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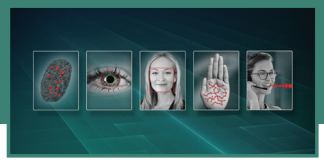
Large-scale AFIS and multi-biometric identification

MegaMatcher SDK



MegaMatcher SDK

Large-scale AFIS and multi-biometric identification

*Document updated on **March 14, 2024***

Contents

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, macOS, iOS and Android platforms.

- Proven in multiple national-scale projects.
- 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.
- ICAO requirements compliancy check for face images.
- Multiplatform, scalable architecture for parallel matching.
- Effective price/performance ratio, flexible licensing, free customer support.

See **demo video**:
https://youtu.be/x9v9m5LezSg

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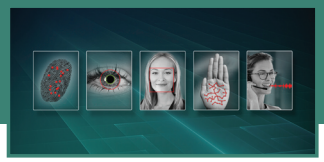

MegaMatcher algorithm features and capabilities

Performance numbers are provided for a PC with Intel Core i7-8xxx series processor.

MegaMatcher technology is available as multiplatform SDK, which 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 biometric software engines are based on deep neural networks and contain many proprietary algorithmic solutions that are especially useful for large-scale identification problems. 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. The image quality determination can tell if a finger is too wet, too dry, pressed too much or not enough, or if only tips of fingers are present.
- **Spoof fingerprint detection.** A deep learning based scanned fingerprint image classification is used to separate live/non-live fingerprints to detect finger presentation attack. This feature covers spoofing attempts performed with ecoflex, wood glue, latex and gelatin and is useful for fraud identification.
- 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. Also, the matching algorithm has a special mode for matching different scale fingerprint records, as well as optional matching of mirrored fingerprints.

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. Also, partially occluded faces (i.e. persons wearing **face masks** or respirators) can be recognized without separate enrollment.
- **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**.
- **Face liveness 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 or single frame is "live" or a photograph.
- 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 user experience during matching. For example a person might be enrolled with eyeglasses and without, or with different types of eyeglasses; with and without beard or mustache, etc.

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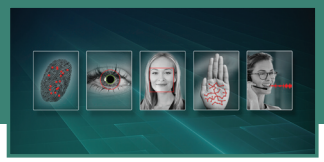

MegaMatcher voice template extraction and matching engine

- **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.
- **Iris image quality determination.** The image quality estimation can be used during iris enrollment to ensure that only the best quality iris template will be stored into database. Roll angle can be determined from iris image for further decisions about accepting the image for enrollment. Also, irises, which are obscured by cosmetic (decorative) contact lenses with some artistic images or color change, can be rejected from enrollment.
- **Liveness detection.** A captured iris can be analyzed whether it is "live" or a spoof to prevent security breach performed by placing a **photo** in front of the camera or wearing **contact lenses** with **fake iris** texture
- **Automatic iris position detection.** The algorithm is able to separate images of left and right irises.

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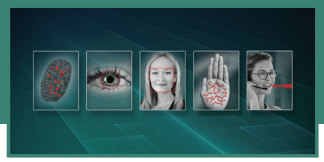

Technology Awards

MegaMatcher technology has received numerous awards and compliancy certifications from government and science authorities.

MINEX evaluations by NIST

- **MINEX III** evaluation was successfully passed in 2015. In **2023** Neurotechnology achieved **first place in the fingerprint template matching** category of the NIST MINEX III evaluation. Combined with the existing **first position in the template generator interoperability** category, Neurotechnology is the **top vendor within the MINEX III evaluation overall**.
- **MINEX Ongoing** evaluation was successfully passed in 2014. The **second place in the Ongoing MINEX ranking** for fingerprint matching algorithms was achieved. MegaMatcher technology was recognized by the NIST as fully MINEX compliant.

FVC-onGoing results

- In 2020 MegaMatcher **fingerprint** recognition algorithm has shown the **top result** at the FVC-onGoing evaluation. The fingerprint extractor and matcher were ranked as the **most accurate** for both FV-STD-1.0 and FV-HARD-1.0 benchmarks.
- In 2019 MegaMatcher **palm print** matching algorithm has shown the **top result** at the FVC-onGoing evaluation. The algorithm was the **most accurate** overall and **fastest** among the five most accurate matchers.

PFT II and PFT III (Proprietary Fingerprint Template) Evaluation

- Different versions of Neurotechnology's fingerprint recognition algorithm were submitted to the NIST Proprietary Fingerprint Template Evaluation. The algorithm's template matching accuracy was among the best participants at the previous PFT II evaluation. Our latest submissions to the PFT II and the ongoing **PFT III** are in average the **most accurate** algorithms in all the tests

SlapSeg III Evaluation

- Neurotechnology's slap fingerprint segmentation algorithm showed off as a top performer in the SlapSeg III evaluation, featuring the fastest performance and almost the best accuracy in most categories of the SlapSeg III evaluation.

FpVTE (Fingerprint Vendor Technology Evaluations) by NIST

- **FpVTE 2012** – in 2015 NIST recognized Neurotechnology's fingerprint identification algorithm as **one of the fastest and most accurate** among the evaluation's participants.
- **FpVTE 2003** – one of the best reliability results in the Middle Scale Test were shown. Neurotechnology participated in FpVTE 2003 under the name *Neurotechnologija*.

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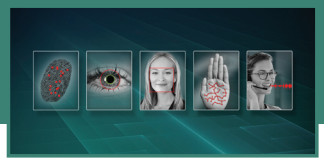

IREX evaluations by NIST

- **IREX 10** – in 2023 Neurotechnology's iris recognition algorithm has been judged by the NIST as the **most accurate** among the IREX 10 participants in the *Rank 1* category. The submitted algorithm outperformed other contenders in both single-eye and two-eye assessments. Also, it showed top results for most performance metrics..
- **IREX IX** – in 2018 Neurotechnology's iris recognition algorithm has been judged by the NIST as the **second most accurate** among the participants. The accelerated version of the algorithm was nearly **50 times faster** than any other matcher in the NIST IREX IX evaluation.
- **IREX IV** – in 2013 Neurotechnology's iris recognition algorithm has been judged the by the NIST as **one of the fastest** and **most accurate among the participants**.
- **IREX III** – in 2012 MegaMatcher iris matching algorithm was the **second fastest** and provided **3 times higher recognition accuracy than the only faster contender**.

FRVT Ongoing

- In 2018 Neurotechnology has been ranked among 8 most accurate face recognition algorithm vendors out of 39, with tenth most accurate algorithm out of 78 in the FRVT leaderboard. The submission was also ranked as **one of the best in two difficult scenarios**, with **second most accurate** result on a complex dataset collected from operational photos related to ongoing criminal investigations, and fourth most accurate result with unconstrained, photojournalism-style photos.

FIVE (Face in Video Evaluation)

- In 2015 Neurotechnology face recognition engine to the NIST Face in Video Evaluation (FIVE). In average the submitted algorithm was ranked among top 8 most accurate face recognition algorithms out of 16 vendors.

WSQ 3.1 Certification by the FBI

- In 2011 **FBI certified Neurotechnology's implementation of WSQ image format support**. Certificates and additional information are available.

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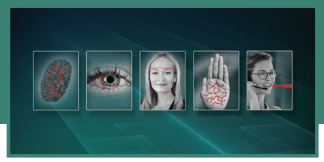

High Productivity System Architecture

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.

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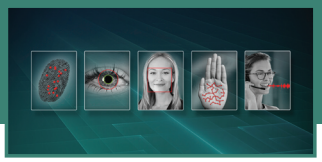
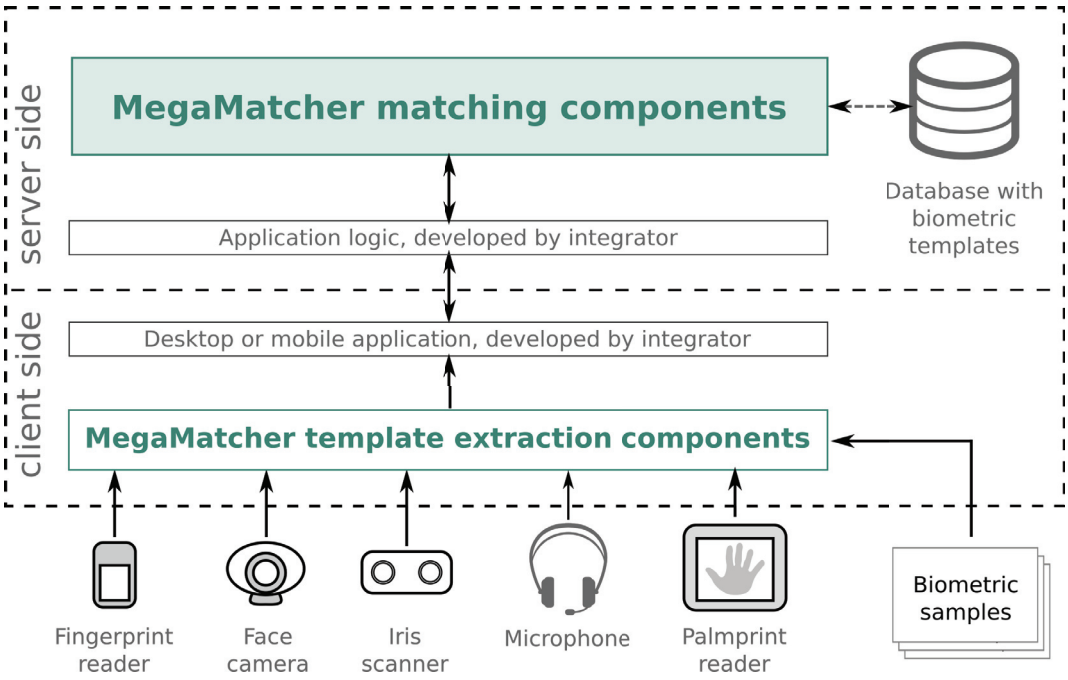


Template creation on client-side and matching on server-side

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 components are provided as **ready-to-use** Matching Server or MegaMatcher Accelerator 13.1 units with **biometric engines** for matching fingerprint, palmprint, face, iris and voiceprint templates.

See pages 12 and 13 for more information about scalable server-side components.

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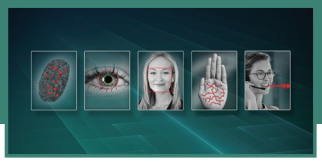
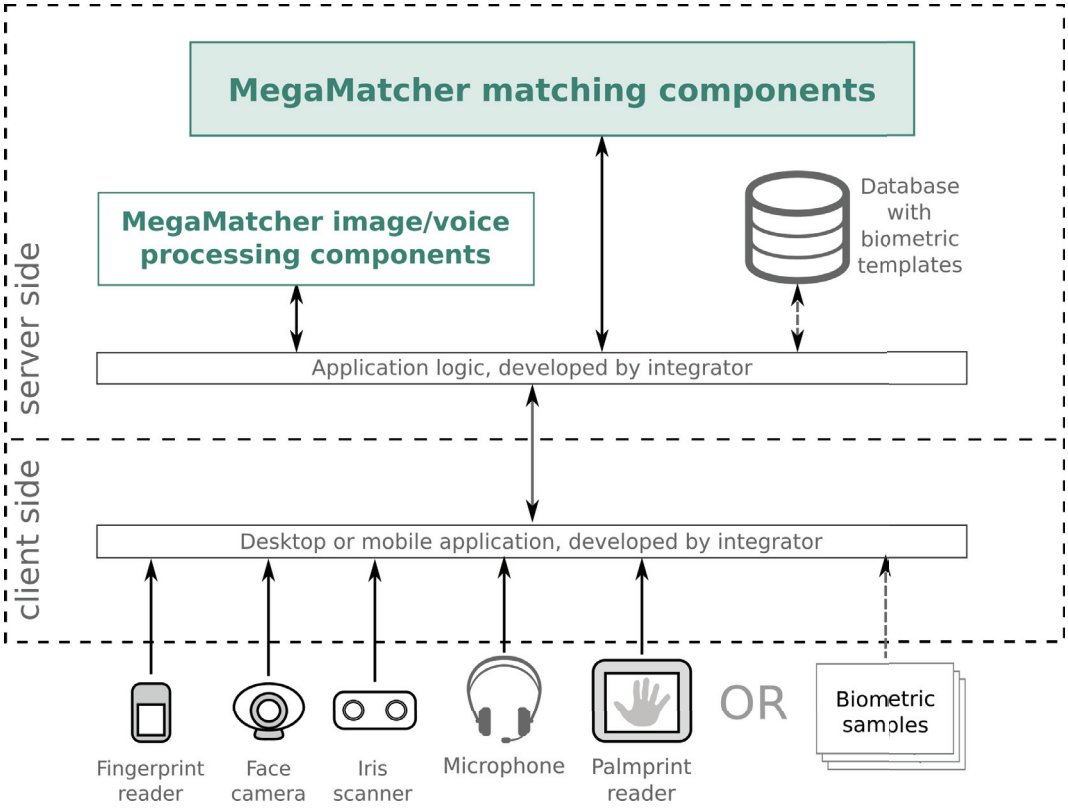


Template creation and matching on server side

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 components can be optionally deployed and are provided as **ready-to-use** Matching Server or MegaMatcher Accelerator 13.1 units with **biometric engines** for matching fingerprint, palmprint, face, iris and voiceprint templates.

