MegaMatcher Automated Biometric Identification System

Turnkey multi-biometric solution for national-scale identification projects
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MegaMatcher Automated Biometric Identification System is a complete system for the deployment of large-scale multi-biometric projects. The modular and customizable solution provides services for high-performance, scalable systems with multiple parallel transactions.

The solution is intended for national-scale projects, like biometric voter registration with records deduplication, passport issuing, border control, as well as other civil or criminal AFIS/ABIS.

Available as on-premise solution and as cloud service.

- Multiple complex biometric transactions processing with high speed and accuracy.
- Technology proven in national-scale projects, like passport issuance and voter deduplication.
- Fingerprint, face, iris and palmprint modalities supported.
- NIST MINEX-compliant fingerprint engine, NIST IREX proven iris engine.
- Scalable, modular architecture with possible customization.
- High availability and fault tolerance.
- Interoperability with other systems.
- Support for ANSI and ISO biometric template standards.
- ICAO compliance checking for face images.
- Customization possible for project needs.

30-day cloud service trial: https://www.megamatcher.online/
Features and Capabilities

MegaMatcher Automated Biometric Identification System (ABIS) is available as on-premise solution and as cloud service:

- **MegaMatcher ABIS 11.1 on-premise solution** is designed as a complete system with all necessary components for deploying a large-scale biometric system. The solution includes ready-to-use services and applications for running on regular hardware.
- **MegaMatcher ABIS 11.1 cloud service** is designed to make the system more accessible from multiple platforms and locations. The secure integrated cloud service provides functionality for enhancing its use as a solution for large and national-scale projects.

MegaMatcher ABIS 11.1 on-premise solution provides these capabilities for large-scale biometric identification systems:

- **High performance.** MegaMatcher Automated Biometric Identification System is designed for fast processing of multiple biometric transactions with high accuracy and reliability. The Management Service distributes external requests between the corresponding services. The Image Processing Service performs parallel biometric template extraction from multiple images. The Matching Service can store biometric and demographic information for unlimited number of persons as well as perform fast search in the whole database.

- **Fingerprint, face, iris and palmprint modalities support.** The system can accept fingerprint, face, iris and palmprint images for creating biometric templates and searching against the database. Each template can contain multiple fingerprints, palmprints, irises or faces. Proprietary fused matching algorithm provides high matching accuracy.

- **Biometric adjudication.** MegaMatcher ABIS can determine questionable biometric matching results like suspicious duplicate(s) or non-matching templates and forward them to human experts for manual adjudication. A specialized visual tool is provided to human experts to facilitate decision making.

- **Interoperability with other systems.** Web-services are provided for communication with third party biometric systems to ensure all aspects of required biometric services as biometric data storing, update, identification, verification and submission of matching results.

- **High availability and fault tolerance.** MegaMatcher ABIS architecture allows to reach high system reliability and better performance by running instances of some or all components in parallel. If an instance of a component becomes unavailable, the other instances of the component can still accept incoming requests and perform corresponding operations. All communications are designed as atomic transactions, thus in case of failure no information is lost or corrupted.

- **Customization for project needs.** Most components of MegaMatcher ABIS can be customized for specific project needs and restrictions. The customization may range from user interface translation into required language to modifying the system architecture.

- **Accuracy.** MegaMatcher ABIS is based on award-winning biometric technologies. See the next page for the list of awards.

- **Biometric standards support.** MegaMatcher ABIS 11.1 allows the use of ANSI/NIST-ITL-1, ISO/IEC 19794-2, ISO/IEC 19794-5 and ISO/IEC 19794-6 biometric template standards. Face images checking for compliancy with ICAO requirements is also available.
Technology Awards

MegaMatcher Automated Biometric Identification System is based on awards-winning fingerprint and iris recognition technologies.

MINEX evaluations by NIST
- MINEX III evaluation was successfully passed in 2015. In 2018 Neurotechnology’s fingerprint recognition algorithms ranked as the most accurate high speed fingerprint recognition system among all MINEX III participants.
- 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.

PFT II (Proprietary Fingerprint Template) Evaluation by NIST
- In 2017 Neurotechnology fingerprint algorithm was submitted to NIST Proprietary Fingerprint Template Evaluation II. The algorithm’s template matching accuracy was among the best participants in most of the experiments.

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.

FVC-onGoing results
- 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.

FRVT (Face Recognition Vendor Test) Ongoing by NIST
- 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.

IREX Evaluations by NIST
- 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.
On-premise System Architecture and Components

Large-scale biometric projects may have specific system requirements. MegaMatcher Automated Biometric Identification System (ABIS) features modular architecture, which allows to adapt to different functional and performance requirements.

MegaMatcher ABIS 11.1 is available as on-premise solution, which is described on this page, and as cloud service.

