contents

MegaMatcher algorithm features and capabilities	3
High productivity system architecture	5
Contents of MegaMatcher 9.0 Standard SDK and Extended SDK	11
Fingerprint components description	14
Face components description	19
Voice components description	24
Iris components description	26
Palm print components description	29
Matching Server component description	30
Supported fingerprint scanners under Microsoft Windows	31
Supported fingerprint scanners under Linux, Mac OS X and Android	32
Supported face capture cameras	33
Supported iris capture cameras	34
Basic recommendations for facial recognition	35
Basic recommendations for speaker recognition	37
System requirements and supported development environments	39
Technical specifications	46
Reliability testing results	49
MegaMatcher SDK Trial and related products	56
Licensing MegaMatcher SDK	57
Prices for MegaMatcher products	60

MegaMatcher technology is designed for large-scale AFIS and multi-biometric systems developers. The technology ensures high reliability and speed of biometric identification even when using large databases.

MegaMatcher is available as a software development kit that allows development of large-scale single- or multi-biometric fingerprint, iris, face, voice or palm print identification products for Microsoft Windows, Linux, Mac OS X, iOS and Android platforms.

- Proven in national-scale projects, including passport issuance and voter deduplication.
- NIST MINEX-compliant fingerprint engine, NIST IREX proven iris engine.
- Includes fingerprint, iris, face, voice and palm print modalities.
- Rolled, flat and latent fingerprint matching.
- BioAPI 2.0 and other ANSI and ISO biometric standards support.
- Multiplatform, scalable architecture for parallel matching.
- Effective price/performance ratio, flexible licensing and free customer support.



MegaMatcher algorithm features and capabilities

Performance numbers are provided for a PC with Intel Core i7-4771 processor (3.5 GHz).

MegaMatcher includes fingerprint, facial, speaker, iris and palm print recognition engines along with a fused algorithm for fast and reliable identification in large-scale systems.

The fingerprint, face, voice and iris identification algorithms may each be used separately to develop AFIS, automated face, speaker or iris identification systems.

The biometric software engines contain many proprietary algorithmic solutions that are especially useful for large-scale identification problems. These solutions were specifically developed for MegaMatcher, incorporating aspects of the VeriFinger, VeriLook, VeriSpeak and VeriEye algorithms. Some of these solutions are listed in the fingerprint, face, voice and iris biometric identification engine descriptions below.

MegaMatcher fingerprint template extraction and matching engine

- **Full MINEX Compliance.** NIST has recognized MegaMatcher fingerprint algorithm as MINEX compliant and suitable for use in personal identity verification (PIV) program applications.
- **Rolled and flat fingerprints matching.** The MegaMatcher fingerprint engine matches rolled and flat fingerprints **between themselves**. Conventional “flat” fingerprint identification algorithms perform matching between flat and rolled fingerprints less reliably due to the specific deformations of rolled fingerprints. MegaMatcher allows flat-to-flat, flat-to-rolled or rolled-to-rolled fingerprint matching with a high degree of reliability and accuracy. The algorithm matches up to 200,000 flat fingerprint records per second on a single PC.
- MegaMatcher includes fingerprint **image quality determination**, which can be used during enrollment to ensure that only the best quality fingerprint template will be stored in the database.
- MegaMatcher is **tolerant to fingerprint translation, rotation and deformation**. It uses a proprietary fingerprint matching algorithm that identifies fingerprints even if they are rotated, translated or have deformations.
- **Adaptive image filtration** algorithm eliminates noises, ridge ruptures and stuck ridges, and reliably extracting minutiae from even the poorest quality fingerprints in less than 1 second.

MegaMatcher face template extraction and matching engine

- **Tolerance to face position** assures a level of enrollment convenience. MegaMatcher allows for 360 degrees head roll. Head pitch can be up to 15 degrees in each direction from the frontal position. Head yaw can be up to 45 degrees in each direction from the frontal position. See technical specifications for more details.
- **Reliable face detection** assures accurate enrollment from cameras, webcams and various scanned documents; faces may be enrolled from the scanned pages of passports or other types of documentation. When there are **multiple faces** present in a video or an image, they may be enrolled and processed simultaneously. Person's **gender**, facial feature points and basic **emotions** can be optionally detected.
- **Age estimation.** MegaMatcher can optionally estimate person's age by analyzing the detected face.
- **Facial attributes recognition.** MegaMatcher can be configured to detect certain attributes during the face extraction – **smile, open-mouth, closed-eyes, glasses, dark glasses, beard and mustache**.
- **Live face detection.** A conventional face identification system can be tricked by placing a photo in front of the camera. MegaMatcher is able to prevent this kind of security breach by determining whether a face in a video stream is “live” or a photograph. The liveness detection can be performed in passive mode, when the engine evaluates certain facial features, and in active mode, when the engine evaluates user's response to perform actions like blinking or head movements. See recommendations for live face detection below for more details.
- The biometric template record can contain **several face samples belonging to the same person**. These samples can be enrolled from different sources and at different times, thus allowing improvement in matching quality. For example a person might be enrolled with eyeglasses and without, or with different types of eyeglasses; with and without beard or mustache, etc.



MegaMatcher voice template extraction and matching engine

- **Text-dependent** voice matching engine determines if a voice sample matches the template that was extracted from a specific phrase. During enrollment, one or more phrases are requested from the person being enrolled. Later that person may be asked to pronounce a specific phrase for verification. This method assures protection against the use of a covertly recorded random phrase from that person.
- **Two-factor authentication with a passphrase** is performed when a person is asked to say a **unique phrase** (such as passphrase or an answer to a “secret question” that is **known only by the person** being enrolled). The overall system security increases as both voice authenticity and password are checked.
- **Text-independent** voice matching engine uses different phrases for user enrollment and recognition. This method is more convenient, as it does not require each user to remember the passphrase. It may be combined with the text-dependent algorithm to perform faster text-independent search with further phrase verification using the more reliable text-dependent algorithm.
- **Automatic voice activity detection.** The engine is able to detect when users start and finish speaking.
- **Liveness detection.** A system may request each user to enroll a set of unique phrases. Later the user will be requested to say a specific phrase from the enrolled set. This way the system can ensure that a live person is being verified (as opposed to impostor who uses voice recording).
- **Several voice records with the same phrase** may be stored to improve speaker recognition reliability. Certain natural voice variations (i.e. hoarse voice) or environment changes (i.e. office and outdoors) can be stored in the same template.

MegaMatcher iris template extraction and matching engine

- **NIST IREX proven reliability.** MegaMatcher iris matching engine is based on VeriEye, recognized by NIST as one of the most reliably accurate iris recognition algorithms available.
- **Fast matching.** The iris matching speed is up to **200,000 comparisons per second** on a single PC. See “technical specifications” section for more details.
- **Robust iris detection.** Irises are detected even when there are obstructions to the image, visual noise and/or different levels of illumination. Lighting reflections, eyelids and eyelashes obstructions are eliminated. Images with narrowed eyelids or eyes that are gazing away are also accepted.
- **Automatic interlacing detection and correction** results in maximum quality of iris feature templates from moving iris images.
- **Correct iris segmentation** is obtained even when perfect circles fail, the centers of the iris inner and outer boundaries are different, iris boundaries are definitely not circles and even not ellipses or iris boundaries seem to be perfect circles.



High Productivity System Architecture

MegaMatcher SDK is intended for large-scale AFIS / ABIS projects and includes specialized **components** and **biometric engines** for biometric data capture, template extraction and matching. Some of the components are designed to provide high performance during large number of requests and/or large databases with millions of biometric templates, whereas others provide easy deployment on client sites for a reasonable price. Also, certain components are intended for building systems with lower performance requirements.

MegaMatcher SDK provides easy system **scalability** and allows to start a biometric system from one or two computers/servers system at the beginning, with further scaling up together with project capacity and speed requirements by using components with higher capabilities or adding more installations of the component connected to the same system.

These system architectures and components are usually used for specific projects:

- **Template creation on client-side and matching on server-side** – recommended for AFIS, border control, various ID issuing systems, such as passports, ID cards, voter registration.
- **Template creation and matching on server side** – recommended for online banking, government e-services and other mass scale systems, in which requests can be submitted by any device or computer.
- **Deduplication after all users data collected** – recommended for ID issuing systems, which have previously collected biometric data, such as voter or population registry cleaning.
- **Template creation and matching on the same computer or device** – recommended for stand-alone deployments like desktop or mobile, civil or forensic identification system.

See the next pages for detailed descriptions of these architectures.

A combination of the mentioned architectures and components can be also used within a large-scale biometric system to reach optimal performance and/or availability.

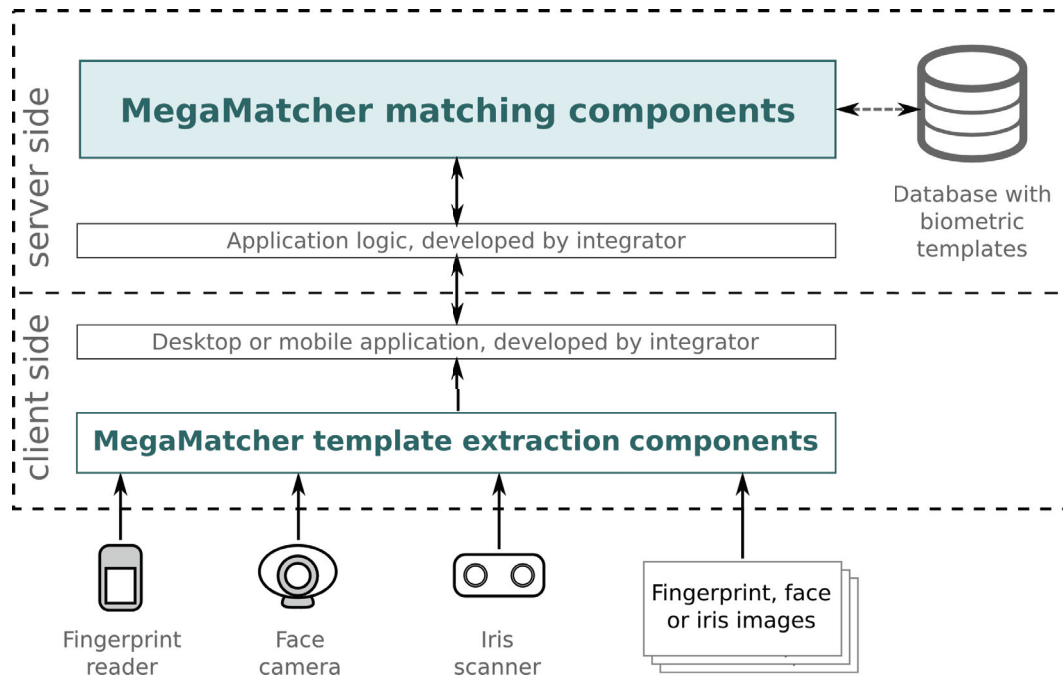
MegaMatcher Automated Biometric Identification System, an integrated multi-biometric **solution** for national-scale identification projects, can be also considered. The solution can be **customized** by Neurotechnology for specific project needs. See www.neurotechnology.com/megamatcher-abis.html for more information.

See Product Advisor at www.neurotechnology.com/product-advisor.html to find out what Neurotechnology products and components will best suit your project requirements.



Template creation on client-side and matching on server-side

This is the most often used architecture for AFIS / ABIS, border control, various ID issuing systems, such as passports, ID cards or voter registration. It is suitable for various systems, ranging from small LAN-based systems to national-scale projects. The chart below shows the key components need for this architecture.



MegaMatcher template extraction components are used by integrators to **develop** client-side desktop or mobile applications. The components include all necessary functionality and performance for biometric data **capture** and template **extraction** for sending them to the server-side. The applications **deployment** needs only additional licenses for the corresponding components for each computer or device running the application.

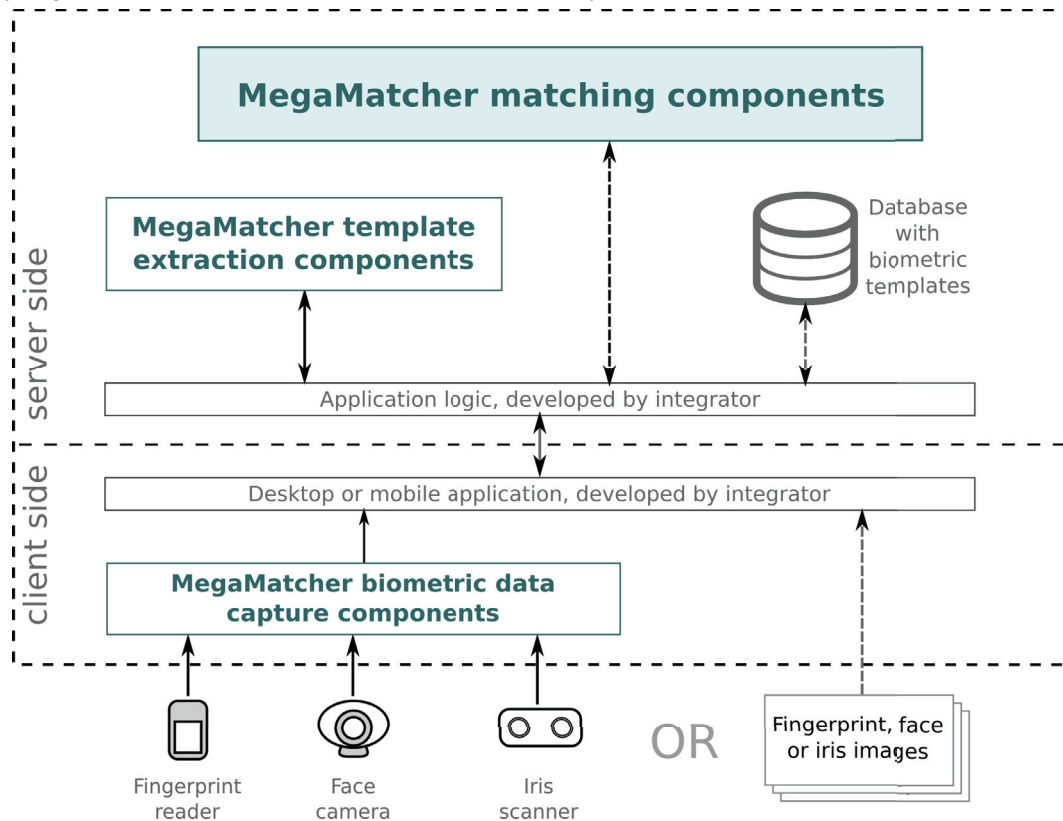
MegaMatcher matching components can be easily **scaled up** at any time for higher performance based on the project requirements. The matching components are provided as **ready-to-use** Matching Server or MegaMatcher Accelerator 9.0 units with **biometric engines** for matching fingerprint, face and iris templates.

See page 10 for more information about scalable server-side components.



Template creation and matching on server side

This architecture is designed to be used for biometric systems, which need to process requests from a very large number of clients in scenarios like **online banking** or **government e-services**, as well as other mass scale systems with very large number of users. The chart below shows the key components needed for this architecture.



MegaMatcher biometric data capture components provide necessary functionality for **client-side** applications, which **acquire** biometric images from scanners or cameras and send them to the server-side for further template extraction. Applications deployment needs only additional licenses for the corresponding components for each computer or device running the application.

Integrators can also implement image capture by themselves and send images to the server-side part of the system. In this case client-side applications deployment does not need any licenses for Neurotechnology components.

MegaMatcher template extraction components are deployed on the server-side of the biometric system. The integrators need to **develop** application logic, which will operate with the template extraction components.

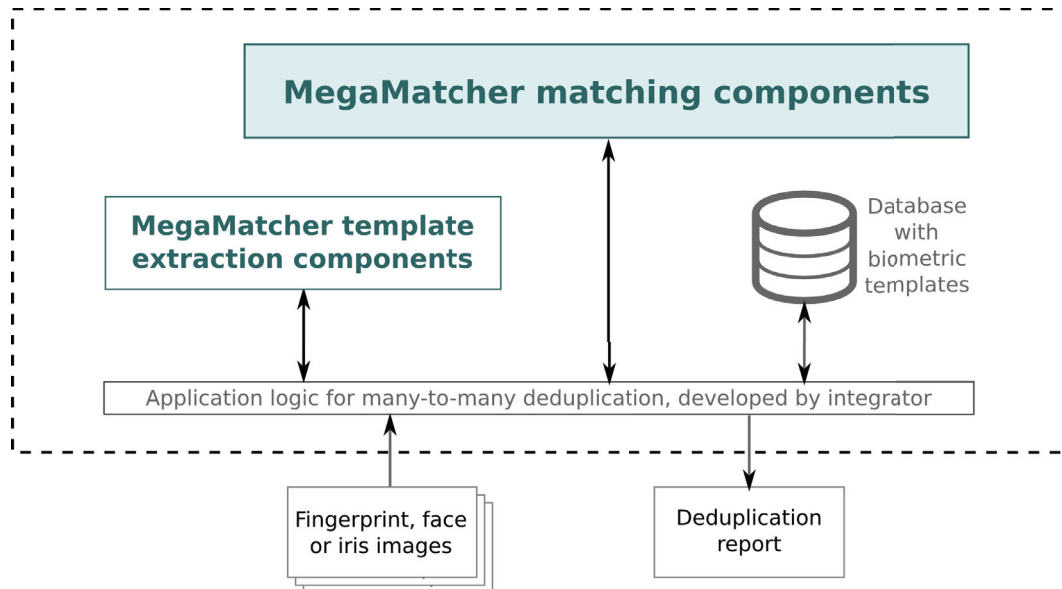
MegaMatcher matching components can be easily **scaled up** at any time for higher performance based on the project requirements. The matching components are provided as **ready-to-use** Matching Server or MegaMatcher Accelerator 9.0 units with **biometric engines** for matching fingerprint, face and iris templates.

See page 10 for more information about scalable server-side components.



Deduplication after all users data collected

This architecture is intended for large-scale projects, like **voter registration** or **population registry cleaning**, when users' biometric data collection is done in two steps. First, the biometric data is captured on multiple sites, which are not connected to the central database. Later, the biometric data from all sites is submitted to the central database and checked for duplicates. The chart below shows the key components need for this architecture.



MegaMatcher template extraction components may need to be deployed on the server-side, as usually the biometric data is captured as fingerprint, face or iris images, which need to be processed into biometric templates. The integrators need to **develop** application logic, which will operate with the template extraction components.

MegaMatcher matching components can be easily **scaled up** at any time for higher performance based on the project requirements. The components are provided as **ready-to-use** Matching Server or MegaMatcher Accelerator units with **biometric engines** for matching fingerprint, face and iris templates. Integrators will need to develop **simple application logic** for sending the biometric templates for for many-to-many deduplication and generating the duplicates search report. Note, that database deduplication task requires a lot of computational resources, as it needs to compare every biometric template with every other biometric template in a database.

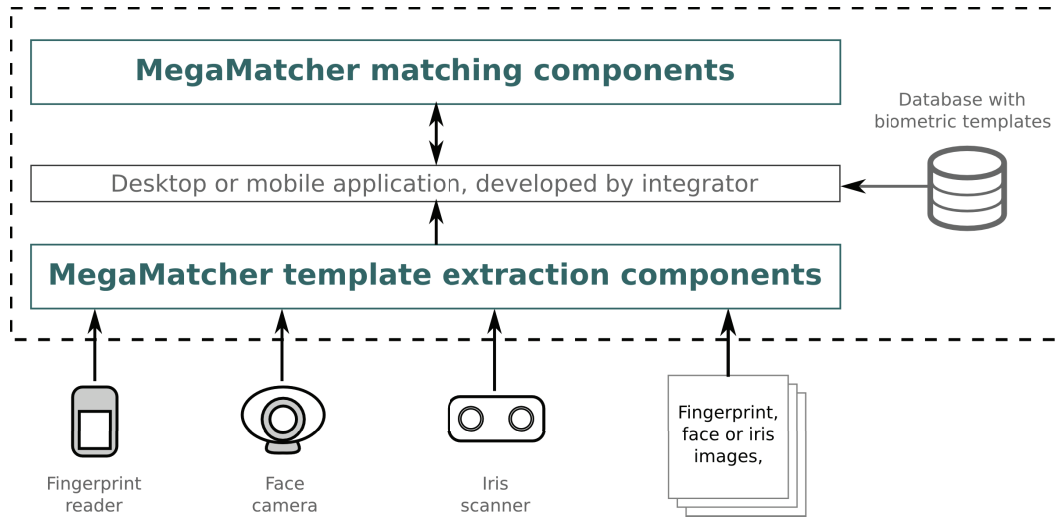
You may also consider the **Deduplication Service**, which provides results for a reasonable price without the need to develop a solution. See www.neurotechnology.com/duplicates-search-service.html for more information.