See pages 12 and 13 for more information about scalable server-side components.

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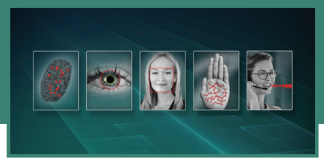
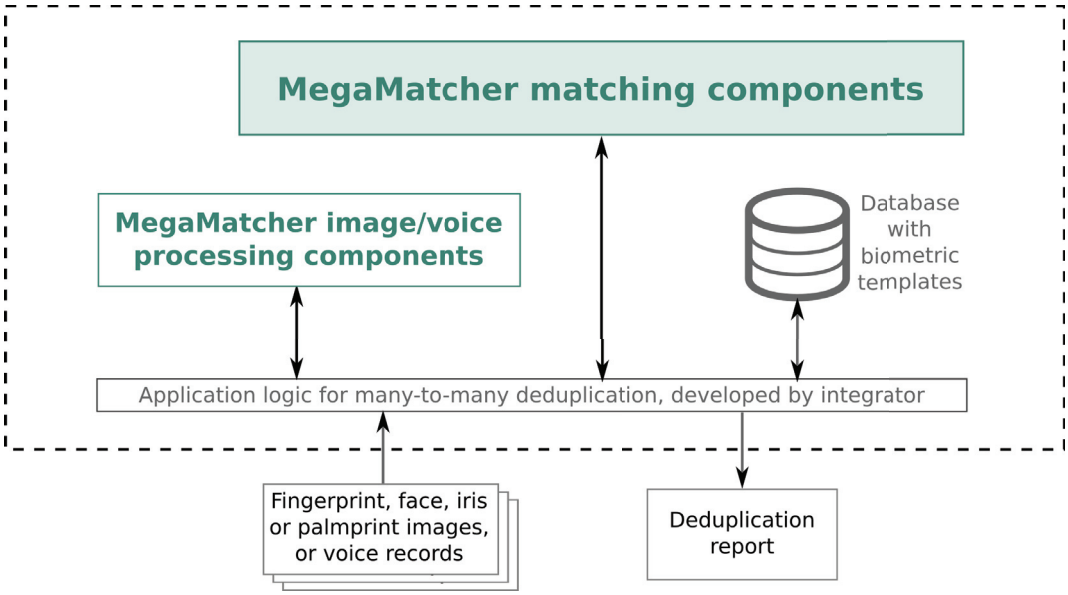


Deduplication after all users data collected

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, or voice samples, 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, palmprint, face, iris and voiceprint 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 **MegaMatcher ABIS Cloud Service**, which provides results for a reasonable price without the need to develop a solution. See *www.megamatcher.online* for more information.

See pages 12 and 13 for more information about scalable server-side components.

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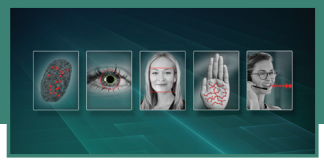
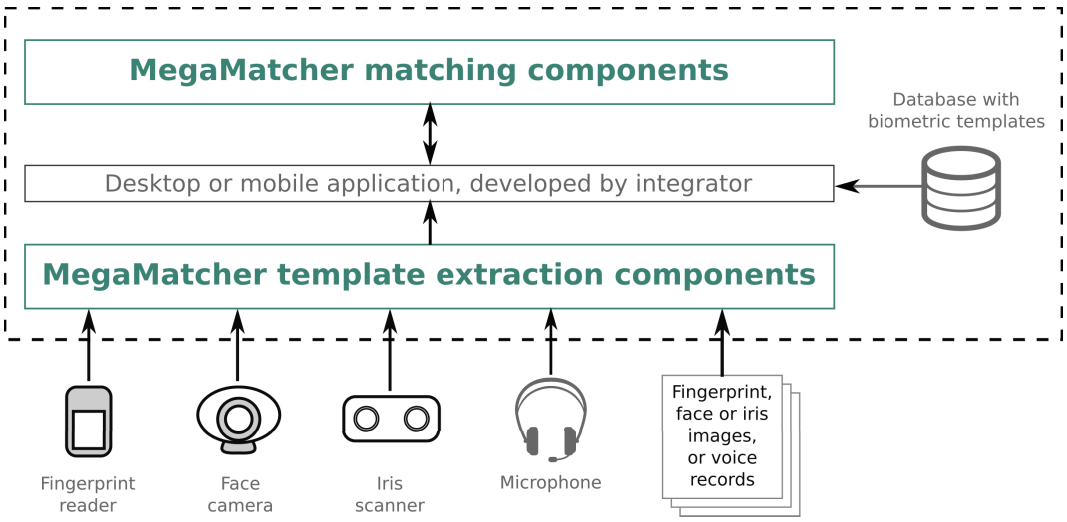


Template creation and matching on the same computer or device

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** ot **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 biometric image processing components

Template extraction components for server-side					
	Fingerprints	Faces	Irises	Voiceprints	Palmprints
Image processing speed	3,000 fingerprints per minute	3,000 faces per minute	3,000 irises per minute	3,000 voiceprints per minute	350 palmprints per minute

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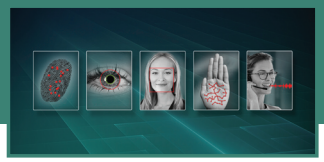

MegaMatcher scalable server-side matching components

MegaMatcher matching components are provided as **ready-to-use** Matching Server or MegaMatcher Accelerator 13.1 units with **biometric engines** for matching fingerprint, palmprint, 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 13.1 Standard SDK.
- MegaMatcher Accelerator 13.1 is a solution for **large-scale** AFIS and multi-biometric projects, which is available as Development Edition, Standard, Extended and Extreme versions. The MegaMatcher Accelerator includes **cluster** software to enable system **scalability**, high **availability** and **fault tolerance**. MegaMatcher Accelerator software is provided with MegaMatcher 13.1 Extended SDK.

The comparison table with the template matching components and engines is available on the next page.
Note that voiceprints and palmprints engines are not available in MegaMatcher Accelerator Extreme Edition.

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.
- **MegaMatcher Accelerator Extended** has no limitations on cluster size, but in general it makes no sense to run more than **4 nodes** in the cluster, as the whole system will cost like one MegaMatcher Accelerator Extreme 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.

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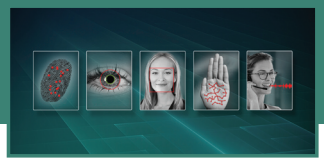

Template matching components performance and scalabilty			
		Database capacity	Matching speed
Matching Server with Matcher engines	Fingerprints	*Unlimited*	*40,000* fingerprints per second
	Faces	*Unlimited*	*40,000* faces per second
	Irises	*Unlimited*	*40,000* irises per second
	Voiceprints	*Unlimited*	*8,000* voiceprints per second
	Palmrprints	*Unlimited*	*800* palmprints per second
Matching Server with Fast Matcher engines	Fingerprints	*Unlimited*	*200,0000* fingerprints per second
	Faces	*Unlimited*	*200,0000* faces per second
	Irises	*Unlimited*	*200,0000* irises per second
	Voiceprints	*Unlimited*	*40,0000* voiceprints per second
	Palmprints	*Unlimited*	*4,0000* palmprints per second
Cluster of MegaMatcher Accelerator 13.1 Dev. Edition with *N* units	Fingerprints	*N* × 4,000,000 fingerprints	*N* × 1,000,000 fingerprints per second
	Faces	*N* × 1,000,000 faces	*N* × 1,000,000 faces per second
	Irises	*N* × 5,000,000 irises	*N* × 1,000,000 irises per second
	Voiceprints	*N* × 1,000,000 voiceprints	*N* × 200,000 voiceprints per second
	Palmrprints	*N* × 800,000 palmprints	*N* × 20,000 palmprints per second
Cluster of MegaMatcher Accelerator 13.1 Standard with *N* units	Fingerprints	*N* × 4,000,000 fiingerprints	*N* × 35,000,000 fingerprints per second
	Faces	*N* × 1,000,000 faces	*N* × 35,000,000 faces per second
	Irises	*N* × 5,000,000 irises	*N* × 70,000,000 irises per second
	Voiceprints	*N* × 1,000,000 voiceprints	*N* × 10,000,000 voiceprints per second
	Palmprints	*N* × 800,000 palmprints	*N* × 600,000 palmprints per second
Cluster of MegaMatcher Accelerator 13.1 Extended with *N* units	Fingerprints	*N* × 40,000,000 fingerprints	*N* × 100,000,000 fingerprints per second
	Faces	*N* × 10,000,000 faces	*N* × 100,000,000 faces per second
	Irises	*N* × 50,000,000 irises	*N* × 200,000,000 irises per second
	Voiceprints	*N* × 10,000,000 voiceprints	*N* × *30,*000,000 voiceprints per second
	Palmrprints	*N* × 8,000,000 palmprints	*N* × 2,000,000 palmprints per second
Cluster of MegaMatcher Accelerator 13.1 Extreme with *N* units	Fingerprints	*N* × 160,000,000 fiingerprints	*N* × 1,200,000,000 fingerprints per second
	Faces	*N* × 40,000,000 faces	*N* × *1,*200,000,000 faces per second
	Irises	*N* × 200,000,000 irises	*N* × *1,200,*000,000 irises per second

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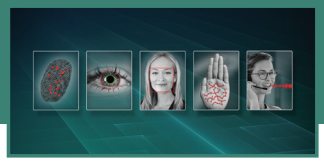

Contents of MegaMatcher Standard SDK and Extended SDK

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 13.1 SDK.

MegaMatcher 13.1 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 13.1 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 13.1 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 13.1 SDK:

- **MegaMatcher 13.1 Standard SDK** for developing a client/server based multi-biometric fingerprint-face-iris identification product. This SDK is suitable for **network-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 macOS.
- **MegaMatcher 13.1 Extended SDK** for developing a large-scale network-based AFIS or multi-biometric identification product. The SDK includes all components of MegaMatcher 13.1 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 13.1 Standard SDK, ready-to-use cluster server software and MegaMatcher Accelerator software. This SDK also allows to develop **network-based** systems.

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

MegaMatcher 13.1 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 Windws	Linux	macOS	Android	iOS
Programming samples					
• C / C++	+	+	+		
• Objective-C					+
• C#	+				
• Visual Basic .NET	+				
• Java	+	+	+	+	
Programming tutorials					
• C / C++	+	+	+		
• C#	+				
• Visual Basic .NET	+				
• Java	+	+	+	+	
• Python 3	+	+			

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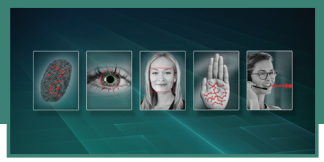

The table below compares MegaMatcher 13.1 Standard SDK and MegaMatcher 13.1 Extended SDK.

	MegaMatcher 13.1 Standard SDK	MegaMatcher 13.1 Extended SDK
Fingerprint component licenses included with a specific SDK:		
• Fingerprint Matcher	1 single computer license	1 single computer license
• Mobile Fingerprint Matcher	1 single computer license	1 single computer license
• Fast Fingerprint Matcher	1 single computer license	1 single computer license
• Fingerprint Client	3 single computer licenses	3 single computer licenses
• Mobile Fingerprint Client	3 single computer licenses	3 single computer licenses
• Fingerprint Extractor	1 single computer license	1 single computer license
• Mobile Fingerprint Extractor	1 single computer license	1 single computer license
• Fingerprint Image Processing	1 single computer license	1 single computer license
Face component licenses included with a specific SDK:		
• Face Matcher	1 single computer license	1 single computer license
• Mobile Face Matcher	1 single computer license	1 single computer license
• Fast Face Matcher	1 single computer license	1 single computer license
• Face Client	3 single computer licenses	3 single computer licenses
• Mobile Face Client	3 single computer licenses	3 single computer licenses
• Face Extractor	1 single computer license	1 single computer license
• Mobile Face Extractor	1 single computer license	1 single computer license
• Face Image Processing	1 single computer license	1 single computer license
Iris component licenses included with a specific SDK:		
• Iris Matcher	1 single computer license	1 single computer license
• Mobile Iris Matcher	1 single computer license	1 single computer license
• Fast Iris Matcher	1 single computer license	1 single computer license
• Iris Client	3 single computer licenses	3 single computer licenses
• Mobile Iris Client	3 single computer licenses	3 single computer licenses
• Iris Extractor	1 single computer license	1 single computer license
• Mobile Iris Extractor	1 single computer license	1 single computer license
• Iris Image Processing	1 single computer license	1 single computer license
Voice component licenses included with a specific SDK:		
• Voice Matcher	1 single computer license	1 single computer license
• Mobile Voice Matcher	1 single computer license	1 single computer license
• Fast Voice Matcher	1 single computer license	1 single computer license
• Voice Client	3 single computer licenses	3 single computer licenses
• Mobile Voice Client	3 single computer licenses	3 single computer licenses
• Voice Extractor	1 single computer license	1 single computer license
• Mobile Voice Extractor	1 single computer license	1 single computer license
• Voice Processing	1 single computer license	1 single computer license
Palm print component licenses included with a specific SDK:		
• Palm Print Matcher	1 single computer license	1 single computer license
• Palm Print Fast Matcher	1 single computer license	1 single computer license
• Palm Print Client	1 single computer license	1 single computer license
• Palm Print Image Processing	1 single computer license	1 single computer license
Server-side matching component licenses included with a specific SDK:		
• MegaMatcher Accelerator 13.1 Development Edition license		1 single computer license

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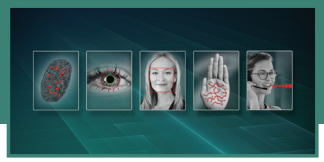

Fingerprint Components Description

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;
- matching templates that contain fingerprint, face, voiceprint and/or iris records (note that matching faces, irises and voiceprints requires to purchase Face Matcher, Iris Matcher and Voice Matcher components correspondingly).

The Fingerprint Matcher component matches 40,000 fingerprints per second.

One Fingerprint Matcher license is included with MegaMatcher 13.1 Standard SDK and MegaMatcher 13.1 Extended SDK. The license can be used on Microsoft Windows, Linux x86-64 or macOS platform. More licenses for this component can be purchased any time by MegaMatcher 13.1 SDK customers.

Mobile Fingerprint Matcher

The Mobile 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 ARM Linux, Android or iOS 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 Mobile Fingerprint Matcher license is included with MegaMatcher 13.1 Standard SDK and MegaMatcher 13.1 Extended SDK. The license can be used on Android, iOS or ARM Linux platform. More licenses for this component can be purchased any time by MegaMatcher 13.1 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 i7-8xxx** series 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 13.1 Standard SDK and MegaMatcher 13.1 Extended SDK. The license can be used on Microsoft Windows, Linux x86-64 or macOS platform. More licenses for this component can be purchased any time by MegaMatcher 13.1 SDK customers.

Mobile Fast Fingerprint Matcher

The Mobile Fast Fingerprint Matcher performs fingerprint template matching in 1-to-1 (verification) and 1-to-many (identification) modes. It matches **200,000 fingerprints per second** and is designed to make **fast fingerprint identification** possible on **stand-alone mobile devices** based on **Android** platform. 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).

Licenses for this component can be purchased any time by MegaMatcher 13.1 SDK customers.

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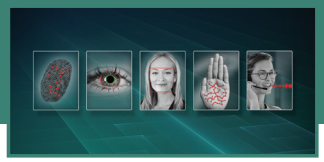

Fingerprint Client

The Fingerprint Client component includes the capabilities of Fingerprint Extractor component with additional fingerprint image segmentation. It also provides functionality for fingerprint template and image formats support based on biometric standards, as well as advanced image formats support and latent fingerprint editor application.

Fingerprint Client creates fingerprint templates from fingerprint images.

Proprietary image quality control may be applied to accept only good quality fingerprint images. Advanded feedback is available to provide information if a finger is: too wet, too dry, pressed too much, pressed not enough or placed incorrectly with only tips of fingers visible.

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 i7-8xxx series processor.

The Fingerprint Client can generalize a fingerprint template from several images that contain the same fingerprint to improve the template's quality.

The **fingerprint image segmentation** module is used to separate fingerprints if an image contains more than one fingerprint. This functionality enables the Fingerprint Client 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 is included with the Fingerprint Client component to determine a fingerprint pattern class. 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 and "Unknown" – for the nondetermined classes.

The Fingerprint Client component also includes support modules for **advanced image formats**:

- **JPEG 2000** image format support module with 1000 ppi Fingerprint Profile;
- NIST **IHead** image format support module;
- module with NIST Fingerprint Image Quality (**NFIQ 2.1**) algorithm, a standard method to determine fingerprint image quality.
- **WSQ (Wavelet Scalar Quantization)** image format module allows to compress a fingerprint image up to 10-15 times, as well as read images in this format. 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

Latent Fingerprint Editor is available with the Fingerprint Client 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.

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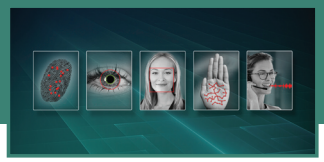

The Fingerprint Client component allows to integrate support for **fingerprint template and image format standards** with new or existing biometric systems based on MegaMatcher SDK. These formats and standards are supported:

- **Neurotechnology proprietary** fingerprint template format
- **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 with Amd. 1:2010, 19785-3:2007 with Amd. 1:2010)** (Common Biometric Exchange Formats Framework)
- **CBEFF V3.0 (ISO/IEC 19785-3:2015)** (Common Biometric Exchange Formats Framework)
- **ISO/IEC 19794-2:2005** with **Cor. 1:2009** (Biometric Data Interchange Formats – Finger Minutiae Data (General Record and On-Card Formats)) and **Amd.2:2015** (XML encoding and clarification of defects);
- **ISO/IEC 19794-2:2011** with **Cor. 1:2012** (General Record and On-Card Formats);
- **ISO/IEC 19794-4:2005** with **Cor. 1:2011** (Biometric Data Interchange Formats - Finger Image Data)
- **ISO/IEC 19794-4:2011** with **Cor. 1:2012** (Biometric Data Interchange Formats - Finger Image Data) and **Amd. 2:2015** (XML encoding and clarification of defects)
- **ISO/IEC 29794-1:2016** (Biometric sample quality)
- **ANSI/INCITS 378-2004** (Finger Minutiae Format for Data Interchange)
- **ANSI/INCITS 378-2009** with **Amd. 1:2010** (Finger Minutiae Format for Data Interchange)
- **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)
- **ANSI/NIST-ITL 1-2011** (Data Format for the Interchange of Fingerprint, Facial, & Other Biometric Information)
- **ANSI/NIST-ITL 1-2011 Update:2013 Edition 2** (Data Format for the Interchange of Fingerprint, Facial, & Other Biometric Information)
- **ANSI/NIST-ITL 1-2011 Update:2015** (Data Format for the Interchange of Fingerprint, Facial, & Other Biometric Information)

The Fingerprint Client 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.

All functionalities of the Fingerprint Client component can be used from **C/C++**, **C#** and **Java** applications on all supported platforms. **.NET** wrappers of Windows libraries are provided for .NET developers.

This component license also enables signature pad support.

Three licenses for the Fingerprint Client component are included with MegaMatcher 13.1 Standard SDK and MegaMatcher 13.1 Extended SDK. The licenses can be used on Microsoft Windows, Linux x86-64 or macOS platform. More licenses for this component can be purchased any time by MegaMatcher 13.1 SDK customers.

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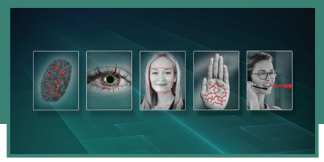

Mobile Fingerprint Client

The Mobile Fingerprint Client component has the same functionality as the Fingerprint Client and is designed to run on **Android** or **iOS** or ARM Linux devices. The component extracts a single fingerprint template in **1.2 seconds**.

Three licenses for the Mobile Fingerprint Client component are included with MegaMatcher 13.1 Standard or MegaMatcher 13.1 Extended SDK. The licenses can be used on Android, iOS or ARM Linux platform. More licenses for this component can be purchased any time by MegaMatcher 13.1 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** (Biometric Data Interchange Formats – Finger Minutiae Data (General Record and On-Card Formats));
- **ISO/IEC 19794-2:2011** with **Cor. 1:2012** (General Record and On-Card Formats) and **Amd.2:2015** (XML encoding and clarification of defects);
- **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 i7-8xxx** series processor.

One Fingerprint Extractor license is included with MegaMatcher 13.1 Standard SDK and MegaMatcher 13.1 Extended SDK. More licenses for this component can be purchased any time by MegaMatcher 13.1 SDK customers.

Mobile Fingerprint Extractor

The Mobile 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 Mobile Fingerprint Extractor license is included with MegaMatcher 13.1 Standard SDK and MegaMatcher 13.1 Extended SDK. The license can be used on Android, iOS or ARM Linux platform. More licenses for this component can be purchased any time by MegaMatcher 13.1 SDK customers.

Fingerprint Image Processing component

The Fingerprint Image Processing component creates fingerprint templates from fingerprint images and is designed to be used in **high-volume server applications**, which run on server hardware with at least **dual Intel Xeon Gold 6416H** (2.2 GHz) processors. The component provides the same list of functionalities, as mentioned in the description of the Fingerprint Client component above, and performs fingerprint template extraction at a speed of **3,000 fingerprints per minute**.

One Fingerprint Image Processing component license is included with MegaMatcher 13.1 Standard SDK and MegaMatcher 13.1 Extended SDK. The license can be used on Microsoft Windows or Linux x86_64 platform. More licenses for this component can be purchased any time by MegaMatcher 13.1 SDK customers.

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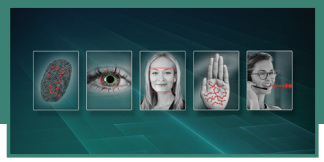

Face Components Description

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 fingerprints, 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**.

One Face Matcher license is included with MegaMatcher 13.1 Standard SDK and MegaMatcher 13.1 Extended SDK. The license can be used on Microsoft Windows, Linux x86-64 or macOS platform. More licenses for this component can be purchased any time by MegaMatcher 13.1 SDK customers.

Mobile Face Matcher

The Mobile 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 ARM Linux, **Android** or **iOS** 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 Mobile Face Matcher license is included with MegaMatcher 13.1 Standard SDK and MegaMatcher 13.1 Extended SDK. The license can be used on Android, iOS or ARM Linux platform. More licenses for this component can be purchased any time by MegaMatcher 13.1 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 i7-8xxx** series 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 13.1 Standard SDK and MegaMatcher 13.1 Extended SDK. The license can be used on Microsoft Windows, Linux x86-64 or macOS platform. More licenses for this component can be purchased any time by MegaMatcher 13.1 SDK customers.

Mobile Fast Face Matcher

The Mobile Fast Face Matcher has the same functionality, as the Face Matcher. It matches **200,000 faces per second** and is designed to be used in **mobile** biometric systems, which run on **Android** devices based on at least **Snapdragon S4** system-on-chip (**Krait 300** processor with 4 cores running at 1.51 GHz).

Licenses for this component can be purchased any time by MegaMatcher 13.1 SDK customers.

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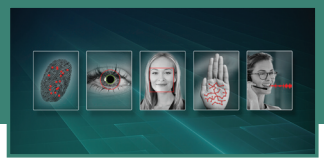

Face Client

The Face Client component includes the capabilities of Face Extractor component for face templates creation from facial images. It also provides advanced functionality for gender, age, emotions, face liveness and other attributes detection, checking images for ICAO compliancy, generation of token face images and image formats support based on biometric standards.

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 i7-8xxx** series processor.

The Face Client component also allows to integrate **JPEG 2000** with Lossy and Lossless Face Profiles support into applications based on MegaMatcher SDK.

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 Face Client component also includes proprietary algorithms, which provide these **advanced functionalities** after facial template extraction:

- Person's gender recognition.
- Emotions detection: confidence values returned for neutral mood, anger, disgust, fear, happiness, sadness and surprise.
- 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, blink (closed-eyes), glasses, dark-glasses, beard and mustache.
- Face liveness 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 face liveness detection for more information.
  - Up to 5 video streams can be processed in parallel with this component. *Web Service* component from the *Face Verification* system can be added to the system for perfoming face liveness check with a larger number of video streams. See the Face Verification brochure for more details.

Captured faces can be checked for compliancy with **ICAO** requirements. These requirements are checked:

- image pixelation, washed out colors;
- background uniformity (any background can be replaced with constant or transparent automatically);
- face darkness, skin tone, skin reflections, glasses reflections;
- red eyes, looking away eyes (the red eyes can be corrected automatically).

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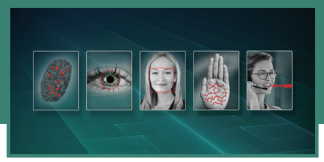

The Face Client component can provide token(1) face images compatible with the Face Image Format as in ISO/IEC 19794 standard. This face image format enables range of applications on variety of devices, including devices that have limited resources required for data storage, and improves recognition accuracy by specifying data format, scene constraints (lighting, pose), photographic properties (positioning, camera focus) and digital image attributes (image resolution, image size). The following features are available:

- 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)

Note: 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."