See page 10 for more information about scalable server-side components.



Template creation and matching on the same computer or device

This architecture is designed for **stand-alone** biometric systems, which need to perform all tasks locally on the same computer or mobile device. The chart below shows the key components need for this architecture.



MegaMatcher template extraction and matching components are used by integrators to **develop** stand-alone biometric applications for desktop or mobile platforms. The components provide all necessary functionality and performance for biometric data **capture**, template **extraction**, multi-biometric **identification** or **verification**, as well as support for biometric standards and formats.

The applications **deployment** requires only licenses for the used biometric components.

Smaller systems can be also developed with single-biometrics SDKs. See *page 56* for more information.



MegaMatcher server-side template extraction components

Template extraction components for server-side			
	Fingerprints	Faces	Irises
Fast Extractor	3,000 fingerprints per minute	3,000 faces per minute	3,000 irises per minute

MegaMatcher scalable server-side matching components

MegaMatcher matching components are provided as **ready-to-use** Matching Server or MegaMatcher Accelerator 9.0 units with **biometric engines** for matching fingerprint, face and iris templates:

- The Matching Server is intended to be used in **moderate** size systems like local AFIS or multi-biometric system which do not have strict requirements on performance or availability. Matching Server software is provided with MegaMatcher 9.0 Standard SDK.
- MegaMatcher Accelerator 9.0 is a solution for **large-scale** AFIS and multi-biometric projects, which is available as Development Edition, Standard and Extended versions. The MegaMatcher Accelerator includes **cluster** software to enable system **scalability**, high **availability** and **fault tolerance**. MegaMatcher Accelerator software is provided with MegaMatcher 9.0 Extended SDK.

Template matching components performance and scalability				
		Fingerprints	Faces	Irises
Matching Server with Matcher engines	Database capacity	Unilimited	Unilimited	Unilimited
	Matching speed	40,000 fingerprints per second	40,000 faces per second	40,000 irises per second
Matching Server with Fast Matcher engines	Database capacity	Unilimited	Unilimited	Unilimited
	Matching speed	200,000 fingerprints per second	200,000 faces per second	200,000 irises per second
Cluster of MegaMatcher Accelerator 9.0 Development Edition with N units	Database capacity	$N \times 4,000,000$ fingerprints	$N \times 1,000,000$ faces	$N \times 5,000,000$ irises
	Matching speed	$N \times 1,000,000$ fingerprints per second	$N \times 1,000,000$ faces per second	$N \times 1,000,000$ irises per second
Cluster of MegaMatcher Accelerator 9.0 Standard with N units	Database capacity	$N \times 4,000,000$ fingerprints	$N \times 1,000,000$ faces	$N \times 5,000,000$ irises
	Matching speed	$N \times 35,000,000$ fingerprints per second	$N \times 35,000,000$ faces per second	$N \times 70,000,000$ irises per second
Cluster of MegaMatcher Accelerator 9.0 Extended with N units	Database capacity	$N \times 40,000,000$ fingerprints	$N \times 10,000,000$ faces	$N \times 50,000,000$ irises
	Matching speed	$N \times 100,000,000$ fingerprints per second	$N \times 100,000,000$ faces per second	$N \times 200,000,000$ irises per second

Recommendations:

- **MegaMatcher Accelerator Development Edition** has no limitations on cluster size, but in general it makes no sense to run more than **3 nodes** in the cluster, as the whole system will cost like one MegaMatcher Accelerator Standard unit while providing lower performance.
- **MegaMatcher Accelerator Standard** has no limitations on cluster size, but in general it makes no sense to run more than **2 nodes** in the cluster, as the whole system will cost like one MegaMatcher Accelerator Extended unit while providing lower performance and capacity.
- The matching speeds are provided for single-biometrics engines. If a template in a database contains multi-biometric entries, like fingerprint and face records belonging to the same person, the matching components will match proportionally lower number of persons' biometric database entries per second.



Contents of MegaMatcher 9.0 Standard SDK and Extended SDK

MegaMatcher SDK is intended for development of large-scale AFIS or multi-biometric identification products. Fingerprint, face, voice, iris and palm print recognition engines are included in MegaMatcher 9.0 SDK.

MegaMatcher 9.0 SDK includes server-side software and a set of modules for developing client-side applications. .NET components are included for rapid development of client-side software. MegaMatcher 9.0 supports **BioAPI 2.0**. To ensure system compatibility with other software, **WSQ** component is available, as well as modules for conversion between MegaMatcher template and biometric standards.

MegaMatcher 9.0 is suitable not only for developing **civil AFIS**, but also for **forensic AFIS applications**, as it includes an API for **latent fingerprint template editing**. Latent fingerprint template editing is necessary in order to submit a latent fingerprint (for example, one taken from a crime scene) for the identification into AFIS. Also MegaMatcher is able to **match rolled and flat fingerprints between themselves**.

There are these types of MegaMatcher 9.0 SDK:

- **MegaMatcher 9.0 Standard SDK** for developing a client/server based multi-biometric face-fingerprint and optionally iris identification product. This SDK is suitable for **network-based** and **web-based** systems with database size ranging from several thousand records up to million records. The SDK includes ready-to-use server-side software and a set of components for developing client-side applications on Microsoft Windows, Android, iOS, Linux and Mac OS X.
- **MegaMatcher 9.0 Extended SDK** for developing a large-scale network-based AFIS or multi-biometric identification product. The SDK includes all components of MegaMatcher 9.0 Standard SDK and MegaMatcher Accelerator software, which can be used for fault-tolerant **scalable cluster** software for fast parallel matching, processing high number of identification requests and handling databases with practically **unlimited size**. The SDK includes all components of MegaMatcher 9.0 Standard SDK, ready-to-use cluster server software and MegaMatcher Accelerator software. This SDK also allows to develop **network-based** and **web-based** systems.

The Standard and Extended SDKs are compared on the next page.

MegaMatcher 9.0 SDK includes programming samples and tutorials that show how to use the components of the SDK to perform fingerprint, face and iris template extraction or matching against other templates. The samples and tutorials are available for these programming languages and platforms:

	Microsoft Windows 32 & 64 bit	Linux 32 & 64 bit	Mac OS X	Android	iOS
Programming samples					
• C / C++	+	+	+		
• Objective-C					+
• C#	+				
• Visual Basic .NET	+				
• Sun Java 2	+	+	+	+	
Programming tutorials					
• C / C++	+	+	+		
• C#	+				
• Visual Basic .NET	+				
• Sun Java 2	+	+	+	+	



The table below compares MegaMatcher 9.0 Standard SDK and MegaMatcher 9.0 Extended SDK. See the licensing model for more information on specific license types.

	MegaMatcher 9.0 Standard SDK	MegaMatcher 9.0 Extended SDK
Fingerprint component licenses included with a specific SDK:		
• Fingerprint Matcher	1 single computer license	1 single computer license
• Embedded Fingerprint Matcher for Android	1 single computer license	1 single computer license
• Embedded Fingerprint Matcher for iOS	1 single computer license	1 single computer license
• Embedded Fingerprint Matcher for ARM Linux	1 single computer license	1 single computer license
• Fast Fingerprint Matcher	1 single computer license	1 single computer license
• Fingerprint Client ⁽¹⁾	3 single computer licenses	3 single computer licenses
• Embedded Fingerprint Client for Android	3 single computer licenses	3 single computer licenses
• Embedded Fingerprint Client for iOS	3 single computer licenses	3 single computer licenses
• Embedded Fingerprint Client for ARM Linux	3 single computer licenses	3 single computer licenses
• Fingerprint Extractor	1 single computer license	1 single computer license
• Embedded Fingerprint Extractor for Android	1 single computer license	1 single computer license
• Embedded Fingerprint Extractor for iOS	1 single computer license	1 single computer license
• Embedded Fingerprint Extractor for ARM Linux	1 single computer license	1 single computer license
• Fast Fingerprint Extractor	1 single computer license	1 single computer license
• Fast Fingerprint Segmenter	1 single computer license	1 single computer license
• Fingerprint Capturer	3 single computer licenses	3 single computer licenses
• Embedded Fingerprint Capturer for Android	3 single computer licenses	3 single computer licenses
• Embedded Fingerprint Capturer for iOS	3 single computer licenses	3 single computer licenses
• Embedded Fingerprint Capturer for ARM Linux	3 single computer licenses	3 single computer licenses
Face component licenses included with a specific SDK:		
• Face Verification component	1 single computer license	1 single computer license
• Face Matcher	1 single computer license	1 single computer license
• Embedded Face Matcher for Android	1 single computer license	1 single computer license
• Embedded Face Matcher for iOS	1 single computer license	1 single computer license
• Embedded Face Matcher for ARM Linux	1 single computer license	1 single computer license
• Fast Face Matcher	1 single computer license	1 single computer license
• Face Client ⁽²⁾	3 single computer licenses	3 single computer licenses
• Embedded Face Client for Android	3 single computer licenses	3 single computer licenses
• Embedded Face Client for iOS	3 single computer licenses	3 single computer licenses
• Embedded Face Client for ARM Linux	3 single computer licenses	3 single computer licenses
• Face Extractor	1 single computer license	1 single computer license
• Embedded Face Extractor for Android	1 single computer license	1 single computer license
• Embedded Face Extractor for iOS	1 single computer license	1 single computer license
• Embedded Face Extractor for ARM Linux	1 single computer license	1 single computer license
• Fast Face Extractor	1 single computer license	1 single computer license
• Fast Face Token Image	1 single computer license	1 single computer license
• Face Capturer	3 single computer licenses	3 single computer licenses
• Embedded Face Capturer for Android	3 single computer licenses	3 single computer licenses
• Embedded Face Capturer for iOS	3 single computer licenses	3 single computer licenses
• Embedded Face Capturer for ARM Linux	3 single computer licenses	3 single computer licenses

Notes:

(1) Fingerprint Client component includes Fingerprint Extractor, Fingerprint Segmenter, Fingerprint BSS and Fingerprint WSQ components, which may be also obtained separately.

(2) Face Client component includes Face Extractor, Face BSS and Face Token Image components, which may be also obtained separately.

Continued on the next page



	MegaMatcher 9.0 Standard SDK	MegaMatcher 9.0 Extended SDK
Iris component licenses included with a specific SDK:		
• Iris Matcher	1 single computer license	1 single computer license
• Embedded Iris Matcher for Android	1 single computer license	1 single computer license
• Embedded Iris Matcher for iOS	1 single computer license	1 single computer license
• Embedded Iris Matcher for ARM Linux	1 single computer license	1 single computer license
• Fast Iris Matcher	1 single computer license	1 single computer license
• Iris Client ⁽³⁾	3 single computer licenses	3 single computer licenses
• Embedded Iris Client for Android	3 single computer licenses	3 single computer licenses
• Embedded Iris Client for iOS	3 single computer licenses	3 single computer licenses
• Embedded Iris Client for ARM Linux	3 single computer licenses	3 single computer licenses
• Iris Extractor	1 single computer license	1 single computer license
• Embedded Iris Extractor for Android	1 single computer license	1 single computer license
• Embedded Iris Extractor for iOS	1 single computer license	1 single computer license
• Embedded Iris Extractor for ARM Linux	1 single computer license	1 single computer license
• Fast Iris Extractor	1 single computer license	1 single computer license
• Iris Capturer	3 single computer licenses	3 single computer licenses
• Embedded Iris Capturer for Android	3 single computer licenses	3 single computer licenses
• Embedded Iris Capturer for iOS	3 single computer licenses	3 single computer licenses
• Embedded Iris Capturer for ARM Linux	3 single computer licenses	3 single computer licenses
Voice component licenses included with a specific SDK:		
• Voice Matcher	1 single computer license	1 single computer license
• Embedded Voice Matcher for Android	1 single computer license	1 single computer license
• Embedded Voice Matcher for iOS	1 single computer license	1 single computer license
• Embedded Voice Matcher for ARM Linux	1 single computer license	1 single computer license
• Voice Client	3 single computer licenses	3 single computer licenses
• Embedded Voice Client for Android	3 single computer licenses	3 single computer licenses
• Embedded Voice Client for iOS	3 single computer licenses	3 single computer licenses
• Embedded Voice Client for ARM Linux	3 single computer licenses	3 single computer licenses
• Voice Extractor	1 single computer license	1 single computer license
• Embedded Voice Extractor for Android	1 single computer license	1 single computer license
• Embedded Voice Extractor for iOS	1 single computer license	1 single computer license
• Embedded Voice Extractor for ARM Linux	1 single computer license	1 single computer license
• Fast Voice Extractor	1 single computer license	1 single computer license
• Voice Capturer	3 single computer licenses	3 single computer licenses
• Embedded Voice Capturer for Android	3 single computer licenses	3 single computer licenses
• Embedded Voice Capturer for iOS	3 single computer licenses	3 single computer licenses
• Embedded Voice Capturer for ARM Linux	3 single computer licenses	3 single computer licenses
Palm print component licenses included with a specific SDK:		
• Palm Print Matcher	1 single computer license	1 single computer license
• Palm Print Client	1 single computer license	1 single computer license
Server-side matching component licenses included with a specific SDK:		
• Matching Server	+	+
• MegaMatcher Accelerator 9.0 Development Edition license		1 single computer license

Notes:

(3) Iris Client component includes Iris Extractor and Iris BSS components, which may be also obtained separately.



Fingerprint Components Description

Fingerprint Matcher

The Fingerprint Matcher performs fingerprint template matching in 1-to-1 (verification) and 1-to-many (identification) modes. Also the Fingerprint Matcher component includes fused matching algorithm that allows to increase template matching reliability by:

- matching templates that contain 2 or more fingerprint records (note that Fingerprint Segmenter or Fingerprint Client components are required to perform template extraction from images that contain more than one fingerprint);
- matching templates that contain fingerprint, face, voiceprint and/or iris records (note that matching faces, irises and voiceprints requires Face Matcher, Iris Matcher and Voice Matcher components correspondingly).

The Fingerprint Matcher component matches **40,000 fingerprints per second** and is designed to be used in **desktop** or mobile biometric systems, which run on PCs or laptops with at least Intel **Core 2 Q9400** (2.67 GHz) processor.

One Fingerprint Matcher license is included with MegaMatcher 9.0 Standard SDK and MegaMatcher 9.0 Extended SDK. More licenses for this component can be purchased any time by MegaMatcher 9.0 SDK customers.

Embedded Fingerprint Matcher

The Embedded Fingerprint Matcher has the same functionality, as the Fingerprint Matcher. It matches **3,000 fingerprints per second** and is designed to be used in **embedded** or **mobile** biometric systems, which run on **Android** or **iOS** or ARM Linux devices. The Android devices should be based on at least **Snapdragon S4** system-on-chip (**Krait 300** processor with 4 cores running at 1.51 GHz).

One Embedded Fingerprint Matcher license for each of Android, iOS and ARM Linux platforms is included with MegaMatcher 9.0 Standard SDK and MegaMatcher 9.0 Extended SDK. More licenses for this component can be purchased any time by MegaMatcher 9.0 SDK customers.

Fast Fingerprint Matcher

The Fast Fingerprint Matcher has the same functionality, as the Fingerprint Matcher. It matches **200,000 fingerprints per second** and is designed for **large-scale AFIS** and biometric systems, which run on high-end PCs or servers hardware with at least Intel **Core i7-4771** (3.5 GHz) processor.

Multi-biometric fused template matching can be achieved by combining the Fast Fingerprint Matcher component with Face, Voice and/or Iris Matchers (regular or fast versions of them can be used depending on project implementation).

One Fast Fingerprint Matcher license is included with MegaMatcher 9.0 Standard SDK and MegaMatcher 9.0 Extended SDK. More licenses for this component can be purchased any time by MegaMatcher 9.0 SDK customers.



Fingerprint Client

The Fingerprint Client component is a combination of the **Fingerprint Extractor**, **Fingerprint BSS**, **Fingerprint Segmenter** and **Fingerprint WSQ** components. It is intended for the systems that need to support most or all functionality of the mentioned components on the same PC. Using these licenses allows to optimize component license costs as well as reduce license management.

The Fingerprint Client extracts a single fingerprint template in **0.6 seconds**. The specified performance requires a **PC** or **laptop** with at least Intel **Core 2 Q9400** (2.67 GHz) processor.

Three licenses for the Fingerprint Client component are included with MegaMatcher 9.0 Standard SDK and MegaMatcher 9.0 Extended SDK. More licenses for this component can be purchased any time by MegaMatcher 9.0 SDK customers.

Embedded Fingerprint Client

The Embedded Fingerprint Client component has the same functionality, as the Fingerprint Client component and is designed to be run on **Android** or **iOS** or ARM Linux devices. The Android devices should be based on at least **Snapdragon S4** system-on-chip (**Krait 300** processor with 4 cores running at 1.51 GHz). The component extracts a single fingerprint template in **1.2 seconds**.

Three licenses for the Embedded Fingerprint Client component for each of Android, iOS and ARM Linux platforms are included with MegaMatcher 9.0 Standard SDK and MegaMatcher 9.0 Extended SDK. More licenses for this component can be purchased any time by MegaMatcher 9.0 SDK customers.

Fingerprint Extractor

Fingerprint Extractor creates fingerprint templates from fingerprint images. Fingerprint templates can be stored in the following formats by the Fingerprint Extractor component:

- **Neurotechnology proprietary** fingerprint template format;
- **ISO/IEC 19794-2:2005** with **Cor. 1:2009** (General and On-Card Fingerprint Minutiae Data Formats);
- **ISO/IEC 19794-2:2011** with **Cor. 1:2012** (General and On-Card Fingerprint Minutiae Data Formats);
- **ANSI/INCITS 378-2004** (Finger Minutiae Format for Data Interchange);
- **ANSI/INCITS 378-2009** with **Amd. 1:2010** (Finger Minutiae Format for Data Interchange).

Proprietary image quality control may be applied to accept only good quality fingerprint images.

Fingerprint Extractor can generalize a fingerprint template from several fingerprint images to improve template quality.

The component extracts a single fingerprint template in **1.34 seconds**. The specified performance requires a **PC** or **laptop** with at least Intel **Core 2 Q9400** (2.67 GHz) processor.

One Fingerprint Extractor license is included with MegaMatcher 9.0 Standard SDK and MegaMatcher 9.0 Extended SDK. More licenses for this component can be purchased any time by MegaMatcher 9.0 SDK customers.

Embedded Fingerprint Extractor

The Embedded Fingerprint Extractor has the same functionality as the Fingerprint Extractor and is designed to be run on **Android** or **iOS** or ARM Linux devices. The component extracts a single fingerprint template in **1.34 seconds**.

One Embedded Fingerprint Extractor license for each of Android, iOS and ARM Linux platforms is included with MegaMatcher 9.0 Standard SDK and MegaMatcher 9.0 Extended SDK. More licenses for this component can be purchased any time by MegaMatcher 9.0 SDK customers.



Fast Fingerprint Extractor

The Fast Fingerprint Extractor has the same functionality as the Fingerprint Extractor and is designed to be used in **high-volume server applications**, which run on server hardware with at least **dual Intel Xeon E5-2680V2** (2.8 GHz) processors. The component performs template extraction at a speed of **3,000 fingerprints per minute**.

One Fast Fingerprint Extractor license is included with MegaMatcher 9.0 Standard SDK and MegaMatcher 9.0 Extended SDK. More licenses for this component can be purchased any time by MegaMatcher 9.0 SDK customers.