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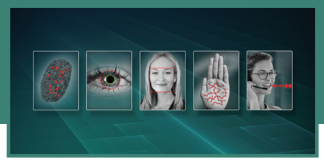

The Face Client component allows to integrate support for facial image format standards with new or existing biometric systems based on MegaMatcher SDK. These biometric standards are supported:

- **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 with Amd. 1:2010, 19785-3:2007 with Amd. 1:2010)** (Common Biometric Exchange Formats Framework)
- **CBEFF V3.0 (ISO/IEC 19785-3:2015)** (Common Biometric Exchange Formats Framework)
- **ISO/IEC 19794-5:2005** (Biometric Data Interchange Formats - Face Image Data)
- **ISO/IEC 19794-5:2011** (Biometric Data Interchange Formats - 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)
- **ANSI/NIST-ITL 1a-2011** (Data Format for the Interchange of Fingerprint, Facial, & Other Biometric Information)
- **ANSI/NIST-ITL 1a-2011 Update:2013 Edition 2** (Data Format for the Interchange of Fingerprint, Facial, & Other Biometric Information)
- **ANSI/NIST-ITL 1a-2011 Update:2015** (Data Format for the Interchange of Fingerprint, Facial, & Other Biometric Information)

All functionalities of the Face Client component can be used from **C/C++**, **C#** and **Java** applications on all supported platforms. **.NET** wrappers of Windows libraries are provided for .NET developers.

This component license also enables signature pad support.

Three licenses for the Face Client component are included with MegaMatcher 13.1 Standard and MegaMatcher 11.1 Extended SDK. The licenses can be used on Microsoft Windows, Linux x86-64 or macOS platform. More licenses for this component can be purchased any time by MegaMatcher 13.1 SDK customers.

Mobile Face Client

The Mobile 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 Mobile Face Client component are included with MegaMatcher 13.1 Standard and MegaMatcher 11.1 Extended SDK. The licenses can be used on Android, iOS or ARM Linux platform. More licenses for this component can be purchased any time by MegaMatcher 13.1 SDK customers.

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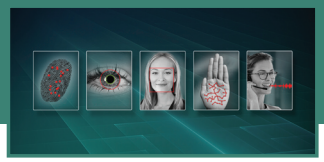

Face Extractor

Face Extractor creates face templates from face images.

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 i7-8xxx** series processor.

One Face Extractor license is included with MegaMatcher 13.1 Standard SDK and MegaMatcher 13.1 Extended SDK. The license can be used on Microsoft Windows, Linux x86-64 or macOS platform. More licenses for this component can be purchased any time by MegaMatcher 13.1 SDK customers.

Mobile Face Extractor

The Mobile 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 Mobile Face Extractor license is included with MegaMatcher 13.1 Standard SDK and MegaMatcher 13.1 Extended SDK. The license can be used on Android, iOS or ARM Linux platform. More licenses for this component can be purchased any time by MegaMatcher 13.1 SDK customers.

Face Image Processing component

The Face Image Processing component creates face templates from face images and is designed to be used in **high-volume server applications**, which run on server hardware with at least **dual Intel Xeon Gold 6416H** (2.2 GHz) processors. The component provides the same list of functionalities, as mentioned in the description of the Face Client component above, and performs face template extraction at a speed of **3,000 faces per minute**.

One Face Image Processing component license is included with MegaMatcher 13.1 Standard SDK and MegaMatcher 13.1 Extended SDK. The license can be used on Microsoft Windows or Linux x86_64 platform. More licenses for this component can be purchased any time by MegaMatcher 13.1 SDK customers.

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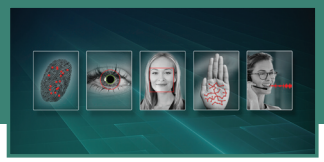

Voice Components Description

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 i7-8xxx** series processor.

One Voice Matcher license is included with MegaMatcher 13.1 Standard SDK and MegaMatcher 13.1 Standard SDK. The license can be used on Microsoft Windows, Linux x86-64 or macOS platform. More licenses for this component can be purchased any time by MegaMatcher 13.1 SDK customers.

Mobile Voice Matcher

The Mobile 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 Mobile Voice Matcher license is included with MegaMatcher 13.1 Standard SDK and MegaMatcher 13.1 Extended SDK. The license can be used on Android, iOS or ARM Linux platform. More licenses for this component can be purchased any time by MegaMatcher 13.1 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 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 i7-8xxx** series processor. This component license also enables signature pad support.

Three licenses for the Voice Client component are included with MegaMatcher 13.1 Standard SDK and MegaMatcher 13.1 Extended SDK. The licenses can be used on Microsoft Windows, Linux x86-64 or macOS platform. More licenses for this component can be purchased any time by MegaMatcher 13.1 SDK customers.

Mobile Voice Client

The Mobile Voice Client component currently has the same functionality as Mobile Voice Extractor component. It is intended for using with Android or iOS or ARM Linux based devices on client-side of 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 Mobile Voice Client component are included with MegaMatcher 13.1 Standard SDK and MegaMatcher 13.1 Extended SDK. The licenses can be used on Android, iOS or ARM Linux platform. More licenses for this component can be purchased any time by MegaMatcher 13.1 SDK customers.

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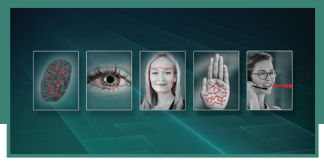

Voice Extractor

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 i7-8xxx** series processor.

One Voice Extractor license is included with MegaMatcher 13.1 Standard SDK and MegaMatcher 13.1 Extended SDK. The license can be used on Microsoft Windows, Linux x86-64 or macOS platform. More licenses for this component can be purchased any time by MegaMatcher 13.1 SDK customers.

Mobile Voice Extractor

The Mobile 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 Mobile Voice Extractor license is included with MegaMatcher 13.1 Standard SDK and MegaMatcher 13.1 Extended SDK. The license can be used on Android, iOS or ARM Linux platform. More licenses for this component can be purchased any time by MegaMatcher 13.1 SDK customers.

Voice Processing component

The Voice Processing component creates voice templates from audio samples and is designed to be used in **high-volume server applications**, which run on server hardware with at least **Intel Xeon Gold 6416H** (2.2 GHz) processor. The component performs template extraction at a speed of **3,000 voiceprints per minute**.

One Voice Processing component license is included with MegaMatcher 13.1 Standard SDK and MegaMatcher 13.1 Extended SDK. The license can be used on Microsoft Windows or Linux x86_64 platform. More licenses for this component can be purchased any time by MegaMatcher 13.1 SDK customers.

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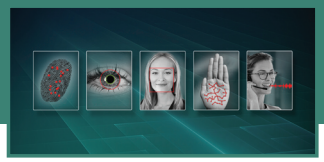

Iris Components Description

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**.

One Iris Matcher license is included with MegaMatcher 13.1 Standard SDK and MegaMatcher 13.1 Extended SDK. The license can be used on Microsoft Windows, Linux x86-64 or macOS platform. More licenses for this component can be purchased any time by MegaMatcher 13.1 SDK customers.

Mobile Iris Matcher

The Mobile Iris Matcher performs iris template matching in 1-to-1 (verification) and 1-to-many (identification) modes. 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 Mobile Iris Matcher license is included with MegaMatcher 13.1 Standard SDK and MegaMatcher 13.1 Extended SDK. The license can be used on Android, iOS or ARM Linux platform. More licenses for this component can be purchased any time by MegaMatcher 13.1 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 i7-8xxx** series 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 13.1 Standard SDK and MegaMatcher 13.1 Extended SDK. The license can be used on Microsoft Windows, Linux x86-64 or macOS platform. More licenses for this component can be purchased any time by MegaMatcher 13.1 SDK customers.

Mobile Fast Iris Matcher

The Mobile Fast Iris Matcher has the same functionality, as the Iris Matcher. It matches **200,000 irises per second** and is designed to be used in **mobile** biometric systems, which run on **Android** devices based on at least **Snapdragon S4** system-on-chip (**Krait 300** processor with 4 cores running at 1.51 GHz).

Licenses for this component can be purchased any time by MegaMatcher 13.1 SDK customers.

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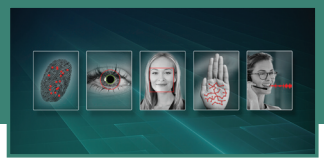

Iris Client

The Iris Client component includes the capabilities of Iris Extractor component for iris templates creation from eye images, as well as image formats support based on biometric standards..

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 i7-8xxx** series processor.

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

The Iris Client 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 with Amd. 1:2010, 19785-3:2007 with Amd. 1:2010)** (Common Biometric Exchange Formats Framework)
- **CBEFF V3.0 (ISO/IEC 19785-3:2015)** (Common Biometric Exchange Formats Framework)
- **ISO/IEC 19794-6:2005** (Biometric Data Interchange Formats - Iris Image Data)
- **ISO/IEC 19794-6:2011** with **Cor. 1:2012**
- **ISO/IEC 29794-6:2015** (Biometric Sample Quality - Iris Image Data)
- **ANSI/INCITS 379-2004** (Iris Image Interchange Format)
- **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)
- **ANSI/NIST-ITL 1-2011** (Data Format for the Interchange of Fingerprint, Facial, & Other Biometric Information)
- **ANSI/NIST-ITL 1-2011 Update:2013 Edition 2** (Data Format for the Interchange of Fingerprint, Facial, & Other Biometric Information)
- **ANSI/NIST-ITL 1-2011 Update:2015** (Data Format for the Interchange of Fingerprint, Facial, & Other Biometric Information)

All functionalities of the Iris Client component can be used from **C/C++**, **C#** and **Java** applications on all supported platforms. **.NET** wrappers of Windows libraries are provided for .NET developers. This component license also enables signature pad support.

Three licenses for the Iris Client component are included with MegaMatcher 13.1 Standard SDK and MegaMatcher 13.1 Extended SDK. The licenses can be used on Microsoft Windows, Linux x86-64 or macOS platform. More licenses for this component can be purchased any time by MegaMatcher 13.1 SDK customers.

Mobile Iris Client

The Mobile 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 Mobile Iris Client component are included with MegaMatcher 13.1 Standard SDK and MegaMatcher 13.1 Extended SDK. The licenses can be used on Android, iOS or ARM Linux platform. More licenses for this component can be purchased any time by MegaMatcher 13.1 SDK customers.

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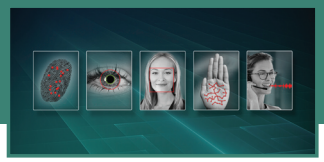

Iris Extractor

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 i7-8xxx** series processor.

One Iris Extractor license is included with MegaMatcher 13.1 Standard SDK and MegaMatcher 13.1 Extended SDK. The license can be used on Microsoft Windows, Linux x86-64 or macOS platform. More licenses for this component can be purchased any time by MegaMatcher 13.1 SDK customers.

Mobile Iris Extractor

The Mobile 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 Mobile Iris Extractor license is included with MegaMatcher 13.1 Standard SDK and MegaMatcher 13.1 Extended SDK. The license can be used on Android, iOS or ARM Linux platform. More licenses for this component can be purchased any time by MegaMatcher 13.1 SDK customers.

Iris Image Processing component

The Iris Image Processing component creates iris templates from eye images and is designed to be used in high-volume server applications, which run on server hardware with at least **Intel Xeon Gold 6416H** (2.2 GHz) processor. The component provides the same list of functionalities, as mentioned in the description of the Iris Client component above, and performs iris template extraction at a speed of 3,000 irises per minute.

One Iris Image Processing component license is included with MegaMatcher 13.1 Standard SDK and MegaMatcher 13.1 Extended SDK. The license can be used on Microsoft Windows or Linux x86_64 platform. More licenses for this component can be purchased any time by MegaMatcher 13.1 SDK customers.

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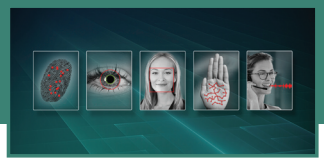

Palm print components description

Palm Print Matcher

The Palm Print Matcher component performs palm print template matching in 1-to-1 (verification) and 1-to-many (identification) modes. The component matches **800 palmprints per second** and is designed for systems with low performance requirements.

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

One license for the Palm Print Matcher component is included in MegaMatcher 13.1 Standard SDK and MegaMatcher 13.1 Extended SDK. More licenses for this component can be purchased any time by MegaMatcher 13.1 SDK customers.

Fast Palm Print Matcher

The Fast Palm Print Matcher has the same functionality, as the Palm Print Matcher. The component matches **4,000 palmprints 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 i7-8xxx** series processor.

One license for the Fast Palm Print Matcher component is included in MegaMatcher 13.1 Standard SDK and MegaMatcher 13.1 Extended SDK. More licenses for this component can be purchased any time by MegaMatcher 13.1 SDK customers.

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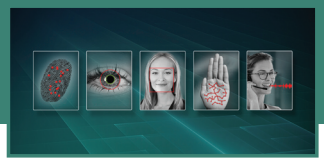

Palm Print Client

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.