Fingerprint Segmenter

The Fingerprint Segmenter components separates fingerprints if an image contains more than one fingerprint. This component enables Fingerprint Extractor component to process fingerprints from scanned **tenprint** card or image captured using scanners that allow to scan two or more fingers at once.

Fingerprint pattern classification module that allows to determine a fingerprint pattern class is included with Fingerprint Segmenter component. The classification is usually used in forensics, but also it can be used to increase fingerprint matching speed. The defined classes are:

- Left Slant Loop;
- Right Slant Loop;
- Tented Arch;
- Whorl;
- Scar;
- "Unknown" – for the nondetermined classes.

The Fingerprint Segmenter is designed for desktop or mobile applications that run on **PC or laptop** with at least Intel **Core 2 Q9400** (2.67 GHz) processor.

The Fingerprint Segmenter licenses can be purchased anytime by MegaMatcher 9.0 SDK customers.

Fast Fingerprint Segmenter

The Fast Fingerprint Segmenter has the same functionality as the Fingerprint Segmenter and is designed to be used in **high-volume server applications**, which run on server hardware with at least **dual Intel Xeon E5-2680V2** (2.8 GHz) processors.

One Fast Fingerprint Segmenter license is included with MegaMatcher 9.0 Standard SDK and MegaMatcher 9.0 Extended SDK. More licenses for this component can be purchased any time by MegaMatcher 9.0 SDK customers.

Fingerprint Capturer

Fingerprint Capturer component is designed for using in systems which acquire fingerprint images from fingerprint readers on client side and send them to a server running Fast Fingerprint Extractor component for further processing.

The Fingerprint Capturer component also includes:

- JPEG 2000 image format support module with 1000 ppi Fingerprint Profile;
- NFIQ algorithm module, which uses a standard method to determine fingerprint image quality.
- WSQ image format support module, which allows to compress a fingerprint image up to 10-15 times. The module functionality is identical to Fingerprint WSQ.

Three Fingerprint Capturer licenses are included with MegaMatcher 9.0 Standard SDK and MegaMatcher 9.0 Extended SDK. More licenses for this component can be purchased any time by MegaMatcher 9.0 SDK customers.



Embedded Fingerprint Capturer

The Embedded Fingerprint Capturer has the same functionality as the Fingerprint Capturer and is designed to be run on Android or iOS or ARM Linux devices.

Three Embedded Fingerprint Capturer licenses for each of Android, iOS and ARM Linux platforms are included with MegaMatcher 9.0 Standard SDK and MegaMatcher 9.0 Extended SDK. More licenses for this component can be purchased any time by MegaMatcher 9.0 SDK customers.

Fingerprint WSQ

The Fingerprint WSQ component allows to integrate support for WSQ (Wavelet Scalar Quantization) image format. The WSQ format allows to compress a fingerprint image up to 10-15 times. WSQ compression process is “lossy”, meaning that the reconstructed image is not equal to the original (some information is lost). However, the WSQ algorithm was specially designed to minimize the loss of fingerprint information therefore the reconstructed image is as close as possible to the original.

Neurotechnology’s implementation of WSQ 3.1 fingerprint image compression was **certified by the FBI** as compliant with the accuracy requirements in the Wavelet Scalar Quantization (WSQ) Gray-Scale Fingerprint Image Compression Specification, Version 3.1.

The component is designed for applications that run on hardware with at least Intel **Core 2 Q9400** (2.67 GHz) processor.

Licenses for the Fingerprint WSQ component can be purchased anytime by MegaMatcher 9.0 SDK customers.



Fingerprint BSS (Biometric Standards Support)

The Fingerprint BSS component allows to integrate support for fingerprint template and image format standards and additional image formats with new or existing biometric systems based on MegaMatcher SDK.

These biometric standards are supported by the Fingerprint BSS component:

- **BioAPI 2.0 (ISO/IEC 19784-1:2006)** (Framework and Biometric Service Provider for fingerprint identification engine)
- **CBEFF V1.2 (ANSI INCITS 398-2008)** (Common Biometric Exchange Formats Framework)
- **CBEFF V2.0 (ISO/IEC 19785-1:2006, 19785-3:2007)** (Common Biometric Exchange Formats Framework)
- **ISO/IEC 19794-4:2005 with Cor. 1:2011** (Finger Image Data)
- **ISO/IEC 19794-4:2011 with Cor. 1:2012** (Finger Image Data)
- **ANSI/INCITS 381-2004** (Finger Image-Based Data Interchange Format)
- **ANSI/INCITS 381-2009 with Amd. 1:2011** (Finger Image-Based Data Interchange Format)
- **ANSI/NIST-CSL 1-1993** (Data Format for the Interchange of Fingerprint, Facial, & SMT Information)
- **ANSI/NIST-ITL 1a-1997** (Data Format for the Interchange of Fingerprint, Facial, & SMT Information)
- **ANSI/NIST-ITL 1-2000** (Data Format for the Interchange of Fingerprint, Facial, & SMT Information)
- **ANSI/NIST-ITL 1-2007** (Data Format for the Interchange of Fingerprint, Facial, & Other Biometric Information)
- **ANSI/NIST-ITL 1a-2009** (Data Format for the Interchange of Fingerprint, Facial, & Other Biometric Information)

The Fingerprint BSS component allows **conversion** between Neurotechnology proprietary fingerprint templates, ISO/IEC 19794-2:2005, ISO/IEC 19794-2:2011, ANSI/INCITS 378-2004, ANSI/INCITS 378-2009 and ANSI/NIST-ITL templates.

The Fingerprint BSS component also includes:

- **JPEG 2000** image format support module with 1000 ppi Fingerprint Profile;
- **NIST IHead** image format support module;
- module with NIST Fingerprint Image Quality (**NFIQ**) algorithm, a standard method to determine fingerprint image quality.

Latent Fingerprint Editor is available with Fingerprint BSS component. In most cases automated image processing is unable to extract all minutiae or extracts a lot of false minutiae from latent fingerprint image (for example, taken from the crime scene). Therefore, an expert should manually edit a fingerprint template in order to submit it to an AFIS for the identification. **Sample latent fingerprint template editor (.NET)** shows how to change minutia's coordinates, direction, type and other parameters.

The component is designed for applications that run on hardware with at least Intel **Core 2 Q9400** (2.67 GHz) processor.

Licenses for the Fingerprint BSS component can be purchased anytime by MegaMatcher 9.0 SDK customers.



Face Components Description

Face Verification component

The Face Verification component is designed for simple integration of facial recognition technology into high-security applications, like mobile banking transactions, which need only biometric identity verification. The component is intended to provide its functionality for reasonable price, especially for large-scale deployments.

The following operations are available via the high-level API:

- Face **enrollment** into the internal database – an image with a face is captured from a camera, the face template is extracted from the image and saved into the database. Custom meta-information (like person's name) can be provided during calling this operation to store it in the database together with the face template.
- Face **verification** against a specific face from the database – an image with a face is captured from a camera, the face template is extracted from the image and matched against the template stored in the specified database record.
- Database record removal.

Integrators can enable or disable face **liveness detection** to prevent fraud attempts with a photo. Also, parameters like template size or matching quality threshold can be modified before calling the enrollment or verification operations.

One Face Verification component license is included with MegaMatcher 9.0 Standard SDK and MegaMatcher 9.0 Extended SDK for all supported desktop and mobile platforms. More licenses for this component can be purchased any time by MegaMatcher 9.0 SDK customers

Face Matcher

The Face Matcher performs facial template matching in 1-to-1 (verification) and 1-to-many (identification) modes. Also the Face Matcher component includes **fused** matching algorithm that allows to increase template matching reliability by matching templates that contain fingerprint, face, voiceprint and/or iris records (note that matching fingerprint, irises and voiceprints requires to purchase Fingerprint Matcher, Iris Matcher and Voice Matcher components correspondingly).

The Face Matcher component matches **40,000 faces per second** and is designed to be used in **desktop** or mobile biometric systems, which run on PCs or laptops with at least Intel **Core 2 Q9400** (2.67 GHz) processor.

One Face Matcher license is included with MegaMatcher 9.0 Standard SDK and MegaMatcher 9.0 Extended SDK. More licenses for this component can be purchased any time by MegaMatcher 9.0 SDK customers.

Embedded Face Matcher

The Embedded Face Matcher has the same functionality, as the Face Matcher. It matches **3,000 faces per second** and is designed to be used in **embedded** or **mobile** biometric systems, which run on **Android** or **iOS** or ARM Linux devices. The Android devices should be based on at least **Snapdragon S4** system-on-chip (**Krait 300** processor with 4 cores running at 1.51 GHz).

One Embedded Face Matcher license for each of Android, iOS and ARM Linux platforms is included with MegaMatcher 9.0 Standard SDK and MegaMatcher 9.0 Extended SDK. More licenses for this component can be purchased any time by MegaMatcher 9.0 SDK customers.



Fast Face Matcher

The Fast Face Matcher has the same functionality, as the Face Matcher. It matches **200,000 faces per second** and is designed for **large-scale** biometric systems, which run on high-end PCs or servers hardware with at least **Intel Core i7-4771** (3.5 GHz) processor.

Multi-biometric fused template matching can be achieved by combining the Fast Face Matcher component with Fingerprint, Voice and/or Iris Matchers (regular or fast versions of them can be used depending on project implementation).

One Fast Face Matcher license is included with MegaMatcher 9.0 Standard SDK and MegaMatcher 9.0 Extended SDK. More licenses for this component can be purchased any time by MegaMatcher 9.0 SDK customers.

Face Client

The Face Client component is a combination of the Face Extractor, Face Token Image and Face BSS components. It is designed for the systems that need to support all functionality of the mentioned components on the same PC. Using these licenses allows to optimize component license costs as well as reduce license management.

The Face Client extracts a single face template in **0.6 seconds**. The specified performance requires a **PC or laptop** with at least Intel **Core 2 Q9400** (2.67 GHz) processor.

Three licenses for the Face Client component are included with MegaMatcher 9.0 Standard SDK and MegaMatcher 9.0 Extended SDK. More licenses for this component can be purchased any time by MegaMatcher 9.0 SDK customers.

Embedded Face Client

The Embedded Face Client component has the same functionality as the Face Client and is designed to run on **Android** or **iOS** or ARM Linux devices. The Android devices should be based on at least **Snapdragon S4** system-on-chip (**Krait 300** processor with 4 cores running at 1.51 GHz). The component extracts a single face template in **1.34 seconds**.

Three licenses for the Embedded Face Client component for each of Android, iOS and ARM Linux platforms are included with MegaMatcher 9.0 Standard SDK and MegaMatcher 9.0 Extended SDK. More licenses for this component can be purchased any time by MegaMatcher 9.0 SDK customers.

Face Extractor

Face Extractor creates face templates from face images. The Extractor can generalize a face template from several images that include the same face to improve the template's quality.

Device Manager software allows to perform **simultaneous capture from multiple cameras**. Integrators can write **plug-ins to support their cameras** or other devices using the plug-in framework provided with the Device Manager.

The component extracts a single face template in **1.34 seconds**. The specified performance requires a **PC or laptop** with at least Intel **Core 2 Q9400** (2.67 GHz) processor.

One Face Extractor license is included with MegaMatcher 9.0 Standard SDK and MegaMatcher 9.0 Extended SDK. More licenses for this component can be purchased any time by MegaMatcher 9.0 SDK customers.



Embedded Face Extractor

The Embedded Face Extractor has the same functionality as the Face Extractor and is designed to be run on **Android** or **iOS** or ARM Linux devices. The Android devices should be based on at least **Snapdragon S4** system-on-chip (**Krait 300** processor with 4 cores running at 1.51 GHz). The component extracts a single face template in **1.34 seconds**.

One Embedded Face Extractor license for each of Android, iOS and ARM Linux platforms is included with MegaMatcher 9.0 Standard SDK and MegaMatcher 9.0 Extended SDK. More licenses for this component can be purchased any time by MegaMatcher 9.0 SDK customers.

Fast Face Extractor

The Fast Face Extractor has the same functionality as the Face Extractor and is designed to be used in **high-volume server applications**, which run on server hardware with at least **Intel Xeon E5-2680V2** (2.8 GHz) processor. The component performs template extraction at a speed of **3,000 faces per minute**.

One Fast Face Extractor license is included with MegaMatcher 9.0 Standard SDK and MegaMatcher 9.0 Extended SDK. More licenses for this component can be purchased any time by MegaMatcher 9.0 SDK customers.

Face Capturer component

Face Capturer component is designed for using in client-server systems which acquire **face images** from cameras on client side and send them to a **server** running **Fast Face Extractor** component for further processing.

The Face Capturer component also includes **JPEG 2000** image format support with Lossy and Lossless Face Profiles.

Three Face Capturer licenses are included with MegaMatcher 9.0 Standard SDK and MegaMatcher 9.0 Extended SDK. More licenses for this component can be purchased any time by MegaMatcher 9.0 SDK customers.

Embedded Face Capturer component

The Embedded Face Capturer has the same functionality as the Face Capturer and is designed to be run on **Android** or **iOS** or ARM Linux devices.

Three Embedded Face Capturer licenses for each of Android, iOS and ARM Linux platforms are included with MegaMatcher 9.0 Standard SDK and MegaMatcher 9.0 Extended SDK. More licenses for this component can be purchased any time by MegaMatcher 9.0 SDK customers.



Face Token Image

The Face Token Image component is designed to provide token* face images compatible with the Face Image Format as in ISO/IEC 19794 standard. This face image format enables range of applications on variety of devices, including devices that have limited resources required for data storage, and improves recognition accuracy by specifying data format, scene constraints (lighting, pose), photographic properties (positioning, camera focus) and digital image attributes (image resolution, image size).

The Face Token Image component has the following features:

- Face Token Image creation from an image containing human face using eye coordinates which may be either hand marked or detected automatically using Neurotechnology face detection algorithm.
- Face is detected and eye coordinates are acquired using state-of-the-art Neurotechnology face detection and recognition algorithm.
- Geometrical face image normalization according to the proportions and photographic properties, which are specified in ISO/IEC 19794 standard.
- Intelligent image padding algorithm for cutting off parts of Face Token Image as specified in ISO/IEC 19794 standard.
- Evaluation of the created token face image for the following quality criteria suggested in ISO/IEC 19794 standard:
 - Background uniformity – the background in the token face image should be uniform, not cluttered.
 - Sharpness – the token face image should not be blurred.
 - Too light or too dark images – the token face image should not be too dark or too light.
 - Exposure range of an image – the token face image should have a reasonable exposure range to represent as much details of the subject in the image as possible.
- Evaluation of the token face image quality based on suggestions of ISO/IEC 19794 standard (using the quality criteria above)
- Captured faces can be checked for compliancy with ICAO requirements.

The Face Token Image component also includes proprietary algorithms for this functionality:

- Person's gender recognition.
- Emotions detection.
- Facial feature points extraction for each person from an image.
- Age estimation for each person from an image.
- Additional face attributes detection: smile, open-mouth, closed-eyes, glasses and dark-glasses.
- Live face detection can be used for determining whether a face in a video stream belongs to a real human or is a photo. See recommendations for live face detection for more information.

The component is designed for desktop or mobile applications that run on **PC or laptop** with at least Intel **Core 2 Q9400** (2.67 GHz) processor. It can be used from **C/C++**, **C#** and **Java** applications on all supported platforms. **.NET wrappers** of Windows libraries are provided for .NET developers.

Licenses for this component can be purchased anytime by MegaMatcher 9.0 SDK customers.

**Token in this context is used as "symbolic image, good enough image for machine recognition". Token Image as in ISO/IEC19794-5: "A Face Image Type that specifies frontal images with a specific geometric size and eye positioning based on the width and height of the image. This image type is suitable for minimizing the storage requirements for computer face recognition tasks such as verification while still offering vendor independence and human verification (versus human examination which requires more detail) capabilities."*



Fast Face Token Image

The Fast Face Token Image component has the same functionality as the Face Token Image and is designed to be used in **high-volume server applications**, which run on server hardware with at least **Intel Xeon E5-2680V2** (2.8 GHz) processor.

One Fast Face Token Image license is included with MegaMatcher 9.0 Standard SDK and MegaMatcher 9.0 Extended SDK. More licenses for this component can be purchased any time by MegaMatcher 9.0 SDK customers.

Face BSS (Biometric Standards Support)

The Face BSS (Biometric Standards Support) component allows to integrate support for facial image format standards and additional image formats with new or existing biometric systems based on MegaMatcher SDK.

These biometric standards are supported:

- **BioAPI 2.0 (ISO/IEC 19784-1:2006)** (Framework and Biometric Service Provider for Face Identification Engine)
- **CBEFF V1.2 (ANSI INCITS 398-2008)** (Common Biometric Exchange Formats Framework)
- **CBEFF V2.0 (ISO/IEC 19785-1:2006, 19785-3:2007)** (Common Biometric Exchange Formats Framework)
- **ISO/IEC 19794-5:2005** (Face Image Data)
- **ISO/IEC 19794-5:2011** (Face Image Data)
- **ANSI/INCITS 385-2004** (Face Recognition Format for Data Interchange)
- **ANSI/NIST-CSL 1-1993** (Data Format for the Interchange of Fingerprint, Facial, & SMT Information)
- **ANSI/NIST-ITL 1a-1997** (Data Format for the Interchange of Fingerprint, Facial, & SMT Information)
- **ANSI/NIST-ITL 1-2000** (Data Format for the Interchange of Fingerprint, Facial, & SMT Information)
- **ANSI/NIST-ITL 1-2007** (Data Format for the Interchange of Fingerprint, Facial, & Other Biometric Information)
- **ANSI/NIST-ITL 1a-2009** (Data Format for the Interchange of Fingerprint, Facial, & Other Biometric Information)

The component is designed for applications that run on hardware with at least Intel **Core 2 Q9400** (2.67 GHz) processor.

Licenses for the Face BSS component can be purchased anytime by MegaMatcher 9.0 SDK customers.



Voice Components Description

Voice Matcher

The Voice Matcher performs voice template matching in 1-to-1 (verification) and 1-to-many (identification) modes. Also the Voice Matcher component includes fused matching algorithm that allows to increase template matching reliability by matching templates that contain fingerprint, face, voice and/or iris records (note that matching fingerprints, irises and faces requires to purchase Fingerprint Matcher, Iris Matcher and Face Matcher components correspondingly).

The Voice Matcher component matches **8,000 voiceprints per second** and is designed to be used in **desktop** or mobile biometric systems, which run on PCs or laptops with at least Intel **Core i7-4771** (3.5 GHz) processor.

One Voice Matcher license is included with MegaMatcher 9.0 Standard SDK and MegaMatcher 9.0 Extended SDK. More licenses for this component can be purchased any time by MegaMatcher 9.0 SDK customers.

Embedded Voice Matcher

The Embedded Voice Matcher has the same functionality, as the Voice Matcher. It matches **100 voiceprints per second** and is designed to be used in **embedded** or **mobile** biometric systems, which run on **Android** or **iOS** or ARM Linux devices. The Android devices should be based on at least **Snapdragon S4** system-on-chip (**Krait 300** processor with 4 cores running at 1.51 GHz).

One Embedded Voice Matcher license is included with MegaMatcher 9.0 Standard SDK and MegaMatcher 9.0 Extended SDK.. More licenses for this component can be purchased any time by MegaMatcher 9.0 SDK customers.

Voice Client

The Voice Client component currently has the same functionality as Voice Extractor component. It is intended for using on PC- and Mac-based clients of web-based and network-based biometric systems.

The Voice Client extracts a single voiceprint template in **0.6 seconds**. The specified performance requires a **PC** or **laptop** with at least Intel **Core 2 Q9400** (2.67 GHz) processor.

Three licenses for the Voice Client component are included with MegaMatcher 9.0 Standard SDK and MegaMatcher 9.0 Extended SDK. More licenses for this component can be purchased any time by MegaMatcher 9.0 SDK customers.

Embedded Voice Client

The Embedded Voice Client component currently has the same functionality as Embedded Voice Extractor component. It is intended for using with Android or iOS or ARM Linux based devices on client-side of web-based and network-based biometric systems.

The component is designed to run on **Android** or **iOS** or ARM Linux devices. The Android devices should be based on at least **Snapdragon S4** system-on-chip (**Krait 300** processor with 4 cores running at 1.51 GHz).

Three licenses for the Embedded Voice Client component are included with MegaMatcher 9.0 Standard SDK and MegaMatcher 9.0 Extended SDK. More licenses for this component can be purchased any time by MegaMatcher 9.0 SDK customers.



Voice Extractor

Voice Extractor creates voice templates from audio samples on PC and Mac platform. The component can be configured to perform automatic voice activity detection, which allows to begin voice capture only when users start speaking, and finish capture when they stop speaking.

See technical specifications for the size of voice template and the requirements for voice record.

The component extracts a single voiceprint template in **1.34 seconds**. The specified performance requires a **PC** or **laptop** with at least Intel **Core 2 Q9400** (2.67 GHz) processor.

One Voice Extractor license is included with MegaMatcher 9.0 Standard SDK and MegaMatcher 9.0 Extended SDK. More licenses for this component can be purchased any time by MegaMatcher 9.0 SDK customers.

Embedded Voice Extractor

The Embedded Voice Extractor has the same functionality as the Voice Extractor and is designed to be run on **Android** or **iOS** or ARM Linux devices. The Android devices should be based on at least **Snapdragon S4** system-on-chip (**Krait 300** processor with 4 cores running at 1.51 GHz). The component extracts a single voiceprint template in **1.34 seconds**.

One Embedded Voice Extractor license is included with MegaMatcher 9.0 Standard SDK and MegaMatcher 9.0 Extended SDK. More licenses for this component can be purchased any time by MegaMatcher 9.0 SDK customers.

Fast Voice Extractor

The Fast Voice Extractor has the same functionality as the Voice Extractor and is designed to be used in **high-volume server applications**, which run on server hardware with at least Intel **Xeon E5-2680V2** (2.8 GHz) processor. The component performs template extraction at a speed of **3,000 voiceprints per minute**.

One Fast Voice Extractor license is included with MegaMatcher 9.0 Standard SDK and MegaMatcher 9.0 Extended SDK. More licenses for this component can be purchased any time by MegaMatcher 9.0 SDK customers.

Voice Capturer

Voice Capturer component is designed for using in client-server systems which acquire **voice records** on client side and send them to a **server** running **Fast Voice Extractor** component for further processing.

Three Voice Capturer licenses are included with MegaMatcher 9.0 Standard SDK and MegaMatcher 9.0 Extended SDK. More licenses for this component can be purchased any time by MegaMatcher 9.0 SDK customers.

Embedded Voice Capturer

The Embedded Voice Capturer has the same functionality as the Voice Capturer and is designed to be run on Android or iOS or ARM Linux devices.

Three Embedded Voice Capturer licenses for each of Android, iOS and ARM Linux platforms are included with MegaMatcher 9.0 Standard SDK and MegaMatcher 9.0 Extended SDK. More licenses for this component can be purchased any time by MegaMatcher 9.0 SDK customers.



Iris Components Description

Iris Matcher

The Iris Matcher performs iris template matching in 1-to-1 (verification) and 1-to-many (identification) modes. Also the Iris Matcher component includes fused matching algorithm that allows to increase template matching reliability by:

- matching templates that contain 2 iris records;
- matching templates that contain fingerprint, face, voiceprint and/or iris records (note that matching fingerprints, faces and voiceprints requires Fingerprint Matcher, Face Matcher and Voice Matcher components correspondingly);

The Iris Matcher component matches **40,000 irises per second** and is designed to be used in **desktop** or mobile biometric systems, which run on PCs or laptops with at least Intel **Core 2 Q9400** (2.67 GHz) processor.

One Iris Matcher license is included with MegaMatcher 9.0 Standard SDK and MegaMatcher 9.0 Extended SDK. More licenses for this component can be purchased any time by MegaMatcher 9.0 SDK customers.

Embedded Iris Matcher

The Embedded Iris Matcher has the same functionality, as the Iris Matcher. It matches **3,000 irises per second** and is designed to be used in embedded or mobile biometric systems, which run on **Android** or **iOS** or ARM Linux devices. The Android devices should be based on at least **Snapdragon S4** system-on-chip (**Krait 300** processor with 4 cores running at 1.51 GHz).

One Embedded Iris Matcher license for each of Android, iOS and ARM Linux platforms is included with MegaMatcher 9.0 Standard SDK and MegaMatcher 9.0 Extended SDK. More licenses for this component can be purchased any time by MegaMatcher 9.0 SDK customers.

Fast Iris Matcher

The Fast Iris Matcher has the same functionality, as the Iris Matcher. It matches **200,000 irises per second** and is designed for **large-scale** biometric systems, which run on high-end PCs or servers hardware with at least Intel **Core i7-4771** (3.5 GHz) processor.

Multi-biometric fused template matching can be achieved by combining the Fast Iris Matcher component with Fingerprint, Face and/or Voice Matchers (regular or fast versions of them can be used depending on project implementation).

One Fast Iris Matcher license is included with MegaMatcher 9.0 Standard SDK and MegaMatcher 9.0 Extended SDK. More licenses for this component can be purchased any time by MegaMatcher 9.0 SDK customers.



Iris Client

The Iris Client component is a combination of the Iris Extractor and Iris BSS components. It is designed for the systems that need to support all functionality of the mentioned components on the same PC. Using these licenses allows to optimize component license costs as well as reduce license management.

The Iris Client extracts a single iris template in **0.6 seconds**. The specified performance requires a **PC** or **laptop** with at least Intel **Core 2 Q9400** (2.67 GHz) processor.

Three licenses for the Iris Client component are included with MegaMatcher 9.0 Standard SDK and MegaMatcher 9.0 Extended SDK. More licenses for this component can be purchased any time by MegaMatcher 9.0 SDK customers.

Embedded Iris Client

The Embedded Iris Client component has the same functionality as the Iris Client and is designed to run on **Android** or **iOS** or ARM Linux devices. The Android devices should be based on at least **Snapdragon S4** system-on-chip (**Krait 300** processor with 4 cores running at 1.51 GHz). The component extracts a single iris template in **1.2 seconds**.

Three licenses for the Embedded Iris Client component for each of Android, iOS and ARM Linux platforms are included with MegaMatcher 9.0 Standard SDK and MegaMatcher 9.0 Extended SDK. More licenses for this component can be purchased any time by MegaMatcher 9.0 SDK customers.

Iris Extractor

Iris Extractor creates iris templates from eye images.

The component extracts a single iris template in **1.34 seconds**. The specified performance requires a **PC** or **laptop** with at least Intel **Core 2 Q9400** (2.67 GHz) processor.

One Iris Extractor license is included with MegaMatcher 9.0 Standard SDK and MegaMatcher 9.0 Extended SDK. More licenses for this component can be purchased any time by MegaMatcher 9.0 SDK customers.

Embedded Iris Extractor

The Embedded Iris Extractor component has the same functionality as the Iris Extractor and is designed to run on **Android** or **iOS** or ARM Linux devices. The Android devices should be based on at least **Snapdragon S4** system-on-chip (**Krait 300** processor with 4 cores running at 1.51 GHz). The component extracts a single iris template in **1.34 seconds**.

One Embedded Iris Extractor license for each of Android, iOS and ARM Linux platforms is included with MegaMatcher 9.0 Standard SDK and MegaMatcher 9.0 Extended SDK. More licenses for this component can be purchased any time by MegaMatcher 9.0 SDK customers.



Fast Iris Extractor

The Fast Iris Extractor has the same functionality as the Iris Extractor and is designed to be used in **high-volume server applications**, which run on server hardware with at least Intel **Xeon E5-2680V2** (2.8 GHz) processor. The component performs template extraction at a speed of **3,000 irises per minute**.

One Fast Iris Extractor license is included with MegaMatcher 9.0 Standard SDK and MegaMatcher 9.0 Extended SDK. More licenses for this component can be purchased any time by MegaMatcher 9.0 SDK customers.

Iris Capturer component

Iris Capturer component is designed for using in client-server systems which acquire **eye images** from iris cameras on client side and send them to a **server** running Fast Iris Extractor component for further processing.

The Iris Capturer component also includes **JPEG 2000** image format support.

Three Iris Capturer licenses are included with MegaMatcher 9.0 Standard SDK and MegaMatcher 9.0 Extended SDK. More licenses for this component can be purchased any time by MegaMatcher 9.0 SDK customers.

Embedded Iris Capturer component

The Embedded Iris Capturer has the same functionality as the Iris Capturer and is designed to be run on **Android** or **iOS** or ARM Linux devices.

Three Embedded Iris Capturer licenses for each of Android, iOS and ARM Linux platforms are included with MegaMatcher 9.0 Standard SDK and MegaMatcher 9.0 Extended SDK. More licenses for this component can be purchased any time by MegaMatcher 9.0 SDK customers.

Iris BSS (Biometric Standards Support)

The Iris BSS (Biometric Standards Support) component allows to integrate support for iris image format standards and additional image formats with new or existing biometric systems based on MegaMatcher SDK.

These biometric standards are supported:

- **BioAPI 2.0** (ISO/IEC 19784-1:2006) (Framework and Biometric Service Provider for iris identification engine)
- **CBEFF V1.2 (ANSI INCITS 398-2008)** (Common Biometric Exchange Formats Framework)
- **CBEFF V2.0 (ISO/IEC 19785-1:2006, 19785-3:2007)** (Common Biometric Exchange Formats Framework)
- **ISO/IEC 19794-6:2005** (Iris Image Data)
- **ISO/IEC 19794-6:2011 with Cor. 1:2012**
- **ISO/IEC 29794-6:2015** (Iris Image Data)
- **ANSI/INCITS 379-2004** (Iris Image Interchange Format)

Iris BSS component also allows to integrate **JPEG 2000** image format support into applications based on the MegaMatcher SDK.

Licenses for the Iris BSS component can be purchased anytime by MegaMatcher 9.0 SDK customers.



Palm print components description

Palm Print Matcher

The Palm Print Matcher component performs palm print template matching in 1-to-1 (verification) and 1-to-many (identification) modes.

“Technical specifications” and “reliability and performance tests” sections contain information about the template matching speeds and recognition quality.

One license for the Palm Print Matcher component is included in MegaMatcher 9.0 Standard SDK and MegaMatcher 9.0 Extended SDK. More licenses for this component can be purchased any time by MegaMatcher 9.0 SDK customers.

Palm Print Client

The Palm Print Client component creates palm print templates from palm images. Also, it allows to integrate support for palm print template and image format standards and additional image formats with new or existing biometric systems based on MegaMatcher SDK.

These biometric standards are supported:

- **CBEFF** (Common Biometric Exchange Formats Framework)
- **ANSI/NIST-ITL 1-2000** (Data Format for the Interchange of Fingerprint, Facial, & SMT Information)
- **ANSI/NIST-ITL 1-2007** (Data Format for the Interchange of Fingerprint, Facial, & Other Biometric Information)
- **ANSI/NIST-ITL 1a-2009** (Data Format for the Interchange of Fingerprint, Facial, & Other Biometric Information)

The Palm Print Client component allows conversion between Neurotechnology proprietary palm print templates and ANSI/NIST-ITL templates.

The Palm Print Client component also includes:

- **WSQ** (Wavelet Scalar Quantization) image format support module. The WSQ format allows to compress a palm print image up to 10-15 times. WSQ compression process is “lossy”, meaning that the reconstructed image is not equal to the original (some information is lost). However, the WSQ algorithm was specially designed to minimize the loss of palm print or fingerprint information therefore the reconstructed image is as close as possible to the original.
- **JPEG 2000** image format support module.

The Palm Print Client component can be used from **C/C++** and **C#** applications on all supported platforms. **.NET** wrappers of Windows libraries are provided for **.NET** developers.

One license for the Palm Print Client component is included in MegaMatcher 9.0 Standard SDK and MegaMatcher 9.0 Extended SDK. More licenses for this component can be purchased any time by MegaMatcher 9.0 SDK customers.



Matching Server Component

The Matching Server is ready-to-use software intended for building moderate size web-based and other network-based systems like local AFIS or multi-biometric identification system. The Server software runs on a server PC and allows to perform the biometric template matching on server side using:

- Fast Fingerprint Matcher or Fingerprint Matcher component for fingerprint template matching;
- Fast Face Matcher or Face Matcher component for face template matching;
- Fast Iris Matcher or Iris Matcher component for iris template matching.
- Voice Matcher component for voice template matching.

Fused multi-biometric matching can be enabled by running components for fingerprint, face, voiceprint and iris matching on the same machine.

Client communication module that allows sending a task to the Matching Server, querying status of the task, getting the results and removing the task from server, is included with MegaMatcher 9.0 SDK, VeriFinger 9.0 SDK, VeriLook 9.0 SDK, VeriSpeak 9.0 SDK and VeriEye 9.0 SDK. This module hides all low level communications and provides high-level API for the developer.

The components and database support modules with source codes included for Matching Server component are listed in the table below. Custom modules for working with other databases can also be developed by integrator and used with the Matching Server software.

The table below shows what components are available with Matching Server software.

Components	Microsoft Windows 32 & 64 bit	Linux 32 & 64 bit	Mac OS X
• Matching server software	+	+	+
• Server administration tool API	+	+	
Database support modules			
• Microsoft SQL Server	+		
• PostgreSQL	+	+	
• MySQL	+	+	
• Oracle	+	+	
• SQLite	+	+	+
Programming samples			
• C# client	+		
• Visual Basic .NET client	+		
• Sun Java 2 web client	+	+	+
Programming tutorials			
• C/C++	+	+	
• C#	+		
• Visual Basic .NET	+		

The Matching Server component requires a **special license** that allows to run the component on all machines that run the fingerprint, face, iris or palm print matching components obtained by an integrator. The Matching Server software is included with MegaMatcher 9.0 Standard SDK and MegaMatcher 9.0 Extended SDK.

Also the Matching Server component is included with VeriFinger 9.0 Extended SDK, VeriLook 9.0 Extended SDK, VeriSpeak 9.0 Extended SDK and VeriEye 9.0 Extended SDK (see their brochures for more info).



Supported Fingerprint Scanners under Microsoft Windows

List of fingerprint scanners supported by MegaMatcher SDK under Linux, Mac OS X and Android are available on the next page.

	Windows XP		Windows Vista / 7		Windows 8	
	32 bit	64 bit	32 bit	64 bit	32 bit	64 bit
• 3M Cogent CSD 330	+		+			
• Abilma UNITY			+	+	+	+
• ACS AET62 / AET65	+		+	+	+	+
• ARH AFS 510	+		+	+		
• Athena ASEDive Ille Combo Bio F2	+	+	+	+	+	+
• Atmel FingerChip	+					
• AuthenTec AES2501B / AES2550 / AES2660 / AES2810	+		+	+	+	+
• BioLink U-Match MatchBook v.3.5	+		+	+	+	+
• Biometrika Fx2000 / Fx2100 / Fx3000 / HiScan / HiScan PRO	+		+			
• Cross Match L Scan 500P / Guardian USB / Patrol / Patrol ID	+	+(1)	+	+(1)		
• Cross Match Verifier 300 / Verifier 320	+	+(1)	+	+(1)		
• DERMALOG LF10 / F1 / ZF1	+		+		+	+
• DigitalPersona U.are.U 4000 / 4500 / 5100 / 5160 / 5200 / EikonTouch 710	+	+	+	+	+	+
• Futronic FS10 / FS26 / FS50 / FS64 / FS80 / FS82 / FS88 / FS88H / FS90 / eFAM	+	+	+	+	+	+
• Futronic FS60	+		+		+	+
• Green Bit DactyScan26 / DactyScan40i / DactyScan84c / DactyScan84n / MultiScan527	+	+	+	+	+	+
• Hongda S500 / S680 / S700	+					
• id3 Certis Image	+					
• Integrated Biometrics Columbo / LES650 / Sherlock / Watson / Watson Mini	+	+	+	+	+	+
• Koehlke KIAU-5110B3 / KIA-UM01	+		+		+	
• L-1 DFR 2080 / DFR 2090	+		+			
• L-1 DFR 2100 / DFR 2300	+		+	+(1)		
• Lumidigm Mercury / Venus series sensors ⁽²⁾	+	+	+	+	+	+
• Miaxis FPR620 / SM-201 / SM-2BU	+		+		+	
• NITGEN Fingkey Hamster / Fingkey Hamster II / Fingkey Mouse III	+	+	+	+	+	+
• NITGEN eNBioScan-F / eNBioScan-C1 / eNBioScan-D Plus	+	+	+	+	+	+
• SecuGen Hamster III	+		+		+	
• SecuGen Hamster Plus / Hamster IV / Hamster Pro 20 / iD-USB SC / iD-USB SC/PIV	+	+	+	+	+	+
• Shanghai Fingertech BIOCA-111	+		+			
• Suprema BioMini / BioMini Plus / BioMini Slim / BioMini SFU-S20 / SFR300-S / SFU300	+		+	+	+	+
• Suprema RealScan-G10 / RealScan-G1 / RealScan-10 / RealScan-D / RealScan-S	+	+	+	+	+	+
• Tacoma CMOS	+		+			
• TENBIO TOUCH ONE	+		+		+	
• Testech Bio-i	+		+		+	
• UPEK Eikon / Eikon Solo / Eikon To Go / EikonTouch 300 / 500 / 700 / TouchChip	+		+	+	+	+
• ViRDI FOH02SC	+		+			
• ZKSoftware ZK4000 / ZK6000 / ZK7000 / ZK8000	+		+			
• ZKS-1000	+					

(1) Can be used on 64-bit OS, but only in 32-bit applications.

(2) Not supported on Java.



Supported Fingerprint Scanners under Linux, Mac OS X and Android

List of fingerprint scanners supported by MegaMatcher SDK under Microsoft Windows is available on the previous page.

	Linux (x86)		Mac OS X (x86)		Android
	32-bit	64-bit	32-bit	64-bit	
• Abilma UNITY	+	+	+	+	+
• ACS AET62 / AET65	+	+	+	+	
• ARH AFS 510	+	+			
• BioLink U-Match MatchBook v.3.5	+				
• DERMALOG LF10 / F1 / ZF1	+				
• DigitalPersona U.are.U 4000 / 4500 / 5100 / 5160 / 5200	+	+			
• Fujitsu MBF200	+	+	+	+	
• Futronic FS10 / FS26	+	+			
• Futronic FS28					+
• Futronic FS50 / FS80 / FS82 / FS88 / FS90 / eFAM	+	+	+	+	+
• Futronic FS88H	+	+			+
• Green Bit DactyScan26 / DactyScan40i / DactyScan84c / DactyScan84n	+				
• Integrated Biometrics LES650	+				
• Integrated Biometrics Columbo/ Sherlock / Watson / Watson Mini	+	+			+
• Lumidigm Mercury / Venus series sensors	+				
• Miaxis SM-201					+
• NITGEN eNBioScan-F	+				
• SecuGen Hamster III	+				
• SecuGen Hamster IV / Hamster Plus					+
• Suprema BioMini / BioMini Plus / BioMini Slim / BioMini SFU-S20	+				+
• Suprema RealScan-G10	+				
• Tacoma CMOS	+	+	+	+	
• TazTag TazPad					+
• TopLink Pacific BLUEFiN					+
• UPEK Eikon / Eikon Solo / Eikon To Go	+	+	+	+	+(1)
• UPEK EikonTouch 300 / 500 / 700 / TouchChip TCRU1C / TCRU2C					+(1)

(1) requires root access to the device.