The Palm Print Client component performs template extraction at a speed of **15 palmprints per minute** on a PC with Intel **Core i7-8xxx** series processor.

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)
- **ANSI/NIST-ITL 1-2011** (Data Format for the Interchange of Fingerprint, Facial, & Other Biometric Information)
- **ANSI/NIST-ITL 1-2011 Update:2013 Edition 2** (Data Format for the Interchange of Fingerprint, Facial, & Other Biometric Information)
- **ANSI/NIST-ITL 1-2011 Update:2015** (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. This component license also enables signature pad support.

One license for the Palm Print Client component is included in MegaMatcher 13.1 Standard SDK and MegaMatcher 13.1 Extended SDK. More licenses for this component can be purchased any time by MegaMatcher 13.1 SDK customers

Palm Print Image Processing component

The Palm Print Image Processing component creates palmprint templates from palmprint images and is designed to be used in **high-volume server applications**, which run on server hardware with at least **dual Intel Xeon Gold 6416H** (2.2 GHz) processors. The component provides the same list of functionalities, as mentioned in the description of the Palm Print Client component above, and performs palmprint template extraction at a speed of **350 palmprints per minute**.

One Palm Print Image Processing component license is included with MegaMatcher 13.1 Standard SDK and MegaMatcher 13.1 Extended SDK. The license can be used on Microsoft Windows or Linux x86_64 platform. More licenses for this component can be purchased any time by MegaMatcher 13.1 SDK customers.

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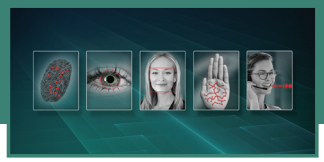

Matching Server Component

The Matching Server is ready-to-use software intended for building moderate size client-server 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.
- **Fast Voice Matchre or** 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 13.1 SDK, VeriFinger 13.1 SDK, VeriLook 13.1 SDK, VeriSpeak 13.1 SDK and VeriEye 13.1 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	Linux	macOS
• 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	+		
• Java 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 13.1 Standard SDK and MegaMatcher 13.1 Extended SDK.

Also the Matching Server component is included with VeriFinger 13.1 Extended SDK, VeriLook 13.1 Extended SDK, VeriSpeak 13.1 Extended SDK and VeriEye 13.1 Extended SDK (see the corresponding brochures for more info).

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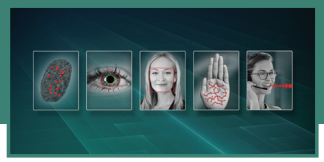

Supported Fingerprint Scanners under Microsoft Windows

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

	Windows 7	Windows 8	Windows 10/11
• Abilma UNITY	+	+	
• ACS AET62 / AET65	+	+	
• Aratek A400 / A600 / A800 / A900 / FRO900			+
• ARH AFS 510	+		+
• Athena ASEDrive IIIe Combo Bio F2	+	+	
• BioLink U-Match MatchBook v.3.5	+	+	+
• Biometrika Fx2100 / HiScan / HiScan PRO			+
• Cross Match Guardian 100 / 200 / 300 / Module / USB	+	+	+
• Cross Match L Scan 500P / Patrol / Patrol ID / Verifier 320	+	+	+
• DERMALOG LF10 / F1 / ZF1		+	+
• DigitalPersona U.are.U 4500 / 5100 / 5160 / 5200 / 5300 / EikonTouch 710	+	+	+
• Futronic FS10 / FS26 / FS50 / FS64 / FS80 / FS82 / FS88 / FS88H / FS90 / eFAM	+	+	+
• Futronic FS60		+	+
• Green Bit DactyID20 / MultiScan527 / DactyScan84c	+	+	
• Green Bit DactyScan40i			+
• HID Lumidigm M / V series sensors	+	+	+
• HFSecurity HF-4000 / HF-7000	+	+	
• Integrated Biometrics Columbo / Kojak / Sherlock / Watson Mini	+	+	+
• Jenetric LIVETOUCH QUATTRO / LIVETOUCH QUATTRO Compact	+	+	+
• Mantra MAPRO-CX / MARC10 / MELO31 / MFS500 / MORPHS	+	+	+
• NASPS NSP303A			+
• Neubio MARS 02	+	+	
• NEXT Biometrics NB-2033 / NB-3010 / NB-3023 / NB-65200 / NB-65210	+	+	+
• NITGEN Fingkey Hamster / Fingkey Hamster II / Fingkey Mouse III	+	+	+
• NITGEN eNBioScan-F / eNBioScan-C1 / eNBioScan-D Plus / NScan-T	+	+	+
• SecuGen Hamster III / Hamster Plus / Hamster IV / Hamster Air	+	+	+
• SecuGen Hamster Pro / Pro 20 / Pro Duo CL/SC/PIV / iD-USB SC / iD-USB SC/PIV	+	+	
• Startek FM220U		+	+
• Suprema BioMini / BioMini Plus / BioMini Plus2 / BioMini Slim / BioMini Slim 2	+	+	+
• Suprema RealScan-G10 / RealScan-10 / RealScan-D / RealScan-FC	+	+	+
• Suprema RealScan S60			+
• Tatvik TMF20			+
• Thales Cogent CS500f / CSD101i			+
• TopLink Pacific BLUEFiN	+	+	
• Umpi TopScan			+
• UPEK Eikon / Eikon Solo / Eikon To Go / EikonTouch 300 / 500 / 700 / TouchChip	+	+	+
• ZKTeco SLK20R / ZK9500	+	+	+
• Zvetco Verifi P5100	+	+	

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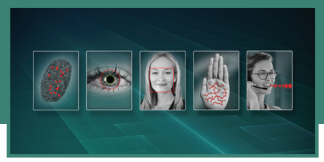

Supported Fingerprint Scanners under Linux x86, Linux ARM and Android

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

	Linux x86-64	Linux ARM	Android
• Abilma UNITY	+	+	+
• ACS AET62 / AET65	+		
• Aratek A400 / A600			+
• Aratek BM5510 / BM7500			+ (2)
• Aratek FRO900	+		+
• ARH AFS 510	+		
• DigitalPersona U.are.U 4500 / 5100 / 5160 / 5200 / 5300	+	+	+
• Famoco FX100 Bio			+ (2)
• Futronic FS10 / FS26 / FS50 / FS80 / FS80H / FS82 / FS88 / FS88H	+		+
• Futronic FS28			+
• Futronic eFAM (FS84)	+	+	+
• Green Bit DactyScanID20 / DactyScan40i / DactyScan84c / MultiScan527	+		+
• HFSecurity HF-4000 / HF-7000			+
• Identos Tactivo Mini for Android Optical			+
• Integrated Biometrics Columbo / Kojak / Sherlock / Watson Mini	+		+
• Mantra MARC10 / MELO31			+
• Miaxis SM-201			+
• NEXT Biometrics NB-3010-U / NB-3023-U2 / NB-65200-U	+	+	+
• SecuGen Hamster IV / Hamster Plus / Hamster Pro / Pro 20			+
• SMUFS Biometric SMUFS BT			+
• Startek FPC360U			+
• Suprema BioMini / BioMini Plus / BioMini Slim / BioMini SFU-S20	+		+
• Suprema RealScan-D / SFR300-S / SFU300	+		
• TopLink Pacific BLUEFiN	+		+
• UPEK Eikon / Eikon Solo / Eikon To Go	+	+	+ (1)
• UPEK EikonTouch 300 / 500 / 700 / TouchChip TCRU1C / TCRU2C			+ (1)
• ZKTeco SLK20R			+
• Zvetco Verifi P5100	+		

(**1**) requires root access to the device.

(**2**) the device has pre-installed Android OS.

Supported Fingerprint Scanners under macOS and iOS

	macOS		iOS
	Intel	Apple M1	
• Fulcrum Biometrics mobileOne QuickDock			+
• Futronic FS50 / FS80 / FS80H / FS82 / FS88 / FS88H	+	+	
• NEXT Biometrics NB-3010-U / NB-3023-U2 / NB-65200-U	+		
• SMUFS Biometric SMUFS BT			+

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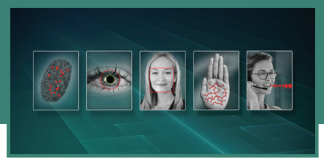

Supported Face Capture Cameras

These cameras are supported by MegaMatcher SDK:

- Any **webcam** or camera that is accessible using:
  - **DirectShow**, **Windows Media** or **Media Foundation** interfaces for Microsoft Windows platform.
  - **GStreamer** interface for Linux or Mac platforms.
- 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 advanced cameras are supported:
  - Akiyama Akys-10 Biometric Camera
  - CMITech EMX-30 – face & iris camera (Microsoft Windows only)
  - Iris ID iCAM R100 and iCAM TD100 – face & iris cameras (Microsoft Windows only)
  - VistaFA2 / VistaFA2E / VistaEY2 face & iris cameras (Microsoft Windows only)
- These models of **still cameras** are supported:
  - Canon EOS family still cameras (Microsoft Windows only; the supported camera models are EOS M50, EOS 2000D, EOS 4000D, EOS 6D Mark II, EOS 200D, EOS 77D, EOS 800D, EOS 5D Mark IV, EOS-1D X Mark II, EOS 80D, EOS 1300D, EOS 5DS, EOS 5DS R, EOS 760D, EOS 750D, EOS 7D Mark II)
  - Nikon DSLR still cameras (Microsoft Windows only; a specific camera model should support video capture)
- Cameras, which can operate in **near-infrared** spectrum, can be used for image capture. MegaMatcher/VeriLook algorithm is able to match faces, captured in near-infrared spectrum, against faces, captured in visible light. See the VeriLook algorithm testing results for details.
- 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.

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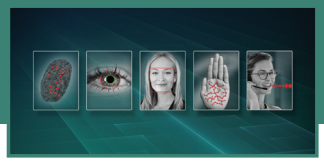

Supported Iris Capture Cameras

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 VeriEye 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	Linux x86-64	Android
• BioID BioIRIS	+		
• CMITech BMT-20 / EMX-30	+		
• HID Crossmatch I Scan 3	+		
• Iris ID iCAM R100 / iCAM T10 / iCAM TD100	+		
• Iritech IriShield USB MK 2120U / IriShield-USB BK 2121U	+	+	+
• Mantra MATISX	+		
• Mantra MIS100V2			+
• NASPS NSP20i	+		
• Videology IDentity-1	+		
• VistaFA2 / VistaFA2E / VistaEY2 / VistaEY2-02 iris & face cameras	+		
• VistaEY2H iris camera	+		

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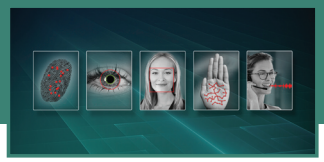

Basic Recommendations for Facial Recognition

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 user experience improvement during recognition.
- **Additional enrollments** may be needed when **facial hair** style changes, especially when beard or mustache is grown or shaved off.
- Persons wearing **face masks** or respirators can be recognized without separate enrollment. Face quality check should be disabled for this scenario.

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) – ±90 degrees from frontal position (configurable).
  - Smaller yaw tolerance values are not recommended to be used except if the target system does not meet the system requirements..
  - Several views of the same face can be enrolled to the database to cover the whole ±90 degrees yaw range from frontal position.

Continued on the next page

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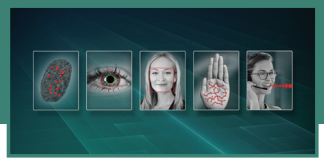

Face Liveness Detection

The face liveness check algorithm was **tested by iBeta** and proven to be **compliant with ISO 30107-3 Biometric Presentation Attack Detection Standards.**

A stream of consecutive images (usually a video stream from a camera) or a single image (in some modes) are required for the face liveness detection.

- 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.
- **80 pixels is the recommended minimal distance between eyes (IOD)** for a face to perform liveness check reliably. **100 pixels or more** recommended for smoother performance.
- During **passive** liveness checks the face should be **still** and the user has to **look directly** at the camera with ±15 degrees tolerances for roll, pitch and yaw to experience the best performance.
- Optionally, **ICAO compliance** check can be used to strengthen the liveness check.
- 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 + Blink** – the engine analyzes certain facial features while the user stays still in front of the camera for a short period of time, when the engine requests the user to blink. Colored images are required for this mode. 10 frames per second or higher frame rate required.
  - **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 frames per second or better frame rate recommended.
    - This mode can work with both colored and grayscale images.
  - **Single frame passive** – the engine uses a neural network to estimate if a face image is not inserted in front of a camera using a paper photo or smartphone screen. This mode does not need any interaction from the user.

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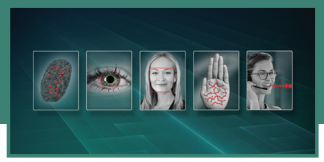

Basic Recommendations for Speaker Recognition

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.