Supported Face Capture Cameras

These cameras are supported by MegaMatcher SDK:

- Any **webcam** or camera that is accessible using:
 - **DirectShow** interface for Microsoft Windows platform
 - **GStreamer** interface for Linux platform.
 - **QuickTime** interface for Mac platform.
- Any built-in **smartphone** or **tablet** camera that is supported by iOS or Android OS. The camera should have at least 0.3 MegaPixel (640 x 480 pixels) resolution.
- Any **IP camera**, that supports **RTSP** (Real Time Streaming Protocol):
 - Only **RTP over UDP** is supported.
 - **VLC** framework can be optionally used for reading video streams.
 - **H.264/MPEG-4 AVC** or **Motion JPEG** should be used for encoding the video stream.
- These models of **still cameras** are supported:
 - Canon EOS family still cameras (Microsoft Windows only)
 - Nikon DSLR still cameras (Microsoft Windows only; a specific camera model should support video capture)
- These specific models of high-resolution **IP cameras** are supported:
 - Axis M1114 camera (Microsoft Windows and Linux)
 - Basler BIP2-1600-25c-DN IP camera (Microsoft Windows and Linux)
 - Canon EOS family still cameras (Microsoft Windows only)
 - Cisco 4500 IP camera (Microsoft Windows only)
 - CMITech EMX-30 – face & iris camera (Microsoft Windows only)
 - IrisGuard IG-AD100 face & iris camera (Microsoft Windows only)
 - Mobotix S14D and DualNight M12 IP cameras (Microsoft Windows and Linux)
 - PiXORD N606 camera (Microsoft Windows and Linux)
 - Prosilica GigE Vision camera (Microsoft Windows and Linux)
 - Sony SNC-CS50 camera (Microsoft Windows and Linux)
 - VistaFA2 / VistaFA2E / VistaEY2 face & iris cameras (Microsoft Windows only)
- Integrators can also write **plug-ins to support their cameras** using the plug-in framework provided with the Device Manager from the MegaMatcher SDK.

A **video file** can be also used as a data source for face capture on MegaMatcher based application.



Supported Iris Capture Cameras

The table below explains which eye iris scanners are supported by MegaMatcher SDK under different operating systems.

We are always looking for scanners' manufacturers to include the support for their iris scanners to our products. Please, contact us for more details.

Integrators or scanner manufacturers can also write plug-ins for the Device Manager from the MegaMatcher SDK to support their iris cameras using the provided plug-in framework. The SDK documentation contains more information about the plug-in framework.

Iris capture cameras	Microsoft Windows XP / Vista / 7 / 8		Linux (32 bit only)	Android
	32 bit	64 bit		
• CMITech BMT-20 / EMX-30	+	+		
• Credence ID Trident				+(2)
• Cross Match I Scan 2	+	+(1)		
• IrisGuard IG-AD100	+	+	+	+
• Iritech IriShield USB MK 2120U / IriShield-USB BK 2121U	+	+	+	+
• Iritech IriMagic1000BK	+			
• UBKEY Mirrorkey Mirrorkem	+			
• VistaFA2 / VistaFA2E / VistaEY2 / VistaEY2-02 iris & face cameras	+	+		
• VistaEY2H iris camera	+	+		

(1) Can be used on 64-bit OS, but only in 32-bit applications.

(2) The device has pre-installed Android OS.



Basic Recommendations for Facial Recognition

Face recognition accuracy of MegaMatcher heavily depends on the quality of a face image. **Image quality during enrollment is important**, as it influences the quality of the face template.

General Recommendations

- **32 pixels is the recommended minimal distance between eyes** for a face on image or video stream to perform face template extraction. **64 pixels or more** recommended for better face recognition results. Note that this distance should be **native**, not achieved by resizing an image.
- **Several images during enrollment**, are recommended for better facial template quality which results in improvement of recognition quality and reliability.
- **Additional enrollments** may be needed when **facial hair** style changes, especially when beard or mustache is grown or shaved off.

Face posture

The face recognition engine has certain tolerance to face posture:

- head **roll** (tilt) – ± 180 degrees (configurable).
 - **± 15 degrees default** value is the fastest setting which is usually sufficient for most near-frontal face images.
- head **pitch** (nod) – ± 15 degrees from frontal position.
 - The head pitch tolerance can be increased up to ± 25 degrees if several views of the same face that covered different pitch angles were used during enrollment.
- head **yaw** (bobble) – ± 45 degrees from frontal position (configurable).
 - **± 15 degrees default** value is the fastest setting which is usually sufficient for most near-frontal face images.
 - **30 degrees difference** between a face template in a database and a face image from camera is **acceptable**.
 - Several views of the same face can be enrolled to the database to cover the whole ± 45 degrees yaw range from frontal position.

Continued on the next page



Live Face Detection

A stream of consecutive images (usually a video stream from a camera) is required for face liveness check:

- When the liveness check is enabled, it is performed by the face engine before feature extraction. If the face in the stream **fails** to qualify as “live”, the features are **not extracted**.
- Only **one face should be visible** in these frames.
- Users can enable these liveness check modes:
 - **Active** – the engine requests the user to perform certain actions like blinking or moving one’s head.
 - 5 frames per second or better frame rate required
 - This mode can work with both colored and grayscale images.
 - This mode requires the user to perform all requested actions to pass the liveness check.
 - **Passive** – the engine analyzes certain facial features while the user stays still in front of the camera for a short period of time
 - Colored images are required for this mode.
 - 10 frames per second or better frame rate required.
 - Better score is achieved when users do not move at all.
 - **Passive then active** – the engine first tries the passive liveness check, and if it fails, tries the active check. This mode requires colored images.
 - **Simple** – the engine requires user to turn head from side to side while looking at camera.
 - 5 frame per second or better frame rate recommended.
 - This mode can work with both colored and grayscale images.



Basic Recommendations for Speaker Recognition

The speaker recognition accuracy of MegaMatcher depends on the audio quality during enrollment and identification. Certain constraints should be noted before or during algorithm integration into a speaker recognition system. Other variables may be overcome by enrollment with the same phrase in different environments.

Voice samples of at least 2 seconds in length are recommended to assure recognition quality.

General Security

A **passphrase should be kept in secret and not pronounced in an environment where other people may hear it** if the speaker recognition system is used in a scenario with unique phrases for each user.

The **text-independent** speaker recognition may be **vulnerable** to attack with a **covertly recorded phrase** from a person. **Passphrase verification** or **two-factor authentication** (i.e. requirement to type a password) will **increase** the overall system **security**.

Microphones

There are no particular constraints on models or manufacturers when using regular PC microphones, headsets or built-in laptop microphones. However these factors should be noted:

- The **same microphone model** is recommended (if possible) for use during both enrollment and recognition, as different models may produce different sound quality. Some models may also introduce specific noise or distortion into the audio, or may include certain hardware sound processing, which will not be present when using a different model. This is also the recommended procedure when using **smartphones** or **tablets**, as different device models may alter the recording of the voice in different ways.
- The same **microphone position** and distance is recommended during enrollment and recognition. **Headsets** provide optimal distance between user and microphone; this distance is recommended when non-headset microphones are used.
- **Web cam built-in** microphones should be **used with care**, as they are usually positioned at a rather long distance from the user and may provide lower sound quality. The sound quality may be affected if users change their position relative to the web cam.

Sound Settings

Settings for clear sound must be ensured; some audio software, hardware or drivers may have **sound modification** enabled by default. For example, the Microsoft Windows OS usually has, by default, sound boost enabled.

At least 11,025 Hz sampling rate with at least **16-bit** depth should be set during voice recording.



Environment Constraints

The MegaMatcher speaker recognition algorithm is sensitive to **noise** or **loud voices** in the **background**; they may **interfere** with the user's voice and affect the recognition results. These solutions may be considered to reduce or eliminate these problems:

- A **quiet environment** for enrollment and recognition.
- **Several samples of the same phrase** recorded in different environments can be stored in a biometric template. Later the user will be matched against these samples with much higher recognition quality.
- **Close-range microphones** (like those in headsets) that are not affected by distant sources of sound.
- Third-party or custom solutions for background noise reduction, such as using two separate microphones for recording user voice and background sound, and later subtracting the background noise from the recording.

User Behavior and Voice Changes

Natural voice changes may affect speaker recognition accuracy:

- A temporarily **hoarse voice** caused by a cold or other sickness
- Different **emotional states** that affect voice (i.e. a cheerful voice versus a tired voice)
- Different **pronunciation speeds** during enrollment and identification

The aforementioned voice and user behavior changes can be managed in two ways:

- **Separate enrollments** for the altered voice, storing the records to the same person's template;
- A **controlled, neutral voice** during enrollment and identification.



System Requirements and Supported Development Environments

System Requirements for MegaMatcher client-side components for PC or Mac

- **PC or Mac with x86 (32-bit) or x86-64 (64-bit) compatible processors.**
 - 0.6 seconds are required to create a template with a single fingerprint, face, iris or voiceprint record using Intel Core 2 Q9400 processor running at 2.67 GHz. See the technical specifications for more details.
 - 4 seconds are required to create a template from a full palm print image on Intel Core i7-4771 processor running at 3.5 GHz.
 - **SSE2 support is required.** Processors that do not support SSE2 cannot run the MegaMatcher algorithm. Please check if a particular processor model supports SSE2 instruction set.
- **at least 128 MB of free RAM** should be available for the application.
- **Free space on hard disk drive (HDD):**
 - at least 1 GB required for the development.
 - 100 MB for client-side components deployment.
 - Additional space optionally would be required in these cases:
 - MegaMatcher does not require the original biometric data (such as fingerprint image or photo) to be stored for the matching; it is enough to use the templates. However, we would recommend to store this data on hard drive for the potential future usage.
 - Usually a database engine runs on back-end servers (on separate computer). However, DB engine can be installed together with MegaMatcher client-side components and Matching Server on the same computer for standalone applications. In this case more HDD space for biometrical templates storage must be available. For example, 1 million users templates (each with 2 fingerprint records) stored using a relational database would require from 2 GB to 12 GB of free HDD space depending on configured template size.
- **Optionally, depending on biometrical modalities and requirements:**
 - A **fingerprint scanner**. MegaMatcher SDK includes support modules for more than 100 models of fingerprint scanners under Microsoft Windows, Linux and Mac OS X platforms.
 - A **webcam or IP camera** or any other came(recommended frame size: 640 x 480 pixels) for face images capturing. An IP camera should support RTSP and stream video in H.264 or M-JPEG. Any other webcam or camera should provide DirectShow interface for Windows platform, GStreamer interface for Linux platform or QuickTime interface for Mac platform.
 - An **iris camera** (recommended image size: 640 x 480 pixels) for iris image capture. MegaMatcher SDK includes support modules for several iris cameras.
 - A **microphone**. Any microphone that is supported by the operation system can be used.
 - An **palm print scanner**.
 - A **flatbed scanner** for fingerprint or palm print data capturing from paper can be used. 500ppi or 1000ppi FBI certified scanners are recommended. Flatbed scanners are supported only under Microsoft Windows platform and should have TWAIN drivers.
 - Integrators can also write **plug-ins to support their biometric capture devices** using the plug-in framework provided with the Device Manager from the MegaMatcher SDK.



- **Network/LAN connection (TCP/IP)** for communication with Matching Server or MegaMatcher Accelerator unit(s). MegaMatcher client-side components can be used without network if they are used only for data collection. For secure communication we would recommend to use a dedicated network or a secured network (such as VPN; VPN must be configured using operating system or third party tools).

- **Linux specific requirements:**
 - Linux 2.6 or newer kernel (32-bit or 64-bit) is required. Linux 3.0 or newer kernel is recommended. If a fingerprint scanner is required, note that some scanners have only 32-bit support modules and will work only from 32-bit applications.
 - glibc 2.13 or newer
 - GStreamer 1.2.2 or newer with gst-plugin-base and gst-plugin-good is required for face capture using camera/webcam or rtsp video. GStreamer 1.4.x or newer is recommended.
 - libgudev-1.0 164-3 or newer (for camera and/or microphone usage)
 - libasound 1.0.x or newer (for voice capture)
 - wxWidgets 3.0.0 or newer libs and dev packages (to build and run SDK samples and applications based on them)
 - Qt 4.8 or newer libs, dev and qmake packages (to build and run SDK samples and applications based on them)
 - GCC-4.4.x or newer (for application development)
 - GNU Make 3.81 or newer (for application development)
 - Sun Java 1.6 SDK or later (for application development with Java)
 - pkg-config-0.21 or newer (optional; only for Matching Server database support modules compilation)

- **Microsoft Windows specific requirements:**
 - Microsoft Windows XP / Vista / 7 / 8 / 10, 32-bit or 64-bit. If a fingerprint scanner is required, note that some scanners have only 32-bit support modules and will work only from 32-bit applications.
 - Microsoft .NET framework 3.5 (for .NET components usage)
 - Microsoft Visual Studio 2008 SP1 or newer (for application development with C++ / C# / VB .NET)
 - Microsoft DirectX 9.0 or later (for face capture using camera/webcam)
 - Sun Java 1.6 SDK or later (for application development with Java)

- **Mac OS X specific requirements:**
 - Mac OS X (version 10.7 or newer)
 - XCode 4.3 or newer (for application development)
 - GStreamer 1.2.2 or newer with gst-plugin-base and gst-plugin-good is required for face capture using camera/webcam or rtsp video. GStreamer 1.4.x or newer is recommended.
 - wxWidgets 3.0.0 or newer libs and dev packages (to build and run SDK samples and applications based on them)
 - Qt 4.8 or newer libs, dev and qmake packages (to build and run SDK samples and applications based on them)
 - GNU Make 3.81 or newer (to build samples and tutorials development)
 - Sun Java 1.6 SDK or later (for application development with Java)



System requirements for MegaMatcher client-side components for Android

- A **smartphone** or **tablet** that is running **Android 4.0 (API level 14)** OS or newer. If you have a custom Android-based device or development board, contact us to find out if it is supported.
- ARM-based **1.5 GHz processor recommended** for processing a fingerprint, face, iris or voiceprint in the specified time. Slower processors may be also used, but the processing of fingerprints, faces, irises and voiceprints will take longer time.
- At least **30 MB of free RAM** should be available for the application. Additional RAM is required for applications that perform 1-to-many identification, as all biometric templates need to be stored in RAM for matching. For example, **1,000 templates** (each containing 1 fingerprint and 1 face record) require about **6 MB of additional RAM**. See the technical specifications for the templates sizes with specific biometric modalities.
- **Free storage** space (built-in flash or external memory card):
 - 30 MB required for MegaMatcher Android components deployment for each separate application.
 - Additional space would be required if an application needs to store original fingerprint, face or iris images, or audio samples. MegaMatcher does not require the original fingerprint, face or iris images, or audio samples to be stored for the matching; only the templates need to be stored.
- **Optionally, depending on biometric modalities and requirements:**
 - A **fingerprint reader**. MegaMatcher is able to work with several supported fingerprint readers under Android OS. Integrators may also use image files or receive image data from external devices like flatbed scanners or other stand-alone cameras.
 - A **camera for face** capture. MegaMatcher is able to work with all cameras that are supported by Android OS. At least **0.3 MegaPixel (640 x 480 pixels)** camera is required for the MegaMatcher biometric algorithm. Integrators may also use image files or receive image data from external devices like flatbed scanners or stand-alone cameras.
 - A **microphone**. MegaMatcher is able to work with all microphones that are supported by Android OS. Integrators may also use audio files or receive audio data from external devices.
 - An **iris scanner**. A project may require to capture iris images using some hand-held devices:
 - Iritech IriShield single iris camera is supported by the MegaMatcher SDK under Android OS.
 - MegaMatcher technology also accepts irises for further processing as **BMP, JPG or PNG** images, thus almost any third-party iris capturing hardware can be used with the MegaMatcher technology if it generates image in the mentioned formats.
 - Integrators may implement the iris scanner support by themselves or use the software provided by the scanners manufacturers. The integrators should note, that the most accurate iris recognition is achievable only when iris images are captured with near-infrared cameras and appropriate illumination. However, it is still possible to recognize irises with reasonable accuracy, when the irises are captured with cameras, which are built in smartphones or tablets, using proper illumination and focus, and choosing proper environment.
- **Network connection**. A MegaMatcher-based embedded or mobile application may require network connection for **activating** the MegaMatcher component licenses. See the Licensing model chapter for the list of available activation option. Also, network connection may be required for **client/server** applications.
- **PC-side development environment requirements:**
 - Java SE JDK 6 (or higher)
 - Eclipse Indigo (3.7) IDE
 - Android development environment (at least API level 14 required)
 - Build automation system - Apache Maven 3.1.x or Gradle 2.10
 - Internet connection for activating MegaMatcher component licenses



System requirements for MegaMatcher client-side components for iOS

- One of the following devices, running **iOS 8.0** or newer:
 - **iPhone 5** or newer iPhone.
 - **iPad 2** or newer iPad, including iPad Mini and iPad Air models.
 - **iPod Touch 6th Generation** or newer iPod.
- ● At least **30 MB of free RAM** should be available for the application. Additional RAM is required for applications that perform 1-to-many identification, as all biometric templates need to be stored in RAM for matching. For example, **1,000 templates** (each containing 1 fingerprint and 1 face record) require about **6 MB of additional RAM**. See the technical specifications for the templates sizes with specific biometric modalities.
- **Free storage** space (built-in flash or external memory card):
 - 30 MB required for MegaMatcher iOS components deployment for each separate application.
 - Additional space would be required if an application needs to store original fingerprint, face or iris images, or audio samples. MegaMatcher does not require the original fingerprint, face or iris images, or audio samples to be stored for the matching; only the templates need to be stored.
- **Optionally, depending on biometric modalities and requirements:**
 - A **fingerprint reader**. MegaMatcher is able to work with several supported fingerprint readers under iOS.
 - A **camera for face** capture. MegaMatcher captures face images from the built-in cameras.
 - A **microphone**. Any smartphone's or tablet's built-in or headset microphone which is supported by iOS. Integrators may also use audio files or receive audio data from external devices.
 - An **iris scanner**. At the moment iris scanner support on iOS platform should be **implemented by integrators**. The integrators should note, that the most accurate iris recognition is achievable only when iris images are captured with near-infrared cameras and appropriate illumination. However, it is still possible to recognize irises with reasonable accuracy, when the irises are captured with cameras, which are built in smartphones or tablets, using proper illumination and focus, and choosing proper environment.
 - MegaMatcher technology also accepts fingerprint, face and iris **images** for further processing as **BMP, JPG** or **PNG** files, thus almost any third-party biometric capturing hardware can be used with the MegaMatcher technology if it generates images in the mentioned formats.
- **Network connection**. A MegaMatcher-based embedded or mobile application may require network connection for **activating** the MegaMatcher component licenses. See the Licensing model chapter for the list of available activation option. Also, network connection may be required for **client/server** applications.
- **Development environment requirements:**
 - a Mac running Mac OS X 10.10.x or newer.
 - Xcode 6.4 or newer.



System requirements for MegaMatcher client-side components for ARM Linux

We recommend to contact us and report the specifications of a target device to find out if it will be suitable for running MegaMatcher-based applications.

There is a list of common requirements for ARM Linux platform:

- A device with ARM-based processor, running **Linux 3.2 kernel** or newer.
- ARM-based **1.5 GHz processor recommended** for fingerprint processing in the specified time.
 - **ARMHF** architecture (**EABI 32-bit hard-float ARMv7**) is required.
 - Lower clock-rate processors may be also used, but the fingerprint, face, iris or voiceprint processing will take longer time.
- At least **128 MB of free RAM** should be available for the application. Additional RAM is required for applications that perform 1-to-many identification, as all biometric templates need to be stored in RAM for matching. For example, **1,000 templates** (each containing 2 fingerprint records) require about **2 MB of additional RAM**.
- **Free storage** space (built-in flash or external memory card):
 - 30 MB required for MegaMatcher ARM Linux components deployment for each separate application.
 - Additional space would be required if an application needs to store original fingerprint, face or iris images, or audio samples. MegaMatcher does not require the original fingerprint, face or iris images, or audio samples to be stored for the matching; only the templates need to be stored.
- **Optionally, depending on biometric modalities and requirements:**
 - A **fingerprint reader**. MegaMatcher is able to work with several supported fingerprint readers under ARM Linux OS.
 - A **camera for face** capture. At least **0.3 MegaPixel (640 x 480 pixels)** camera is required for the MegaMatcher biometric algorithm. These cameras are supported by MegaMatcher on ARM Linux platform:
 - Any camera which is accessible using GStreamer interface.
 - Any IP camera, that supports RTSP (Real Time Streaming Protocol). Only RTP over UDP is supported. H.264/MPEG-4 AVC or Motion JPEG should be used for encoding the video stream.
 - A **microphone**. MegaMatcher is able to work with all microphones that are supported by the OS.
 - An **iris scanner**. At the moment iris scanner support on ARM Linux platform should be **implemented by integrators**. The integrators should note, that the most accurate iris recognition is achievable only when iris images are captured with near-infrared cameras and appropriate illumination. However, it is still possible to recognize irises with reasonable accuracy, when the irises are captured with regular cameras, using proper illumination and focus, and choosing proper environment.
- glibc 2.13 or newer.
- libstdc++-v3 4.7.2 or newer.
- GStreamer 1.2.2 or newer with gst-plugin-base and gst-plugin-good is required for face capture using camera/webcam or rtsp video. GStreamer 1.4.x or newer is recommended.
- libasound 1.0.x or newer (for voice capture)
- libgudev-1.0 164-3 or newer (for microphone usage)
- **Network connection** for client/server applications. If the communication must be secured, a dedicated network (not accessible outside the system) or a secured network (such as VPN; VPN must be configured using operating system or third party tools) is recommended.
- **PC-side development environment requirements:**
 - GCC-4.4.x or newer
 - GNU Make 3.81 or newer
 - JDK 1.6 or later



System requirements for server-side fast template extraction components

- **Server hardware** with at least these processors (see the technical specifications for more details):
 - **Dual Intel Xeon E5-2680V2** (2.8 GHz) processors for extracting a template from a single fingerprint image in the specified time;
 - **Single Intel Xeon E5-2680V2** (2.8 GHz) processor for extracting templates from single face or iris images, or voice samples in the specified time.
 - The processors should support **SSE2**. Processors that do not support SSE2 cannot run the MegaMatcher algorithm. Please check if a particular processor model supports SSE2 instruction set.
- **At least 2 GB of free RAM** should be available for the high-volume server application.
- **Free space on hard disk drive (HDD):**
 - at least 1 GB required for the development.
 - 100 MB for the server-side fast template extraction components deployment.
 - Additional space optionally would be required in these cases:
 - MegaMatcher does not require to store the original biometric data (such as fingerprint image or photo); it is enough to use the templates for persons' verification or identification. However, some systems may require to store this data on hard drive for the potential future usage.
 - Usually a database engine runs on back-end servers (on separate computer). However, DB engine can be installed together with MegaMatcher client-side components and Matching Server on the same computer for standalone applications. In this case more HDD space for biometric templates storage must be available. For example, 1 million users templates (each with 2 fingerprint records) stored using a relational database would require about 2 GB of free HDD space.
- **Network/LAN connection (TCP/IP)** for communication with client-side applications, Matching Server or MegaMatcher Accelerator unit(s). MegaMatcher does not provide any tools for encrypting the communication. If communication must be secured, we recommend to **use some strong enough encryption** for sending the biometric images or voice samples over the internet. Also, a dedicated network (not accessible outside the system) or a secured network (such as VPN; VPN must be configured using operating system or third party tools) may be used.
- **Linux specific requirements:**
 - Linux 2.6 or newer kernel (32-bit or 64-bit) is required. Linux 3.0 or newer kernel is recommended.
 - glibc 2.11.3 or newer
 - GStreamer 1.2.2 or newer with gst-plugin-base and gst-plugin-good (for face capture using rtsp video)
- **Microsoft Windows specific requirements:**
 - Microsoft Windows Server 2003 / Server 2008 / Server 2008 R2 / Server 2012, 64-bit.
 - Microsoft .NET framework 3.5 (for .NET components usage)



System requirements for Matching Server

- **PC, Mac or server with x86 (32-bit) or x86-64 (64-bit) compatible processor.**
 - 64-bit platform must be used when large databases (more than 2.5 million fingerprints or more than 400,000 users with 2 fingerprints and 1 face enrolled) used and 3 GB RAM is not enough for templates storing in RAM.
 - Intel Core i7-4771 (3.5 GHz) processor or better is recommended.
 - **SSE2 support is required.** Processors that do not support SSE2 cannot run the MegaMatcher algorithm. Please check if a particular processor model supports SSE2 instruction set.
- **Enough free RAM** to store Matching Server code (about 5 MB), matching engines and templates. For example, 1 million users templates (each with 2 fingerprint records) require from 2 GB to 12 GB of RAM depending on configured template size. At least 20% reserve recommended and some additional memory may be taken by an operating system. Therefore, **to hold mentioned 1 million users data, 3 GB of free RAM is recommended** for the computer running Matching Server software.
- **Free space on hard disk drive (HDD):**
 - 5 MB required for Matching Server software.
 - If a database engine is installed on the same computer, enough HDD space for DB engine installation and data storage is required. For example, 1 million users templates with 2 fingerprint records stored using a relational database would require 2 GB to 12 GB of free HDD space depending on configured template size.
 - A database engine itself requires HDD space for running. Please refer to HDD space requirements from the database engine providers.
 - For example, 1 million users templates with 10 fingerprint records and 1 face record stored using a relational database would require about 15 GB of free HDD space.
 - MegaMatcher does not require the original biometric data (such as fingerprint image or photo) to be stored for the matching; it is enough to use the templates. However, we would recommend to store this data on hard drive for the potential future usage.
- **Database engine** or connection with it. Usually a DB engine required for the Matching Server is running on the same computer. MegaMatcher SDK contains support modules for Microsoft SQL Server, PostgreSQL, MySQL, Oracle, SQLite and memory DB. The fastest option is memory DB but it does not support relational queries, therefore the recommended option is SQLite, as it requires less resources than other options but provides enough functionality.
- **Network/LAN connection (TCP/IP)** for the communication with client side. Communication is not encrypted therefore, if communication must be secured, we would recommend to use a dedicated network (not accessible outside the system) or a secured network (such as VPN; VPN must be configured using operating system or third party tools).
- **Linux specific requirements:**
 - Linux 2.6 or newer kernel (32-bit or 64-bit) is required. Linux 3.0 or newer kernel is recommended.
 - glibc 2.11.3 or newer
- **Microsoft Windows specific requirements:**
 - Microsoft Windows XP / Vista / 7 / 8 / 10 / Server 2003 / Server 2008 / Server 2008 R2 / Server 2012.
- **Mac OS X specific requirements:**
 - Mac OS X (version 10.7 or newer)



Technical Specifications

Fingerprint, Face, Voiceprint and Iris Engines Technical Specifications

All biometric templates should be loaded into RAM before identification, thus the maximum biometric templates database size is limited by the amount of available RAM.

- Fingerprint scanners are recommended to have at least **500 ppi** resolution and at least **1" x 1"** fingerprint sensors. The specifications are provided for 500 x 500 pixels fingerprint images and templates extracted from these images.
- Face capture cameras are recommended to produce at least **640 x 480 pixels** images for reliable faces' detection. Face template extraction and matching speed is not dependent on the image size.
- The **minimal distance between eyes is 32 pixels** for a face on image or video stream to perform face template extraction. **64 pixels or more recommended** for better template extraction results.
- Face recognition engine has certain tolerance to face posture:
 - head **roll** (tilt) – ± 180 degrees (configurable); **± 15 degrees default** value is the fastest setting which is usually sufficient for most near-frontal face images.
 - head **pitch** (nod) – ± 15 degrees from frontal position.
 - head **yaw** (bobble) – ± 45 degrees from frontal position. **± 15 degrees default** value is the fastest setting which is usually sufficient for most near-frontal face images.

The specifications are provided for the default roll and yaw values.

- Iris capture cameras are recommended to produce at least **640 x 480 pixels** images. The specifications are provided for these images.
- **Voice samples of at least 2-seconds in length** are recommended to assure speaker recognition quality.
- **A minimum 11025 Hz** sampling rate, with at least **16-bit** depth, should be used during voice recording.

See also the lists of basic recommendations for facial recognition and speaker recognition (previous chapters).

MegaMatcher biometric template extraction and matching algorithm is designed to run on **multi-core processors** allowing to reach maximum possible performance on the used hardware. The performance specifications are available on the next page.



MegaMatcher 9.0 fingerprint engine specifications					
	Embedded / mobile platform ⁽¹⁾		PC-based platform ⁽²⁾		Server platform
Template extraction components	Embedded Fingerprint Extractor	Embedded Fingerprint Client	Fingerprint Extractor	Fingerprint Client	Fast Fingerprint Extractor ⁽³⁾
Template extraction speed (fingerprints per minute)	45	50	45	100	3,000
Template matching components	Embedded Fingerprint Matcher		Fingerprint Matcher		Fast Fingerprint Matcher ⁽⁴⁾
Template matching speed (fingerprints per second)	3,000		40,000		200,000
Single fingerprint record size in a template ⁽⁵⁾ (bytes)	700 - 6,000 (configurable)				

MegaMatcher 9.0 face engine specifications					
	Embedded / mobile platform ⁽¹⁾		PC-based platform ⁽²⁾		Server platform
Template extraction components	Embedded Face Extractor	Embedded Face Client	Face Extractor	Face Client	Fast Face Extractor ⁽⁶⁾
Template extraction speed (faces per minute)	45	50	45	100	3,000
Template matching components	Embedded Face Matcher		Face Matcher		Fast Face Matcher ⁽⁴⁾
Template matching speed (faces per second)	3,000		40,000		200,000
Single face record size in a template ⁽⁵⁾ (bytes)	4,028 or 5,066 or 7,128 (configurable)				

MegaMatcher 9.0 iris engine specifications					
	Embedded / mobile platform ⁽¹⁾		PC-based platform ⁽²⁾		Server platform
Template extraction components	Embedded Iris Extractor	Embedded Iris Client	Iris Extractor	Iris Client	Fast Iris Extractor ⁽⁶⁾
Template extraction speed (irises per minute)	45	50	45	100	3,000
Template matching components	Embedded Iris Matcher		Iris Matcher		Fast Iris Matcher ⁽⁴⁾
Template matching speed (irises per second)	3,000		40,000		200,000
Single iris record size in a template ⁽⁵⁾ (bytes)	2,348				

MegaMatcher 9.0 voiceprint engine specifications					
	Embedded / mobile platform ⁽¹⁾		PC-based platform		Server platform
Template extraction components	Embedded Voice Extractor	Embedded Voice Client	Voice Extractor ⁽²⁾	Voice Client ⁽²⁾	Fast Voice Extractor ⁽⁶⁾
Template extraction speed (voiceprints per minute)	45	50	45	100	3,000
Template matching components	Embedded Voice Matcher		Voice Matcher ⁽⁴⁾		
Template matching speed (voiceprints per second)	100		8,000		
Single voiceprint record size in template ⁽⁵⁾⁽⁷⁾ (bytes)	3,500 - 4,500				

Notes and requirements for reaching the specified performance

- (1) on Android or iOS devices based on at least Snapdragon S4 system-on-chip with Krait 300 processor (4 cores, 1.51 GHz);
- (2) on PC or laptop with at least Intel Core 2 Q9400 quad-core processor (2.67 GHz);
- (3) on server hardware with at least Dual Intel Xeon processors E5-2680V2 (2.8 GHz);
- (4) on PC with at least Intel Core i7-4771 quad-core processor (3.5 GHz).
- (5) Multiple biometric records of the same or different biometric modalities can be stored in a template; in this case the template size is the sum of all included biometric records;
- (6) on server hardware with at least Intel Xeon E5-2680V2 processor (2.8 GHz);
- (7) for 5-second long voice samples; template size has linear dependence from voice sample length.



Palm Print Engine Technical Specifications

All specifications are given for Intel Core i7-4771 processor running at 3.5 GHz.

Palm print template extraction and matching require much more time than fingerprints, as palm images are much larger compared to fingerprint images, but have similar features density.

An image of fingerprint, which was scanned with AFIS-class scanner at 500 dpi resolution, is usually at least 500 x 500 pixels (0.25 Megapixels). Full palm image, scanned at the same resolution, is 160 times bigger (40 Megapixels). After excluding white space, palm image is still about 50 times bigger than fingerprint image. Also, full palm print templates may contain about 2,000 minutiae compared to about 50 for fingerprint templates.

MegaMatcher palm print template matching algorithm may be configured to use more than one processor core on **multi-core processors** allowing to increase template matching speed.

MegaMatcher palm print identification algorithm has this performance when processing full palm prints:

- Template extraction time: 4 seconds;
- Template matching time: 15 palm prints templates per second;
- Average template size: 69 kilobytes.



Full palm print;
fingerprints marked
in red for reference



Reliability Testing Results

The identification reliability is important for large-scale systems. MegaMatcher SDK includes a fused algorithm for fast and reliable identification using several biometric records taken from the same person.

As we do not have any single database with all supported biometric modalities, separate tests with selected modalities were performed for the MegaMatcher biometric engines to demonstrate their reliability and performance with single biometric modalities and combinations of several modalities:

- Voiceprint and face engines with XM2VTS database
- Fingerprint, face and iris engines tests with internal multi-modal database
- Palm print engine

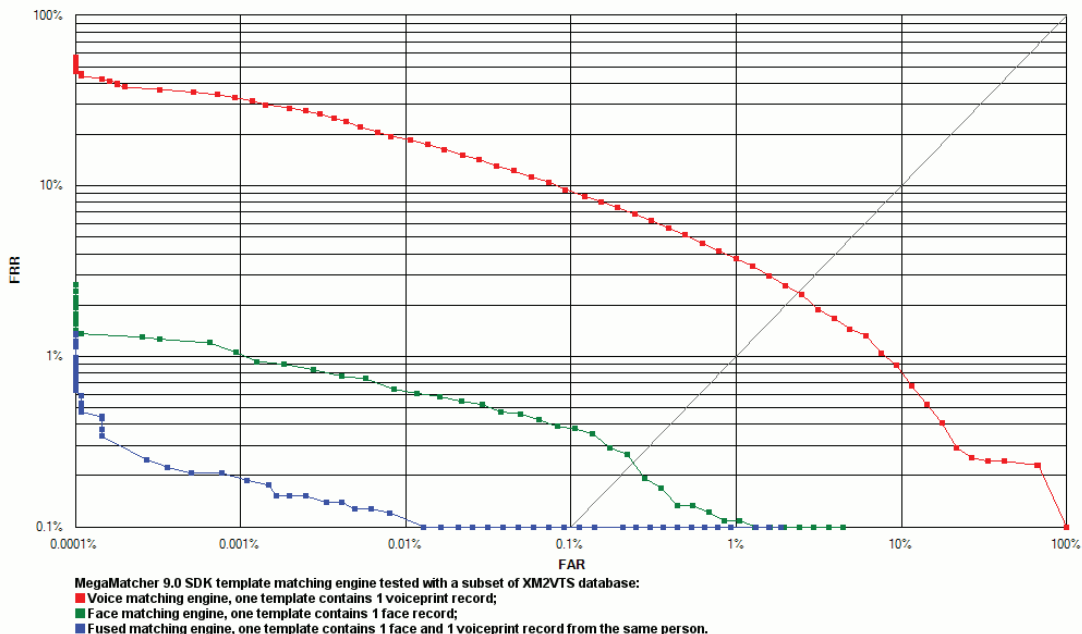
Voiceprint and Face Matching Engine Tests

The tests with MegaMatcher biometric face and voiceprint matching engines, and the fused template matching algorithm were performed using face images and voice samples from the XM2VTS Database:

- 295 unique persons were represented in the database.
- 8 capture sessions were performed for each person.
- The *phrase 1* from the database was used for the testing, meaning that the same **fixed phrase** was used for all subjects.

The tests were performed with biometric template types, which contained 1 voiceprint record, 1 face record or 1 voiceprint + 1 face records taken from the same person.

MegaMatcher 9.0 face, voiceprint and fused template matching engines tests		
A template contains these biometric records	FRR at 0.001 % FAR	FRR at 0.0001 % FAR
1 voiceprint	32.8500 %	46.5900 %
1 face	1.0540 %	1.4300 %
1 voiceprint + 1 face	0.2058 %	0.6295 %





Fingerprint, Face and Iris Matching Engines Tests

The identification reliability and speed are important for large-scale systems. MegaMatcher SDK includes a fused algorithm for fast and reliable identification using several biometric templates taken from the same person. The tests with MegaMatcher biometric fingerprint, face and iris matching engines and fused template matching algorithm were performed using Neurotechnology internal multi-biometric database:

- The database had 7,500 sets of biometric records; each set contained 1 face, 2 irises and 10 fingerprints representing a unique person.
- 1,500 unique persons were represented in the database.
- 5 capture sessions were performed for each person.

The tests were performed with these biometric template types:

- **1 fingerprint record** extracted from left index fingerprint image.
- **1 face record.**
- **1 iris record** extracted from left eye image.
- **2 fingerprint records** extracted from same person's left and right index fingerprint images.
- **2 iris records** extracted from same person's different eye images.
- **1 fingerprint + 1 face records** – left index fingerprint and face taken from the same person.
- **1 face + 1 iris records** – left iris and face taken from the same person.
- **1 fingerprint + 1 iris records** – left index fingerprint and left iris taken from the same person.
- **1 fingerprint + 1 face + 1 iris records** – left index fingerprint, left iris and face taken from the same person.

The biometric engines had these parameters set:

- **±90 degrees fingerprint rotation tolerance** value was used for template matching;
- **±15 degrees iris rotation tolerance** value was used for template matching.

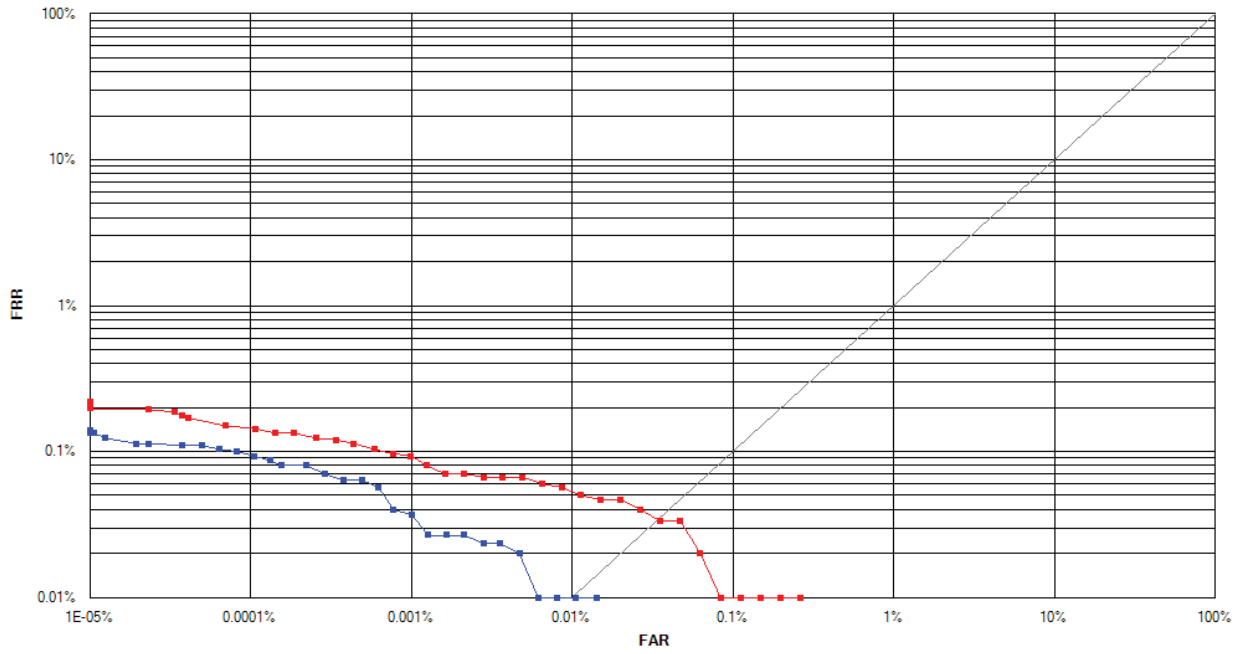
Two tests were performed with each template type:

- **Test 1 maximized matching accuracy.** MegaMatcher 9.0 fused algorithm reliability in this test is shown as **blue curves** on the ROC charts.
- **Test 2 maximized matching speed.** MegaMatcher 9.0 fused algorithm reliability in this test is shown as **red curves** on the ROC charts.