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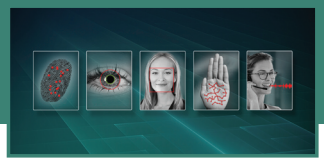

Environment Constraints

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.

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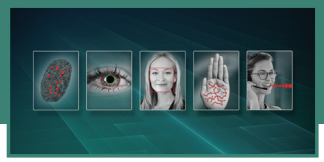

System Requirements and Supported Development Environments

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

- **PC-specific:**
  - x86-64 (64-bit) processors are highly recommended.
  - **AVX2 support is highly recommended.** Processors that do not support AVX2 will still run the MegaMatcher algorithms, but in a mode, which will not provide the specified performance. Most modern processors support this instruction set, but please check if a particular processor model supports it.
  - The CPU plugin supports inference on Intel Xeon with Intel AVX2 and AVX-512, Intel Core processors with Intel AVX2, Intel Atom Processors with Intel SSE.
  - 0.6 seconds are required to create a template with a single fingerprint, face, iris or voiceprint record using Intel Core i7-8xxx series processor.
  - 4 seconds are required to create a template from a full palm print image on Intel Core i7-8xxx series processor.
- **Mac-specific:**
  - x86-64 (Intel) and ARM (Apple M1 family) processor architectures supported.
  - 0.6 seconds are required to create a template with a single fingerprint, face, iris or voiceprint record using Intel Core i7-8xxx series processor.
  - 4 seconds are required to create a template from a full palm print image on Intel Core i7-8xxx series processor.
- **at least 2 GB of free RAM is recommended** for general usage scenarios. It is possible to reduce RAM usage for particular scenarios.
- **Optionally, depending on biometric modalities and requirements:**
  - A **fingerprint scanner.** MegaMatcher SDK includes support modules for more than 140 models of fingerprint scanners under Microsoft Windows, Linux and macOS 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. Cameras, which can operate in **near-infrared** spectrum, can be also used for image capture. Any other webcam or camera should provide DirectShow, Windows Media or Media Foundation interfaces for Windows platform, GStreamer interface for Linux and Mac platforms.
  - 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.
  - A **palm print scanner.**
  - A signature pad. The captured results are provided as vector or bitmap image, depending on supported formats. MegaMatcher SDK includes support modules for these signature pad models: Dermalog LF10, SignoTec Sigma, Wacom STU-300, STU-430, STU-540.
  - A **flatbed scanner** for fingerprint or palm print data capturing from paper can be used. 500ppi or 1000ppi FBI certified scanners are recommended. MegaMatcher SDK includes a programming sample, which shows how to use a flatbed scanner on Microsoft Windows platform.
  - 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.

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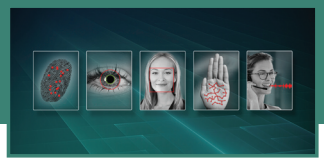

- **Network/LAN connection (TCP/IP)** for communication with Matching Server or MegaMatcher Accelerator unit(s). MegaMatcher client-side components can be used without network if they are used only for data collection.

- **Linux specific requirements:**
  - **Linux 4.9 kernel** or newer is required.
  - glibc 2.24 or newer
  - GStreamer 1.10.x or newer with gst-plugin-base and gst-plugin-good is required for face capture using camera/webcam or rtsp video.
  - libgudev-1.0 230 or newer (for camera and/or microphone usage)
  - alsa-lib 1.1.6 or newer (for voice capture)
  - gcc 6.3 or newer (for application development)
  - GNU Make 3.81 or newer (for application development)
  - Java SE JDK 8 or newer (for application development with Java)
  - Python 3.x (for application development with Python)

- **Microsoft Windows specific requirements:**
  - Microsoft Windows 7 / 8 / 10 / 11.
  - Microsoft .NET framework 4.5 (for .NET components usage)
  - Microsoft Visual Studio 2012 or newer (for application development with C++ / C# / VB .NET)
  - Microsoft DirectX 9.0 or later (for face capture using camera/webcam)
  - Java SE JDK 8 or newer (for application development with Java)
  - Python 3.x (for application development with Python)

- **macOS specific requirements:**
  - macOS (version 10.13 or newer)
  - XCode 9.3 or newer (for application development)
  - GStreamer 1.10.x or newer with gst-plugin-base and gst-plugin-good is required for face capture using camera/webcam or rtsp video.
  - GNU Make 3.81 or newer (to build samples and tutorials development)
  - Java SE JDK 8 or newer (for application development with Java)

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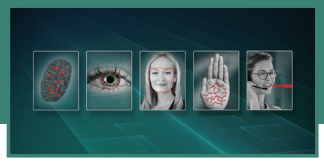

System requirements for MegaMatcher client-side components for Android

- A **smartphone** or **tablet** that is running **Android 5.0 (API level 21)** 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 **1 GB 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. See the technical specifications for the templates sizes with specific biometric modalities.
- **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:
    - MegaMatcher SDK includes support modules for several iris cameras under Android OS.
    - MegaMatcher technology also accepts irises for further processing as **BMP**, **JPG, PNG** or **WebP** 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 mobile application may require network connection for **activating** the MegaMatcher component licenses.s 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 8 (or higher)
  - AndroidStudio 4.0 IDE
  - AndroidSDK 21+ API level
  - Gradle 6.8.2 build automation system or newer
  - Android Gradle Plugin 4.1.2
  - Internet connection for activating MegaMatcher component licenses

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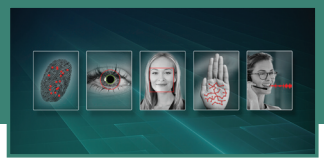

System requirements for MegaMatcher client-side components for iOS

- One of the following devices, running **iOS 11.0** or newer:
  - **iPhone 5S** or newer iPhone.
  - **iPad Air** or newer iPad models.
- At least **1 GB 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. See the technical specifications for the templates sizes with specific biometric modalities.
- **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, PNG** or **WebP** 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 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 macOS 10.13 or newer.
  - Xcode 9.3 or newer.

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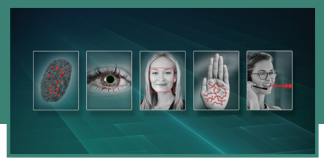

System requirements for MegaMatcher client-side components for ARM Linux

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 **1 GB 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.
- **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 2.17 or newer.
- GStreamer 1.10.x or newer with gst-plugin-base and gst-plugin-good is required for face capture using camera/webcam or rtsp video.
- alsa-lib 1.1.6 or newer (for voice capture)
- libgudev-1.0 219 or newer (for camera and/or microphone usage)
- **Network connection** for client/server applications. Also, network connection is required for using the Matching Server component.
- **PC-side development environment requirements:**
  - gcc 4.8 or newer
  - GNU Make 3.81 or newer
  - Java SE JDK 8 or newer

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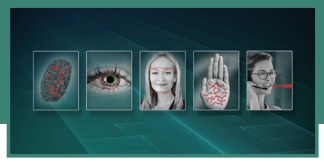

System requirements for server-side fast template extraction components

- **Server hardware** with at least these processors (see the technical specifications for more details):
  - **Dual Intel Xeon Gold 6416H** (2.2 GHz) processors for extracting a template from a single fingerprint, face or palmprint image in the specified time;
  - **Single Intel Xeon Gold 6416H** (2.2 GHz) processor for extracting templates from single iris images, or voice samples in the specified time.

  The processors should support **AVX2**.
- **At least 8 GB of free RAM** should be available for the high-volume server application.
- **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 4.9 or newer kernel is required.
  - glibc 2.17 or newer
  - GStreamer 1.10.x or newer with gst-plugin-base and gst-plugin-good (for face capture using rtsp video)
- **Microsoft Windows specific requirements:**
  - Microsoft Windows Server 2008 / Server 2012 / Server 2016 / Server 2019, 64-bit.
  - Microsoft .NET framework 4.5 (for .NET components usage)

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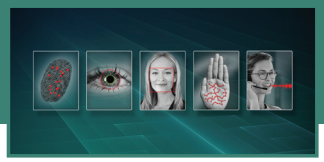

System requirements for Matching Server

- **PC, Mac or server with x86-64 (64-bit) compatible processor.**
  - Intel Core i7-8xxx series processor or newer is recommended.
  - **AVX2 support is highly recommended.** Processors that do not support AVX2 will still run the MegaMatcher algorithms, but in a mode, which will not provide the specified performance. Most modern processors support this instruction set, but please check if a particular processor model supports it.
- **Enough free RAM** for Matching Server code, matching engines and templates. See the technical specifications for the templates sizes with specific biometric modalities.
- **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.
- **Linux specific requirements:**
  - Linux 4.9 or newer kernel is required.
  - glibc 2.17 or newer
- **Microsoft Windows specific requirements:**
  - Microsoft Windows 7 / 8 / 10 / 11 / Server 2008 / Server 2012 / Server 2016 / Server 2019.
- **macOS specific requirements:**
  - macOS (OS X 10.9 or newer macOS version)

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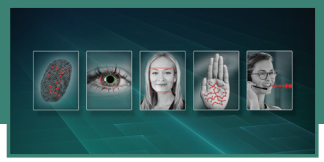

Technical Specifications

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. Also, the matching algorithm has a special mode for matching different scale fingerprint records, like different image resolutions or age-related changes in finger 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) – ±90 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.

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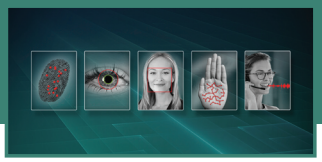

MegaMatcher 13.1 fingerprint engine specifications					
	Embedded / mobile platform (1)		PC-based platform (2)		Server platform
Template extraction components	Mobile Fingerprint Extractor	Mobile Fingerprint Client	Fingerprint Extractor	Fingerprint Client	Fingerprint Image Processing (3)
Template extraction speed (fingerprints per minute)	45	50	45	100	3,000
Template matching components	Mobile Fingerprint Matcher	Mobile Fast Fingerprint Matcher	Fingerprint Matcher		Fast Fingerprint Matcher (2)
Template matching speed (fingerprints per second)	3,000	200,000	40,000		200,000
Single fingerprint record size in a template(4) (bytes, configurable)	300 - 3,200 (flat/plain) 1,100 - 6,000 (rolled)				

MegaMatcher 13.1 face engine specifications					
	Embedded / mobile platform (1)		PC-based platform (2)		Server platform
Template extraction components	Mobile Face Extractor	Mobile Face Client	Face Extractor	Face Client	Face Image Processing (3)
Template extraction speed (faces per minute)	45	50	45	100	3,000
Template matching components	Mobile Face Matcher	Mobile Fast Face Matcher	Face Matcher		Fast Face Matcher (2)
Template matching speed (faces per second)	3,000	200,000	40,000		200,000
Single face record size in a template(4) (bytes)	194 or 322 (configurable)				

MegaMatcher 13.1 iris engine specifications					
	Embedded / mobile platform (1)		PC-based platform (2)		Server platform
Template extraction components	Mobile Iris Extractor	Mobile Iris Client	Iris Extractor	Iris Client	Iris Image Extractor (5)
Template extraction speed (irises per minute)	45	50	45	100	3,000
Template matching components	Mobile Iris Matcher	Mobile Fast Iris Matcher	Iris Matcher		Fast Iris Matcher (2)
Template matching speed (irises per second)	3,000	200,000	40,000		200,000
Single iris record size in a template(4) (bytes)	2,486				

MegaMatcher 13.1 voiceprint engine specifications					
	Embedded / mobile platform (1)		PC-based platform		Server platform
Template extraction components	Mobile Voice Extractor	Mobile Voice Client	Voice Extractor (2)	Voice Client (2)	Voice Processing (5)
Template extraction speed (voiceprints per minute)	45	50	45	100	3,000
Template matching components	Mobile Voice Matcher		Voice Matcher (2)		Fast Voice Matcher (2)
Template matching speed (voiceprints per second)	100		8,000		40,000
Single voiceprint record size in template(4)(6) (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 with at least Intel Core i7-8xxx series processor.
(3) on server hardware with at least Dual Intel Xeon Gold 6126 processors (2.6 GHz);
(4) 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;
(5) on server hardware with at least Intel Xeon Gold 6126 processor (2.6 GHz);
(6) for 5-second long voice samples; template size has linear dependence from voice sample length.

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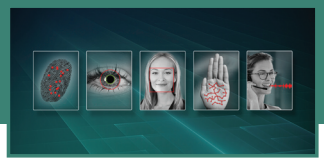

Palm Print Engine Technical Specifications

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 ppi 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:

Full palm print; fingerprints marked in red for reference

MegaMatcher 13.1 palmprint engine specifications		
	PC-based platform	Server platform
Template extraction components	Palm Print Client (1)	Palm Print Image Processing (2)
Template extraction speed (palmprints per minute)	15	350
Template matching components	Palm Print Matcher (1)	Fast Palm Print Matcher (1)
Template matching speed (palmprints per second)	800	4,000
Average single palm print record size in a template (3) (kilobytes)	33	

Notes and requirements for reaching the specified performance

(1) on PC or laptop with at least Intel Core i7-8xxx series processor.

(2) on server hardware with at least Dual Intel Xeon Gold 6126 processors (2.6 GHz);

(3) 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;

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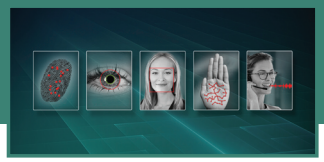


Reliability Testing Results

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

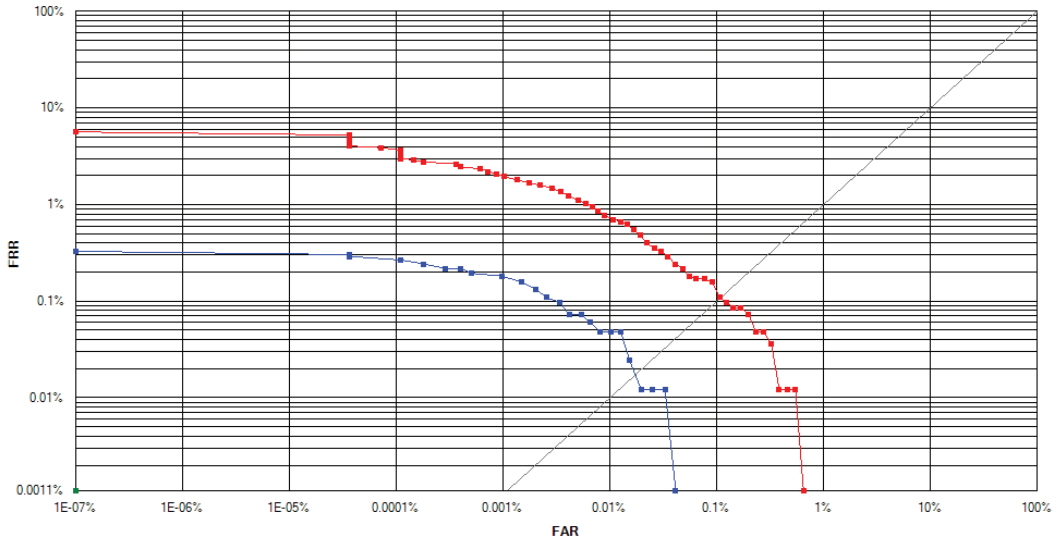
Voiceprint and Face Matching Engine Tests

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 13.1 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	2.0840 %	3.8770 %
1 face	0.1818 %	0.2908 %
1 voiceprint + 1 face	0.0000 %	0.0000 %



MegaMatcher 13.1 SDK template matching engine tested with a subset of XM2VTS database:
Voice matching engine, one template contains 1 voiceprint record;
Face matching engine, one template contains 1 face record;
Fused matching engine, one template contains 1 face and 1 voiceprint record from the same person.

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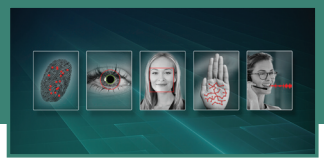

Fingerprint, Face and Iris Matching Engines Tests

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 13.1 fused algorithm reliability in this test is shown as **blue curves** on the ROC charts.
- **Test 2 maximized matching speed.** MegaMatcher 13.1 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 13.1 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	0.0000 %	0.0533 %	0.0200 %	0.0800 %
1 face	0.3000 %	0.4800 %	0.3200 %	0.8000 %
1 iris	0.0133 %	0.0133 %	0.0133 %	0.0200 %
2 fingerprints (1)	0.0000 %	0.0000 %	0.0000 %	0.0000 %
2 irises (1)	0.0000 %	0.0000 %	0.0000 %	0.0000 %
1 fingerprint + 1 face (1)	0.0000 %	0.0000 %	0.0000 %	0.0000 %
1 fingerprint + 1 iris (1)	0.0000 %	0.0000 %	0.0000 %	0.0000 %
1 face + 1 iris (1)	0.0000 %	0.0000 %	0.0000 %	0.0000 %
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

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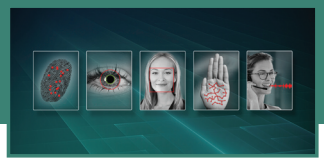
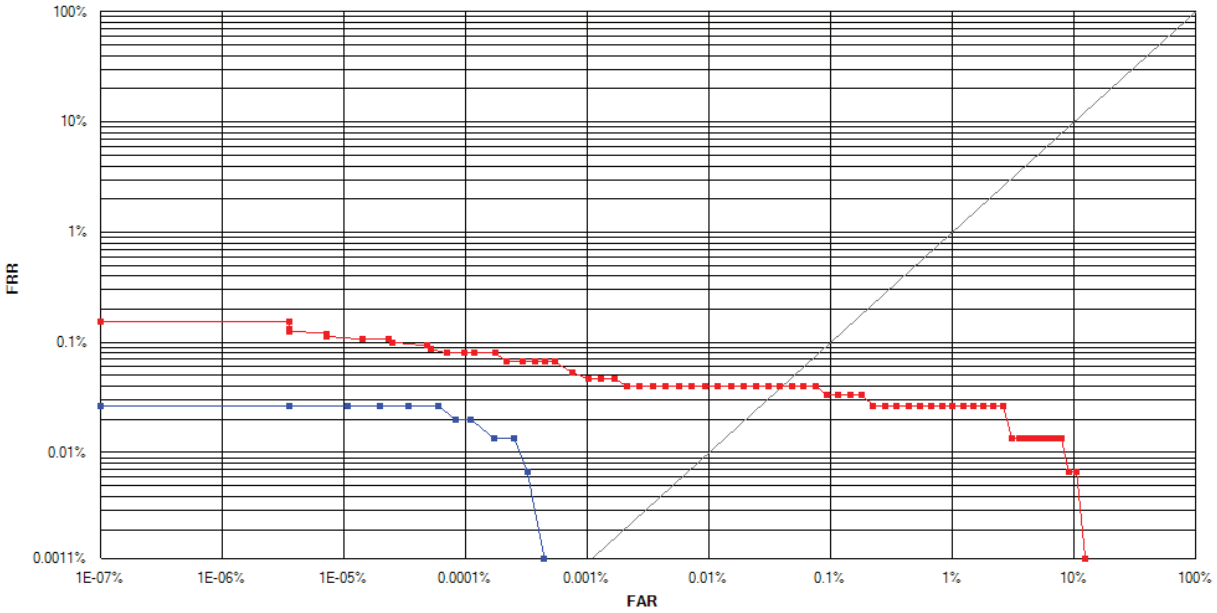
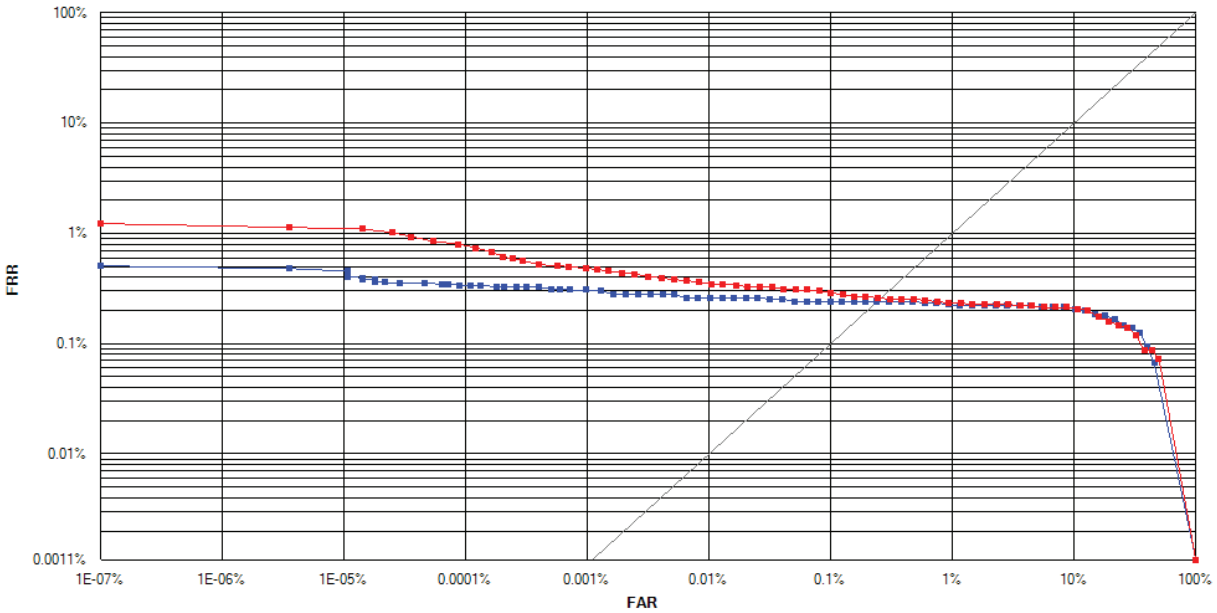




MegaMatcher 13.1 SDK fingerprint matching engine;
a template contains 1 fingerprint record:
Maximized extraction and matching speed scenario
Maximized extraction and matching accuracy scenario



MegaMatcher 13.1 SDK face matching engine;
a template contains 1 face record:
Maximized matching speed scenario
Maximized matching accuracy scenario

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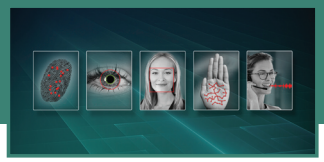

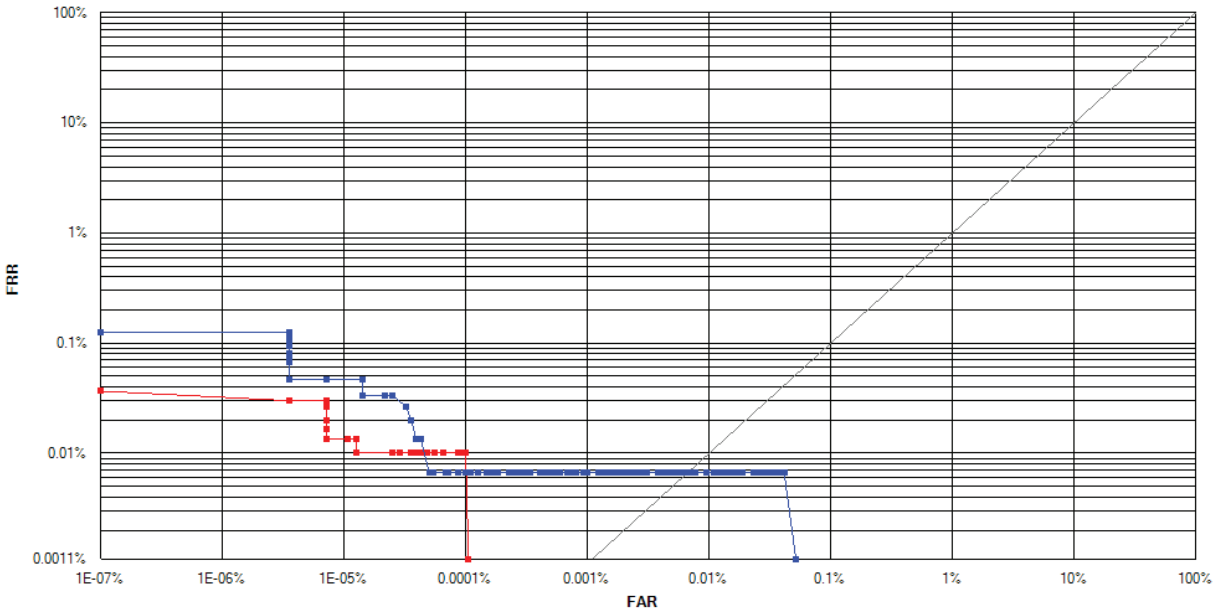

MegaMatcher 13.1 SDK iris matching engine;
a template contains 1 iris record:
Maximized matching speed scenario
Maximized matching accuracy scenario

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**.