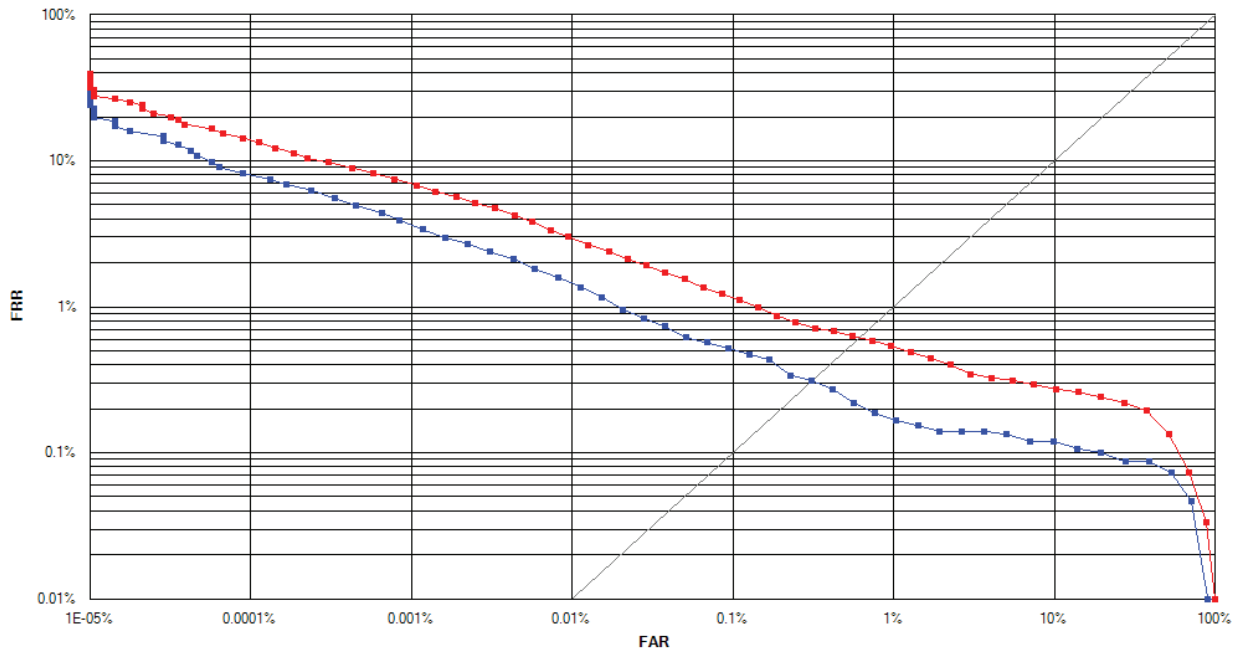
Receiver operation characteristics (**ROC**) curves are usually used to demonstrate the recognition quality of an algorithm. ROC curves show the dependence of false rejection rate (**FRR**) on the false acceptance rate (**FAR**).

MegaMatcher 9.0 template matching engines reliability testing results				
A template contains these biometric records	FRR at 0.001 % FAR		FRR at 0.0001 % FAR	
	Test 1	Test 2	Test 1	Test 2
1 fingerprint	0.0400 %	0.0933 %	0.1000 %	0.1500 %
1 face	3.9200 %	7.4870 %	8.2330 %	14.3400 %
1 iris	0.7933 %	1.0700 %	1.0230 %	1.2970 %
2 fingerprints	0.0000 %	0.0000 %	0.0067 %	0.0000 %
2 irises	0.1500 %	0.1833 %	0.2133 %	0.2400 %
1 fingerprint + 1 face	0.0000 %	0.0000 %	0.0000 %	0.0067 %
1 fingerprint + 1 iris ⁽¹⁾	0.0000 %	0.0000 %	0.0000 %	0.0000 %
1 face + 1 iris	0.0367 %	0.1833 %	0.0833 %	0.2367 %
1 fingerprint + 1 face + 1 iris ⁽¹⁾	0.0000 %	0.0000 %	0.0000 %	0.0000 %

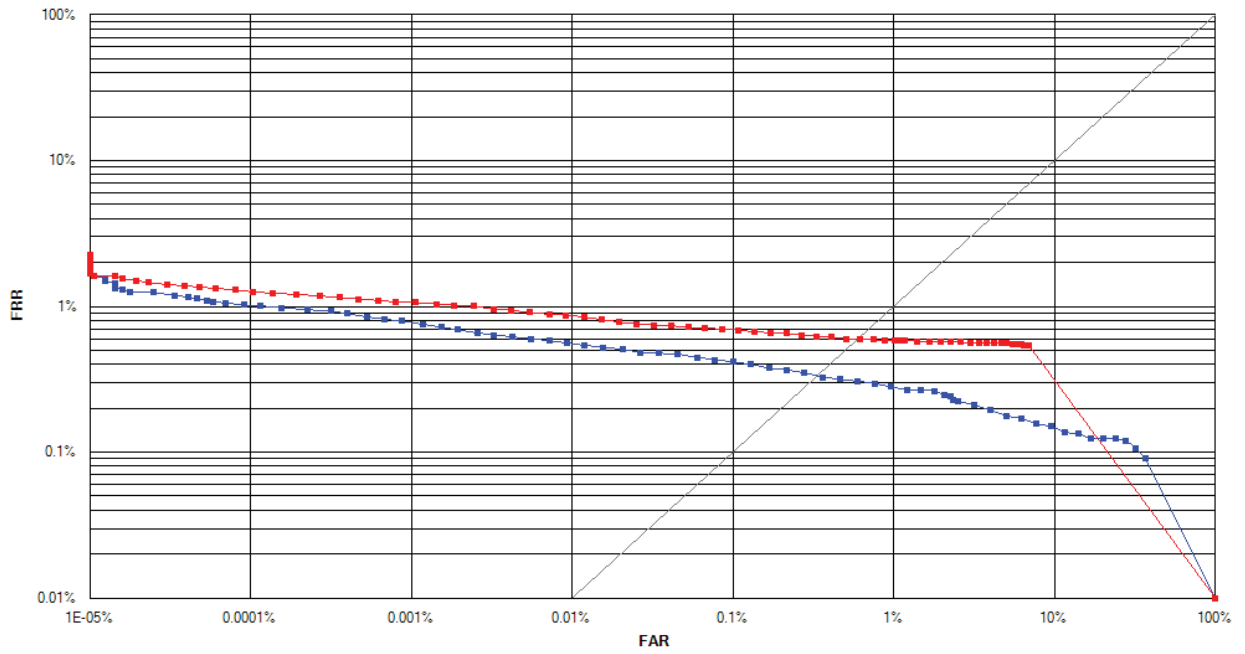
(1) These tests produced 0 % FRR for all FAR values, thus the ROC charts for them are not presented here



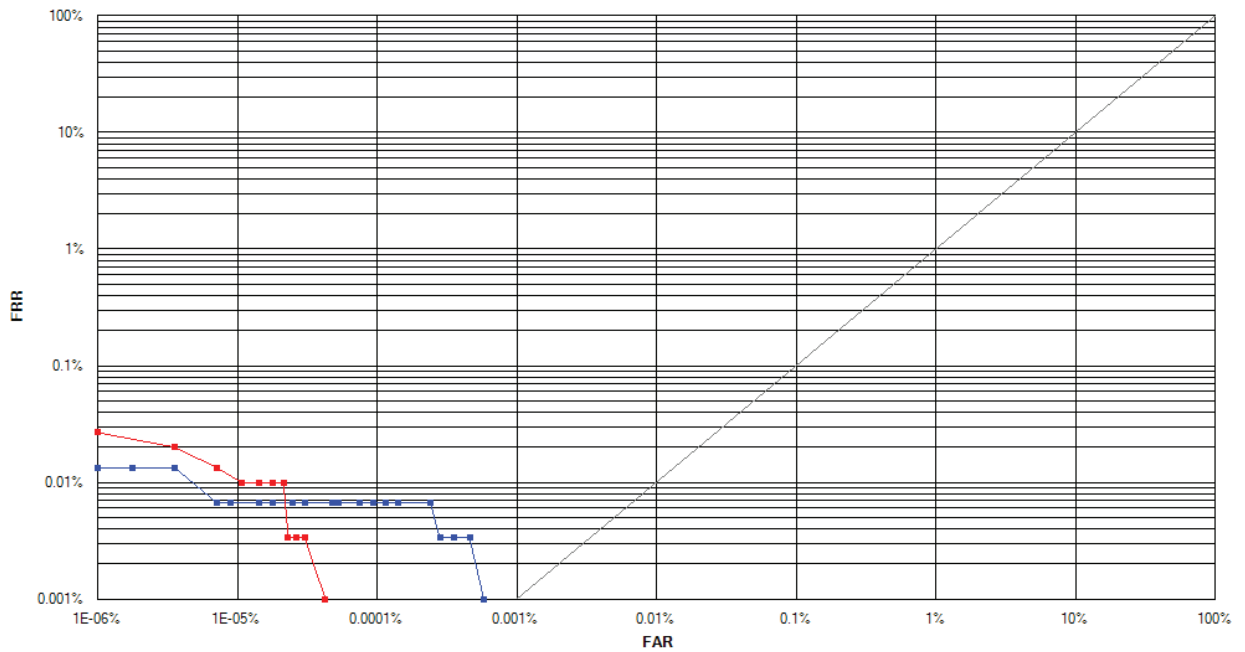
MegaMatcher 9.0 SDK fingerprint matching engine;
a template contains 1 fingerprint record:
■ Maximized matching speed scenario
■ Maximized matching accuracy scenario



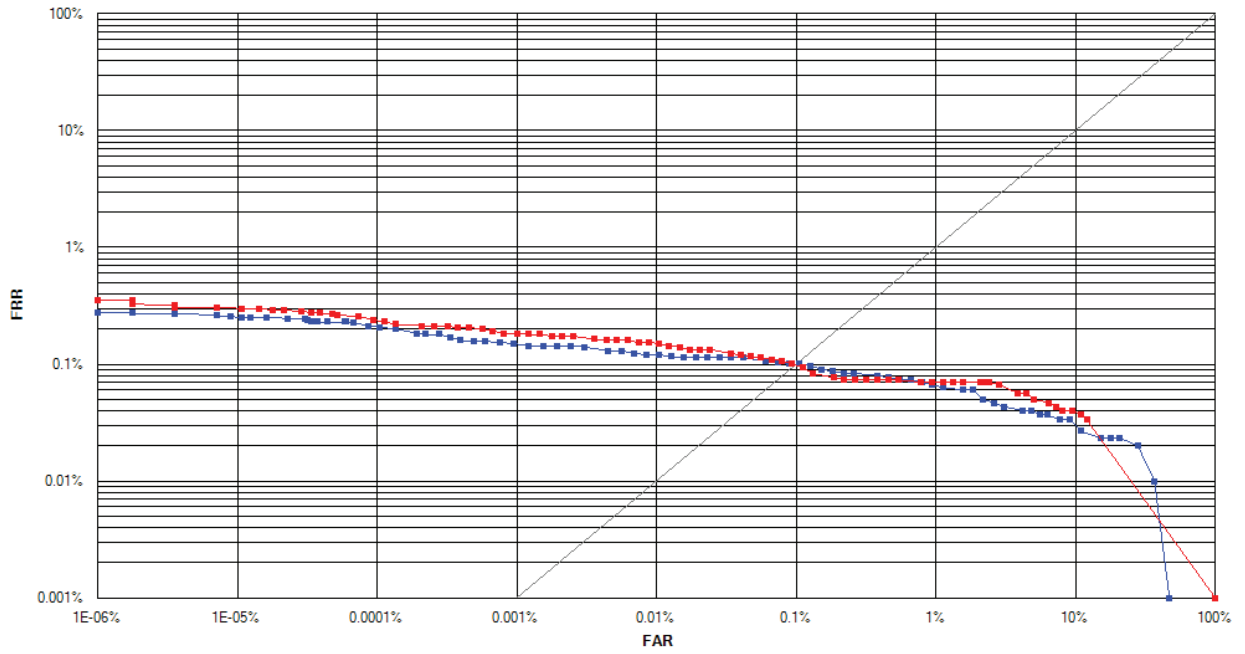
MegaMatcher 9.0 SDK face matching engine;
a template contains 1 face record:
■ Maximized matching speed scenario
■ Maximized matching accuracy scenario



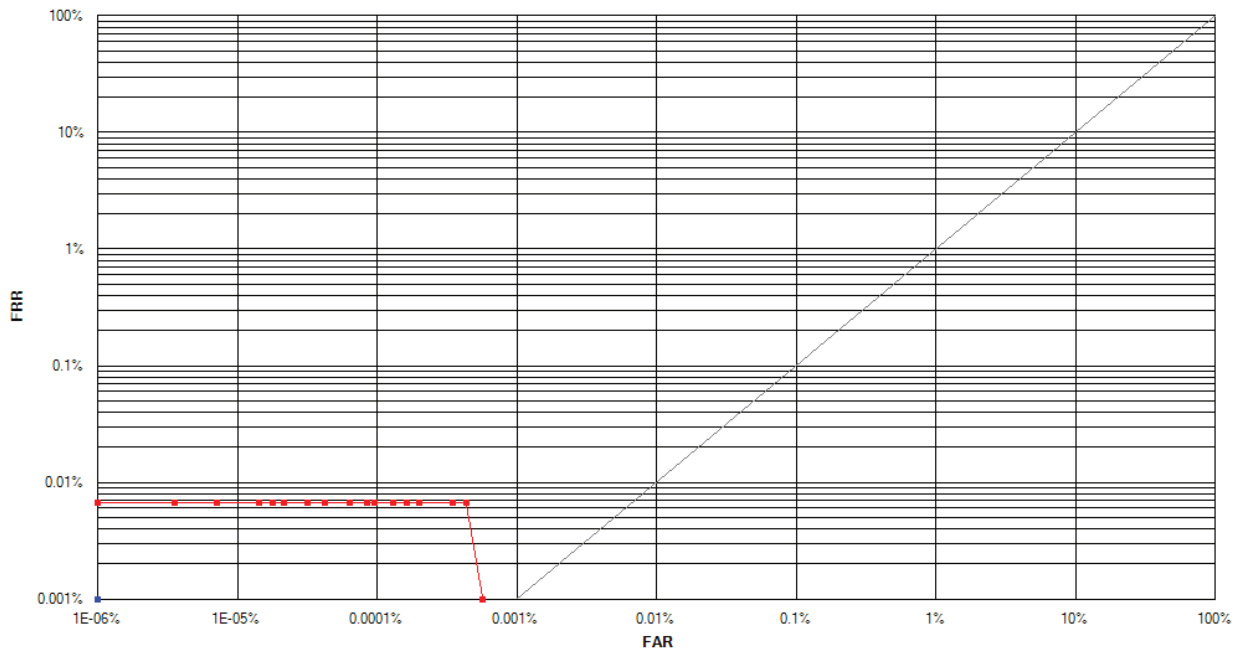
MegaMatcher 9.0 SDK iris matching engine;
a template contains 1 iris record:
■ Maximized matching speed scenario
■ Maximized matching accuracy scenario



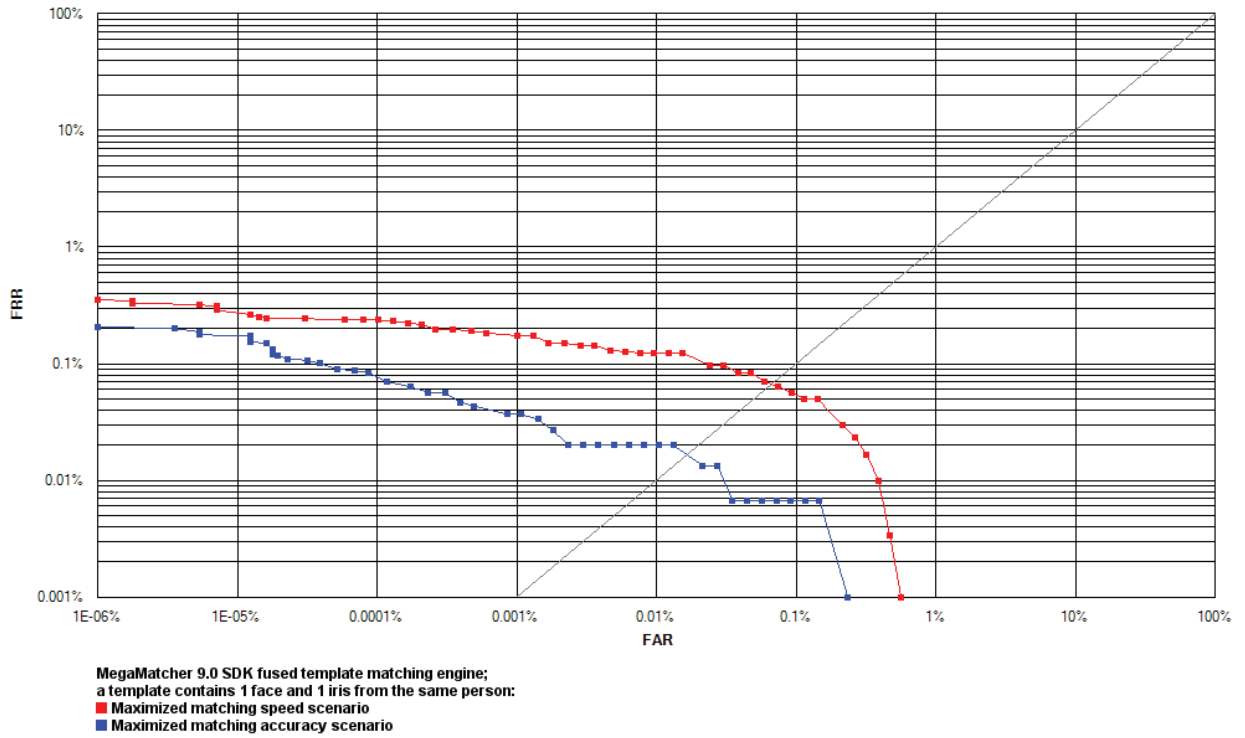
MegaMatcher 9.0 SDK fused template matching engine;
a template contains 2 different fingerprints from the same person:
■ Maximized matching speed scenario
■ Maximized matching accuracy scenario



MegaMatcher 9.0 SDK fused template matching engine;
 a template contains 2 different irises from the same person:
 ■ Maximized matching speed scenario
 ■ Maximized matching accuracy scenario



MegaMatcher 9.0 SDK fused template matching engine;
 a template contains 1 fingerprint and 1 face from the same person:
 ■ Maximized matching speed scenario
 ■ Maximized matching accuracy scenario



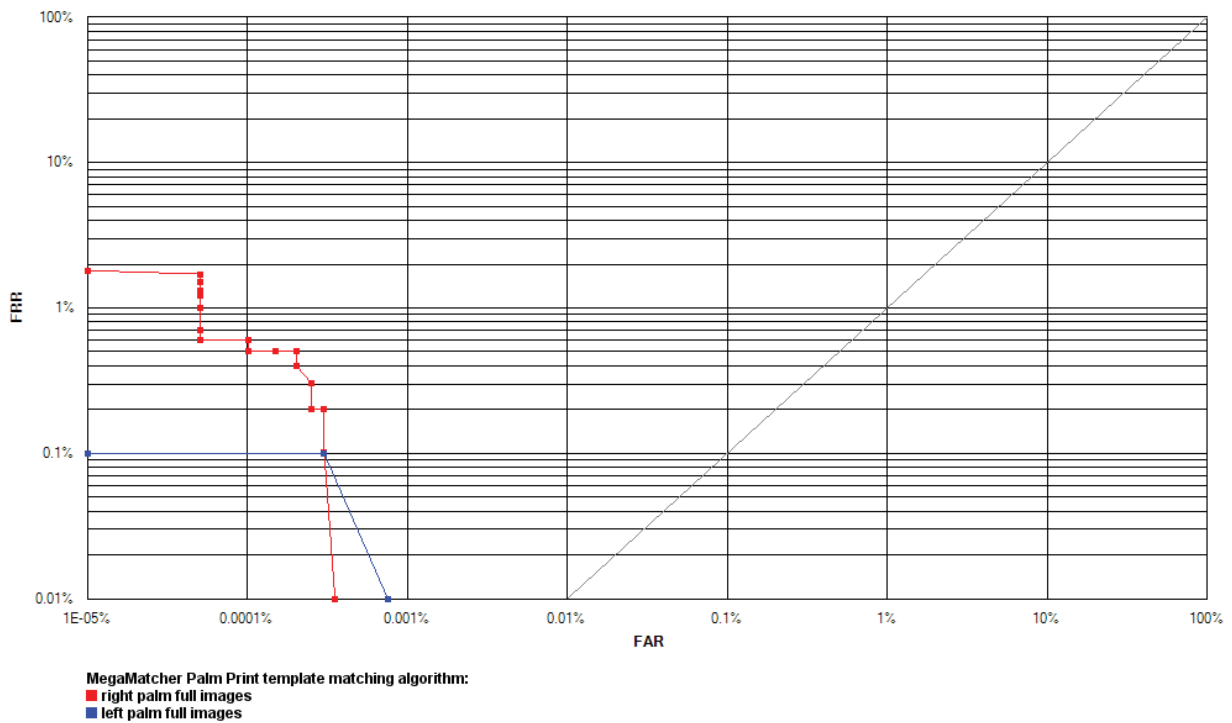
These tests show that a large-scale automated biometric identification system based on MegaMatcher provides high identification reliability when using fingerprints, using fused same-biometric (different fingerprints or irises from the same person) matching significantly reduces FRR, and using multi-biometric identification results in a significant reliability increase, allowing the system to reach almost 0 % FRR.



Palm Print Engine Tests

The MegaMatcher Palm Print template matching algorithm reliability tests were performed using internal palm print images database. The database contained 1,993 images of right hand full palms and 1,996 images of left hand full palms. The database represented 1,000 unique persons.

Receiver operation characteristics (ROC) curves are usually used to demonstrate the recognition quality of an algorithm. ROC curves show the dependence of false rejection rate (FRR) on the false acceptance rate (FAR). The chart with ROC curves for the MegaMatcher Palm Print template matching algorithm are available below.





MegaMatcher SDK Trial, Demo Applications and Related Products

MegaMatcher **30-day SDK Trial**, as well as fingerprint, face and iris engines **demo applications** are available for downloading at www.neurotechnology.com/download.html

These products are related to MegaMatcher SDK:

- **MegaMatcher Automated Biometric Identification System (ABIS)** – an integrated multi-biometric solution for national-scale identification projects.
- **MegaMatcher Accelerator 9.0** – a software/hardware solution for building the server-side of a large-scale AFIS or multi-biometric system; available in Standard and Extended versions; a single MegaMatcher Accelerator Standard matches **35 million fingerprints per second** or **70 million irises per second** or **35 million faces per second**, and the Extended matches **100 million fingerprints per second** or **200 million irises per second** or **100 million faces per second**. See “MegaMatcher Accelerator” brochure for more information.
- **MegaMatcher On Card SDK** – a product for fingerprint, iris and face matching on smart cards. See “MegaMatcher On Card SDK” brochure for more information.
- **FingerCell SDK** – for integrating fingerprint recognition into embedded platforms, like low-power, low-memory microcontrollers. See “FingerCell SDK” brochure for more information.
- Single biometrics SDKs for stand-alone and Web-based solutions:
 - **VeriFinger SDK** – for development of PC-based or Web-based fingerprint identification systems. See “VeriFinger SDK” brochure for more information.
 - **VeriLook SDK** – for development of PC-based or Web-based face identification systems. See “VeriLook SDK” brochure for more information.
 - **VeriEye SDK** – for development of PC-based or Web-based iris identification systems. See “VeriEye SDK” brochure for more information.
 - **VeriSpeak SDK** – for development of PC-based or Web-based speaker recognition applications. See “VeriSpeak SDK” brochure for more information.



Licensing MegaMatcher SDK

The following licensing model is intended for **end-user** product developers. Integrators who want to develop and sell a MegaMatcher-based development tool (with API, programming possibilities, programming samples, etc.), must obtain permission from Neurotechnology and sign a special VAR agreement.

Product Development

An integrator should obtain either a MegaMatcher 9.0 Standard SDK (EUR 2,590) or MegaMatcher 9.0 Extended SDK (EUR 4,990) to develop a product based on MegaMatcher technology. The SDK needs to be purchased just once and may be used by all the developers within the integrator's company.

MegaMatcher SDKs include a number of components; each particular component has specific functionality. A license for an individual MegaMatcher component is required for each computer or device that runs the component.

See the "Contents of MegaMatcher 9.0 Standard SDK and Extended SDK" chapter (the tables on the pages 8 and 9) for the list of component licenses included with MegaMatcher 9.0 Standard and MegaMatcher 9.0 Extended SDK.

The components are copy-protected – a license is required for a component to run. License activation options are listed below on this page.

Additional component licenses may be obtained by MegaMatcher 9.0 SDK customers as required by their development process.

Product Deployment

To deploy a product developed with MegaMatcher 9.0 SDK, an integrator needs to obtain only the additional licenses required for the particular MegaMatcher 9.0 components that will run on each computer or device belonging to their customers. The available MegaMatcher components and license types for product deployment are the same as for product development.

Each MegaMatcher component running on a computer belonging to the integrator's customer requires a license. License activation options are listed below on this page.

Prices for MegaMatcher 9.0 SDK and additional MegaMatcher component licenses can be found in the next chapter.

Licensing Agreement

The Licensing Agreement (http://neurotechnology.com/mm_90_sla.html) contains all licensing terms and conditions.

Note that you unambiguously accept this agreement by placing an order using Neurotechnology online ordering service or by email or other means of communications. Please read the agreement before making an order.

Single computer licenses

A single computer license allows the installation and running of a MegaMatcher component installation on one computer or device. Neurotechnology provides a way to renew the license if the computer undergoes changes due to technical maintenance.

Each single computer license requires activation for a MegaMatcher component to run. The available activation options are listed below.

Additional single computer licenses for MegaMatcher components may be obtained at any time by MegaMatcher SDK customers.



License activation options

Single computer licenses are supplied in three ways:

- **Serial numbers** are used to activate licenses for particular MegaMatcher components. The activation is done via the Internet or by email. After activation the network connection is not required for single computer license usage.
Notes:
 1. Activation by serial number is **not suitable for iOS and ARM-Linux** platforms.
 2. Activation by serial number is **not suitable for virtual environments**.
- **Internet activation.** A special **license file** is stored on a computer or a mobile or embedded device; the license file allows to run particular MegaMatcher components on that computer or device after **checking** the license over the Internet. **Internet connection** should be available periodically for a short amount of time. A single computer license can be **transferred** to another computer or device by moving the license file there and waiting until the previous activation expires.
- Licenses may be stored in a volume license manager **dongle**. License activation using volume license manager may be performed without connection to the Internet and is suitable for virtual environments.

Volume license manager

Volume license manager is used on site by integrators or end users to manage licenses for MegaMatcher components. It consists of license management software and a dongle, used to store the purchased licenses. An integrator or an end-user may use the volume license manager in the following ways:

- **Activating single computer licenses** – An installation license for a MegaMatcher component will be activated for use on a particular computer. The number of available licenses in the license manager will be decreased by the number of activated licenses.
- **Managing single computer licenses via a LAN or the Internet** – The license manager allows the management of installation licenses for MegaMatcher components across multiple computers or mobile/embedded devices in a LAN or over the Internet. The number of managed licenses is limited by the number of licenses in the license manager. No license activation is required and the license quantity is not decreased. Once issued, the license is assigned to a specific computer or device on the network.
- **Using license manager as a dongle** – A volume license manager containing at least one license for a MegaMatcher component may be used as a dongle, allowing the MegaMatcher component to run on the particular computer where the dongle is attached.



Disaster recovery licenses

Disaster recovery licenses for MegaMatcher server-side components are intended for using in disaster recovery centers (DRC). A DRC is a location which has the same equipment as the primary site, completely mirrors the data environment of the primary site and is **on standby** while the primary site is working. If the primary site fails, the DRC takes over operations.

Licenses for these MegaMatcher server-side components are available for disaster recovery centers with **40 % discount**:

- Fast Fingerprint Matcher, Fast Fingerprint Extractor, Fast Fingerprint Segmenter;
- Fast Face Matcher, Fast Face Extractor, Fast Face Token Image;
- Fast Iris Matcher, Fast Iris Extractor;
- Fast Voice Extractor.

For more information please contact us.

MegaMatcher enterprise license

The MegaMatcher enterprise license allows an **unlimited use** of MegaMatcher components in end-user products for a specific territory, market segment or project. Specific restrictions would be included in the licensing agreement.

The enterprise license price depends on the application size and the number of potential users of the application within the designated territory, market segment or project.

For more information please contact us.



Prices for MegaMatcher products

- The prices are **effective June 1, 2016**. The prices may change in the future, so please **download and review the latest version** of the brochure before making an order.
- Quantity discounts do not accumulate over time.
- Prices do not include local import duties or taxes.
- Product shipping costs depend on delivery country.
- Customers with Solution Partner status are eligible for product discounts.

SDK prices

MegaMatcher 9.0 Standard SDK	€ 2,590.00
MegaMatcher 9.0 Extended SDK	€ 4,990.00

*The prices for fingerprint, face, iris, voiceprint and palm print components are available on the **next pages**.*



Fingerprint components prices

Client-side fingerprint acquisition components (prices per single computer license)

Quantity	Fingerprint Client	Embedded Fingerprint Client	Fingerprint Capturer	Embedded Fingerprint Capturer
1 - 9	€ 70.00	€ 45.00	€ 10.00	€ 6.50
10 - 19	€ 51.00	€ 33.00	€ 7.50	€ 4.70
20 - 49	€ 45.00	€ 29.00	€ 6.50	€ 4.20
50 - 99	€ 40.00	€ 25.50	€ 5.50	€ 3.70
100 - 199	€ 36.00	€ 22.80	€ 5.00	€ 3.30
200 - 499	€ 32.00	€ 20.50	€ 4.50	€ 2.90
500 - 999	€ 28.00	€ 17.80	€ 4.00	€ 2.60
1000 - 1999	€ 25.00	€ 15.90	€ 3.50	€ 2.30
2000 and more	Please contact us for more information			

Client-side fingerprint matching components (prices per single computer license)

Quantity	Fingerprint Matcher	Embedded Fingerprint Matcher
1 - 9	€ 25.00	€ 17.00
10 - 19	€ 18.00	€ 12.00
20 - 49	€ 16.00	€ 10.80
50 - 99	€ 14.00	€ 9.60
100 - 199	€ 12.50	€ 8.40
200 - 499	€ 11.00	€ 7.60
500 - 999	€ 10.00	€ 6.80
1000 - 1999	€ 9.00	€ 6.00
2000 and more	Please contact us for more information	

Server-side fingerprint components (prices per single computer license)

Quantity	Fast Fingerprint Extractor	Fast Fingerprint Segmenter	Fast Fingerprint Matcher
1 - 9	€ 2,000.00	€ 500.00	€ 540.00
10 - 19	€ 1,450.00	€ 370.00	€ 390.00
20 - 49	€ 1,300.00	€ 320.00	€ 355.00
50 and more	Please contact us for more information		

Fingerprint Client advanced sub-components (prices per single computer license)

Quantity	Fingerprint Extractor	Embedded Fingerprint Extractor	Fingerprint Segmenter	Fingerprint BSS	Fingerprint WSQ
1 - 9	€ 20.00	€ 13.00	€ 40.00	€ 10.00	€ 10.00
10 - 19	€ 15.00	€ 10.00	€ 30.00	€ 7.50	€ 7.50
20 - 49	€ 13.00	€ 8.70	€ 26.00	€ 6.50	€ 6.50
50 - 99	€ 11.00	€ 7.50	€ 23.00	€ 5.50	€ 5.50
100 - 199	€ 10.00	€ 6.70	€ 20.00	€ 5.00	€ 5.00
200 - 499	€ 9.00	€ 6.00	€ 18.00	€ 4.50	€ 4.50
500 - 999	€ 8.00	€ 5.30	€ 16.00	€ 4.00	€ 4.00
1000 - 1999	€ 7.00	€ 4.70	€ 14.00	€ 3.50	€ 3.50
2000 and more	Please contact us for more information				



Face components prices

Client-side face acquisition components (prices per single computer license)				
Quantity	Face Client	Embedded Face Client	Face Capturer	Embedded Face Capturer
1 - 9	€ 60.00	€ 27.00	€ 10.00	€ 6.50
10 - 19	€ 44.00	€ 20.00	€ 7.50	€ 4.70
20 - 49	€ 39.00	€ 18.00	€ 6.50	€ 4.20
50 - 99	€ 34.00	€ 15.00	€ 5.50	€ 3.70
100 - 199	€ 30.00	€ 13.50	€ 5.00	€ 3.30
200 - 499	€ 27.00	€ 12.00	€ 4.50	€ 2.90
500 - 999	€ 24.00	€ 10.50	€ 4.00	€ 2.60
1000 - 1999	€ 21.00	€ 9.50	€ 3.50	€ 2.30
2000 and more	Please contact us for more information			

Client-side face matching components (prices per single computer license)			
Quantity	Face Matcher	Embedded Face Matcher	Face Verification component
1 - 9	€ 25.00	€ 11.00	€ 1.75
10 - 19	€ 18.00	€ 8.00	€ 1.27
20 - 49	€ 16.00	€ 7.10	€ 1.13
50 - 99	€ 14.00	€ 6.20	€ 1.00
100 - 199	€ 12.50	€ 5.60	€ 0.89
200 - 499	€ 11.00	€ 5.00	€ 0.79
500 - 999	€ 10.00	€ 4.40	€ 0.69
1000 - 1999	€ 9.00	€ 3.90	€ 0.62
2000 and more	Please contact us for more information		

Server-side face components (prices per single computer license)			
Quantity	Fast Face Extractor	Fast Face Token Image	Fast Face Matcher
1 - 9	€ 2,000.00	€ 300.00	€ 300.00
10 - 19	€ 1,450.00	€ 220.00	€ 220.00
20 - 49	€ 1,300.00	€ 195.00	€ 195.00
50 and more	Please contact us for more information		

Face Client advanced sub-components (prices per single computer license)				
Quantity	Face Extractor	Embedded Face Extractor	Face Token Image	Face BSS
1 - 9	€ 20.00	€ 9.00	€ 40.00	€ 10.00
10 - 19	€ 15.00	€ 6.50	€ 30.00	€ 7.50
20 - 49	€ 13.00	€ 5.80	€ 26.00	€ 6.50
50 - 99	€ 11.00	€ 5.10	€ 23.00	€ 5.50
100 - 199	€ 10.00	€ 4.60	€ 20.00	€ 5.00
200 - 499	€ 9.00	€ 4.10	€ 18.00	€ 4.50
500 - 999	€ 8.00	€ 3.60	€ 16.00	€ 4.00
1000 - 1999	€ 7.00	€ 3.20	€ 14.00	€ 3.50
2000 and more	Please contact us for more information			



Iris components prices

Client-side iris acquisition components (prices per single computer license)				
Quantity	Iris Client	Embedded Iris Client	Iris Capturer	Embedded Iris Capturer
1 - 9	€ 38.00	€ 25.00	€ 10.00	€ 6.50
10 - 19	€ 28.00	€ 18.00	€ 7.50	€ 4.70
20 - 49	€ 25.00	€ 16.00	€ 6.50	€ 4.20
50 - 99	€ 22.00	€ 14.00	€ 5.50	€ 3.70
100 - 199	€ 19.00	€ 12.50	€ 5.00	€ 3.30
200 - 499	€ 17.00	€ 11.00	€ 4.50	€ 2.90
500 - 999	€ 15.00	€ 10.00	€ 4.00	€ 2.60
1000 - 1999	€ 13.00	€ 9.00	€ 3.50	€ 2.30
2000 and more	Please contact us for more information			

Client-side iris matching components (prices per single computer license)		
Quantity	Iris Matcher	Embedded Iris Matcher
1 - 9	€ 38.00	€ 25.00
10 - 19	€ 28.00	€ 18.00
20 - 49	€ 25.00	€ 16.00
50 - 99	€ 22.00	€ 14.00
100 - 199	€ 19.00	€ 12.50
200 - 499	€ 17.00	€ 11.00
500 - 999	€ 15.00	€ 10.00
1000 - 1999	€ 13.00	€ 9.00
2000 and more	Please contact us for more information	

Server-side iris components (prices per single computer license)		
Quantity	Fast Iris Extractor	Fast Iris Matcher
1 - 9	€ 2,000.00	€ 800.00
10 - 19	€ 1,450.00	€ 580.00
20 - 49	€ 1,300.00	€ 520.00
50 and more	Please contact us for more information	

Iris Client advanced sub-components (prices per single computer license)			
Quantity	Iris Extractor	Embedded Iris Extractor	Iris BSS
1 - 9	€ 30.00	€ 20.00	€ 10.00
10 - 19	€ 22.00	€ 15.00	€ 7.50
20 - 49	€ 19.00	€ 13.00	€ 6.50
50 - 99	€ 17.00	€ 11.00	€ 5.50
100 - 199	€ 15.00	€ 10.00	€ 5.00
200 - 499	€ 13.00	€ 9.00	€ 4.50
500 - 999	€ 12.00	€ 8.00	€ 4.00
1000 - 1999	€ 11.00	€ 7.00	€ 3.50
2000 and more	Please contact us for more information		



Voice components prices

Client-side voice acquisition components (prices per single computer license)				
Quantity	Voice Client	Embedded Voice Client	Voice Capturer	Embedded Voice Capturer
1 - 9	€ 20.00	€ 9.00	€ 10.00	€ 6.50
10 - 19	€ 15.00	€ 6.50	€ 7.50	€ 4.70
20 - 49	€ 13.00	€ 5.80	€ 6.50	€ 4.20
50 - 99	€ 11.00	€ 5.10	€ 5.50	€ 3.70
100 - 199	€ 10.00	€ 4.60	€ 5.00	€ 3.30
200 - 499	€ 9.00	€ 4.10	€ 4.50	€ 2.90
500 - 999	€ 8.00	€ 3.60	€ 4.00	€ 2.60
1000 - 1999	€ 7.00	€ 3.20	€ 3.50	€ 2.30
2000 and more	Please contact us for more information			

Voice matching components (prices per single computer license)		
Quantity	Voice Matcher	Embedded Voice Matcher
1 - 9	€ 25.00	€ 11.00
10 - 19	€ 18.00	€ 8.00
20 - 49	€ 16.00	€ 7.10
50 - 99	€ 14.00	€ 6.20
100 - 199	€ 12.50	€ 5.60
200 - 499	€ 11.00	€ 5.00
500 - 999	€ 10.00	€ 4.40
1000 - 1999	€ 9.00	€ 3.90
2000 and more	Please contact us for more information	

Server-side voice components (prices per single computer license)	
Quantity	Fast Voice Extractor
1 - 9	€ 2,000.00
10 - 19	€ 1,450.00
20 - 49	€ 1,300.00
50 and more	Please contact us for more information

Voice Client advanced sub-components (prices per single computer license)		
Quantity	Voice Extractor	Embedded Voice Extractor
1 - 9	€ 20.00	€ 9.00
10 - 19	€ 15.00	€ 6.50
20 - 49	€ 13.00	€ 5.80
50 - 99	€ 11.00	€ 5.10
100 - 199	€ 10.00	€ 4.60
200 - 499	€ 9.00	€ 4.10
500 - 999	€ 8.00	€ 3.60
1000 - 1999	€ 7.00	€ 3.20
2000 and more	Please contact us for more information	



Palm print components prices

Palm print components (prices per single computer license)		
Quantity	Palm Print Client	Palm Print Matcher
1 - 9	€ 123.00	€ 154.00
10 - 19	€ 90.00	€ 112.00
20 - 49	€ 80.00	€ 100.00
50 - 99	€ 70.00	€ 87.00
100 and more	Please contact us for more information	

License management

License management	
Volume license manager	€ 16.00

MegaMatcher products can be ordered:

- online, at www.neurotechnology.com/cgi-bin/order.cgi
- via a local Neurotechnology distributor; the list of distributors is available at www.neurotechnology.com/distributors.html