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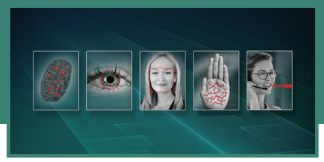
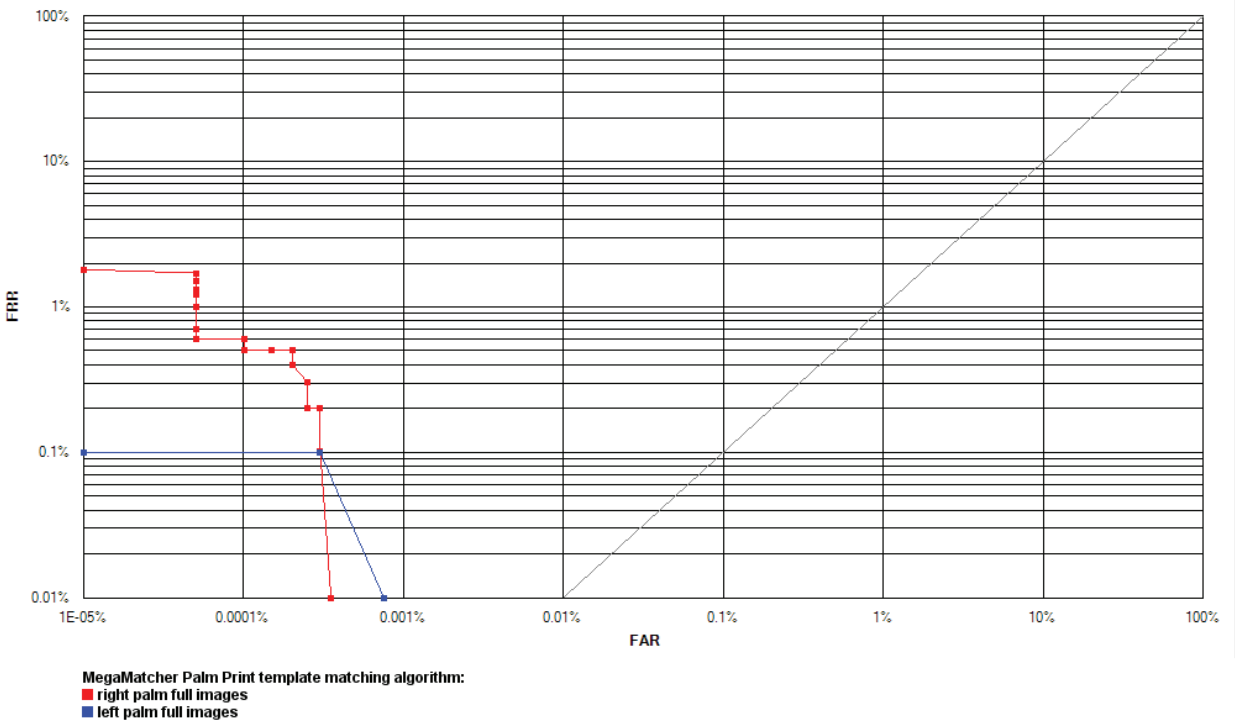


Palm Print Engine Tests

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.



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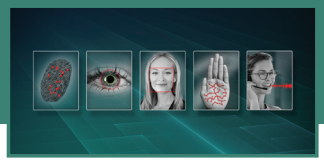

MegaMatcher SDK Trial, Demo Applications and Related Products

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 (see corresponding product brochures for more information):

- **MegaMatcher Automated Biometric Identification System (ABIS)** – a turnkey multi-biometric solution for national-scale identification projects. Available as **on-premise solution** and as **cloud service**.
- **MegaMatcher Accelerator** – a software/hardware solution for building the server-side of a large-scale AFIS or multi-biometric system.
- **MegaMatcher On Card SDK** – a product for fingerprint, iris and face matching on smart cards.
- **FingerCell SDK** – for integrating fingerprint recognition into embedded platforms, like low-power, low-memory microcontrollers.
- Single biometrics SDKs for stand-alone and Web-based solutions:
  - **VeriFinger SDK** – for development of PC-based or Web-based fingerprint identification systems.
  - **VeriLook SDK** – for development of PC-based or Web-based face identification systems.
  - **VeriEye SDK** – for development of PC-based or Web-based iris identification systems.
  - **VeriSpeak SDK** – for development of PC-based or Web-based speaker recognition applications.

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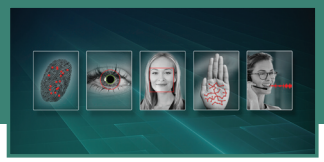

Licensing MegaMatcher SDK

Product Development

An integrator should obtain either a MegaMatcher 13.1 Standard SDK (EUR 2590) or MegaMatcher 13.1 Extended SDK (EUR 4990) to develop a end-user product based on MegaMatcher technology. The SDK needs to be purchased just once and may be used for all projects and by all the developers within the integrator's company.

See the "Contents of MegaMatcher Standard SDK and Extended SDK" chapter (the tables on the page 14) for the list of component licenses included with MegaMatcher 13.1 Standard and MegaMatcher 13.1 Extended SDK.

Integrators can obtain additional component licenses if more component licenses are required for the development process.

Product Deployment

To deploy their developed products, an integrator need obtain licenses of components for every **computer or device**, where component will be installed together with integrator's product. See Product Advisor and high productivity system architecture (page 7) to find out what specific components will be needed for the deployment of your system. Integrators can purchase additional MegaMatcher component licenses if required at anytime.

License activation options

The components are copy-protected. The following license activation options are available:

- **Serial numbers** are used to activate licenses for particular MegaMatcher components on particular computer or device. 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 ARM-Linux** platform, except BeagleBone Black and Raspberry Pi 3 devices.
  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.
- **Volume License Manager.** 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 is **used on site by integrators or end users** to manage licenses for MegaMatcher components in the following ways:
  1. **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. .
  2. **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.
  3. **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.

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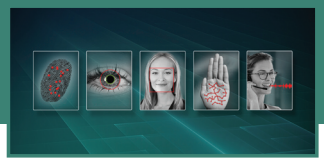

Licenses Validity

All SDK and component licenses are perpetual and do not have expiration. There are no annual fee or any other fees except license purchasing fee. It is possible to move licenses from one computer or device to another. Neurotechnology provides a way to renew the license if the computer undergoes changes due to technical maintenance.

Licensing Agreement

The Licensing Agreement (*https://www.neurotechnology.com/mm_130_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.

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, Fingerprint Image Processing;
- Fast Face Matcher, Face Image Processing;
- Fast Iris Matcher, Iris Image Processing;
- Fast Voice Matcher, Voice Image Processing;
- Fast Palm Print Matcher, Palm Print Image Processing;

For more information please contact us.

Other licensing options

- **VAR License.** The above described 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. For more information please contact us.
- **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.

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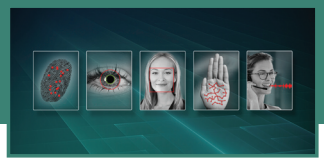

Prices for MegaMatcher products

- The prices are **effective February 13, 2024**. 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 13.1 Standard SDK	€ 2,590.00
MegaMatcher 13.1 Extended SDK	€ 4,990.00

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

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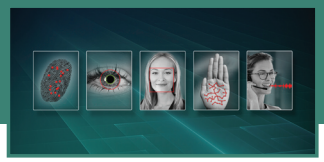

Fingerprint components prices

Client-side fingerprint acquisition components (prices per single computer license)				
Quantity	Fingerprint Client	Fingerprint Extractor	Mobile Fingerprint Client	Mobile Fingerprint Extractor
1 - 9	€ 70.00	€ 20.00	€ 45.00	€ 13.00
10 - 19	€ 51.00	€ 15.00	€ 33.00	€ 10.00
20 - 49	€ 45.00	€ 13.00	€ 29.00	€ 8.70
50 - 99	€ 40.00	€ 11.00	€ 25.50	€ 7.50
100 - 199	€ 36.00	€ 10.00	€ 22.80	€ 6.70
200 - 499	€ 32.00	€ 9.00	€ 20.50	€ 6.00
500 - 999	€ 28.00	€ 8.00	€ 17.80	€ 5.30
1000 and more	Please contact us for more information			

Client-side fingerprint matching components (prices per single computer license)			
Quantity	Fingerprint Matcher	Mobile Fingerprint Matcher	Mobile Fast Fingerprint Matcher
1 - 9	€ 25.00	€ 17.00	€ 370.00
10 - 19	€ 18.00	€ 12.00	€ 265.00
20 - 49	€ 16.00	€ 10.80	€ 240.00
50 - 99	€ 14.00	€ 9.60	€ 210.00
100 - 199	€ 12.50	€ 8.40	€ 190.00
200 - 499	€ 11.00	€ 7.60	€ 170.00
500 - 999	€ 10.00	€ 6.80	€ 150.00
1000 and more	Please contact us for more information		

Server-side fingerprint components (prices per single computer license)		
Quantity	Fingerprint Image Processing	Fast Fingerprint Matcher
1 - 9	€ 2,000.00	€ 540.00
10 - 19	€ 1,450.00	€ 390.00
20 - 49	€ 1,300.00	€ 355.00
50 and more	Please contact us for more information	

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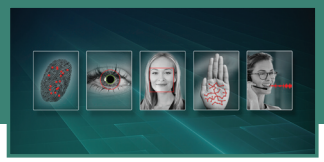

Face components prices

Client-side face acquisition components (prices per single computer license)				
Quantity	Face Client	Face Extractor	Mobile Face Client	Mobile Face Extractor
1 - 9	€ 70.00	€ 20.00	€ 45.00	€ 13.00
10 - 19	€ 51.00	€ 15.00	€ 33.00	€ 10.00
20 - 49	€ 45.00	€ 13.00	€ 29.00	€ 8.70
50 - 99	€ 40.00	€ 11.00	€ 25.50	€ 7.50
100 - 199	€ 36.00	€ 10.00	€ 22.80	€ 6.70
200 - 499	€ 32.00	€ 9.00	€ 20.50	€ 6.00
500 - 999	€ 28.00	€ 8.00	€ 17.80	€ 5.30
1000 and more	Please contact us for more information			

Client-side face matching components (prices per single computer license)			
Quantity	Face Matcher	Mobile Face Matcher	Mobile Fast Face Matcher
1 - 9	€ 25.00	€ 17.00	€ 370.00
10 - 19	€ 18.00	€ 12.00	€ 265.00
20 - 49	€ 16.00	€ 10.80	€ 240.00
50 - 99	€ 14.00	€ 9.60	€ 210.00
100 - 199	€ 12.50	€ 8.40	€ 190.00
200 - 499	€ 11.00	€ 7.60	€ 170.00
500 - 999	€ 10.00	€ 6.80	€ 150.00
1000 and more	Please contact us for more information		

Server-side face components (prices per single computer license)		
Quantity	Face Image Processing	Fast Face Matcher
1 - 9	€ 2,000.00	€ 540.00
10 - 19	€ 1,450.00	€ 390.00
20 - 49	€ 1,300.00	€ 355.00
50 and more	Please contact us for more information	

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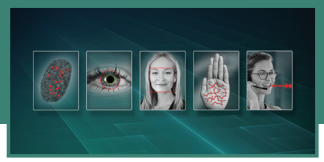

Iris components prices

Client-side iris acquisition components (prices per single computer license)				
Quantity	Iris Client	Iris Extractor	Mobile Iris Client	Mobile Iris Extractor
1 - 9	€ 38.00	€ 30.00	€ 25.00	€ 20.00
10 - 19	€ 28.00	€ 22.00	€ 18.00	€ 15.00
20 - 49	€ 25.00	€ 19.00	€ 16.00	€ 13.00
50 - 99	€ 22.00	€ 17.00	€ 14.00	€ 11.00
100 - 199	€ 19.00	€ 15.00	€ 12.50	€ 10.00
200 - 499	€ 17.00	€ 13.00	€ 11.00	€ 9.00
500 - 999	€ 15.00	€ 12.00	€ 10.00	€ 8.00
1000 and more	Please contact us for more information			

Client-side iris matching components (prices per single computer license)			
Quantity	Iris Matcher	Mobile Iris Matcher	Mobile Fast Iris Matcher
1 - 9	€ 38.00	€ 25.00	€ 545.00
10 - 19	€ 28.00	€ 18.00	€ 395.00
20 - 49	€ 25.00	€ 16.00	€ 355.00
50 - 99	€ 22.00	€ 14.00	€ 310.00
100 - 199	€ 19.00	€ 12.50	€ 275.00
200 - 499	€ 17.00	€ 11.00	€ 245.00
500 - 999	€ 15.00	€ 10.00	€ 215.00
1000 and more	Please contact us for more information		

Server-side iris components (prices per single computer license)		
Quantity	Iris Image Processing	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	

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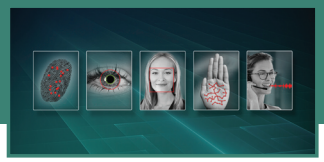

Voice components prices

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

Voice matching components (prices per single computer license)		
Quantity	Voice Matcher	Mobile 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 and more	Please contact us for more information	

Server-side voice components (prices per single computer license)		
Quantity	Voice Processing	Fast Voice Matcher
1 - 9	€ 2,000.00	€ 540.00
10 - 19	€ 1,450.00	€ 390.00
20 - 49	€ 1,300.00	€ 355.00
50 and more	Please contact us for more information	

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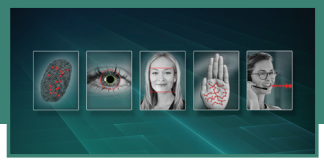

Palm print components prices

Client-side 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 - 199	€ 62.00	€ 78.00
200 - 499	€ 56.00	€ 69.00
500 and more	Please contact us for more information	

Server-side palm print components (prices per single computer license)		
Quantity	Palm Print Image Processing	Fast Palm Print 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	

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***

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