The services, modules and components of MegaMatcher ABIS 11.1 on-premise solution are described on the next pages.
MegaMatcher ABIS Client Application

MegaMatcher ABIS Client Application is a modular web-based application designed to operate with the MegaMatcher ABIS solution. It provides the following functionalities:

- **Identity Management** – provides the following functionalities:
  - **Enrollment** – registration of person’s biometric and demographic data with the following features:
    - Multi-biometric capture – supports fingerprint, palmprint, face and iris biometric modalities. A wide range of biometric devices is supported, including more than 150 fingerprint readers and iris scanners models, as well as out-of-the-shelf web and IP cameras.
    - Demographic data – allows to specify name, sex, date of birth, address, as well as other data fields, which are unlimited and can be customized.
    - Live registration – person’s biometric and demographic data are entered into the system in real time from stationary or mobile enrollment stations.
    - Data import – the system provides means to import a batch of biometric data from image files, which were captured in the field or taken from another system.
    - Quality check – evaluation of image quality based on standard and proprietary algorithms
      - ICAO compliant facial image capturing – checks image pixelation, washed out colors, background uniformity, face darkness, skin tone, skin reflections, glasses reflections, red eyes and looking away eyes. The red eyes can be corrected automatically.
  - **Update** – personal records can be refilled or changed at any time with new biometric and demographic data.
  - **Delete** – personal records, which are outdated or incorrect, can be deleted
  - **Demographic and biometric search** – allows to find particular person not only by name or surname, but also by face, fingerprint, palmprint and iris biometric records.
• **Adjudication** – a **visual tool** designed for operators to examine questionable biometric matching results, which are forwarded by the Matching Service, and take appropriate decisions. The questionable matching results, like non-matching templates or detected duplicate(s), are determined by defined restrictions in the System administration module. The tool provides easy examination of given biometric data by providing detailed templates review.

  - Fingerprint, palmprint, face and iris images are shown in side by side or overlapping view with the possibility to transform and enhance biometric images so that some aspects could be seen more clearly.
  - Modality-specific features (such as fingerprint minutiae, cores, deltas).
  - Matching scores for each biometric modality.
  - Problematic fingers.
  - Matched data which is highlighted for easier inspection (such as matched minutiae are optionally connected by lines for visualization).
  - Age estimation and gender classification are performed automatically to help human operators in resolving questionable cases.

• **Latent Fingerprint Editor** – a **visual tool** which provides ability to analyze the fingerprint image, perform automatic and manual enhancements as well as fingerprint feature points management. It is designed for the cases, when automated image processing is unable to extract all minutiae or extracts a lot of false minutiae from a 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 the system for the identification.

• **System administration** – designed to manage and monitor MegaMatcher ABIS system using role-based access control and consists of the following parts:

  - **System Management** – provides ability to manage MegaMatcher ABIS system’s state.
  - **System Monitoring** – dedicated for visual MegaMatcher ABIS real-time execution monitoring.
  - **User Management** – dedicated to create and revoke users as well as provide or restrict access permissions to particular MegaMatcher ABIS modules.
  - **System Configuration** – provides ability to define criteria for search engine (such as matching thresholds for identification and verification).
  - **Report Generation** – statistical reports with filtering possibility are provided for full MegaMatcher ABIS actions inspection.

MegaMatcher ABIS Client Application works on Microsoft Windows, Linux, Android and iOS.

**MegaMatcher ABIS API**

MegaMatcher ABIS API is a web services-based interface (RESTful) designed for easy and quick integration with third-party systems. It provides all necessary functionalities including identity management, adjudication and system administration. Integrators can develop client-side applications using the MegaMatcher ABIS API to meet specific requirements.
Management Service

MegaMatcher ABIS is designed to maintain system’s integrity ensuring that individual operations are executed consistently. The Management Service is the core component of MegaMatcher ABIS responsible for orchestrating the work of all system services and managing the workflow of operations.

- **Transaction management** – each operation forms a transaction which is passed through several stages:
  - **Validation** – ensures the sufficiency of provided biometric and demographic data.
  - **Data preparation** – conducts biometric data quality analysis, adjustments and biometric template extraction.
  - **Matching** – conducts biometric comparison using predefined parameters.
  - **Adjudication** – manual inspection of matching results.

- **Workflow management** – the ability to adjust operation workflow to meet particular business needs.

- **Security** – role-based access control ensures that user without privileges will not be able to execute a particular operation.

Image Processing Service

The Image Processing Service is based on MegaMatcher 11.1 biometric template extraction technology. This component is used for biometric data quality assessment and biometric data extraction from fingerprint, palmprint, face and iris images.

These functions are performed by the Image Processing Service:

- **Fingerprint segmentation** – images with fingerprint slaps are split into separate images with single fingerprints.

- **Quality check** – images with fingerprints, palmprints, faces and irises are processed by proprietary and standard algorithms to determine their quality and suitability for further processing.

- **Fingerprint sequence check** – a set of single fingerprints from the same person is checked for duplicates and missing fingerprints.

- **Feature extraction** – biometric templates are created from the provided fingerprint, palmprint, face and iris images. Optionally, automatic age estimation and gender classification can be performed for a given facial image.

- **Age estimation** – the age detection from the facial image allows to check if the age corresponds person’s demographic data.
Matching Service
The Matching Service is a high-performance biometric engine which performs the following operations:

- **Identity verification** – matching a biometric template against a selected database record (1-to-1).
- **Person identification** – matching a biometric template against the whole database (1-to-many).
- **Records deduplication** – matching all biometric templates in the database against each other (many-to-many). The questionable matching results are resolved via the adjudication procedure, either automatically or by human operators.

The service is based on MegaMatcher Accelerator 11.1 technology and is controlled by the Management Service.

The Matching Service is a **scalable** unit. Multiple units can be arranged into a **cluster** to meet specific project’s performance and capacity requirements.

Customization
Taking into account different business needs and specific project requirements, some customization might be required. This may include developing custom user interface, workflow scenarios, person’s record structure (biometric and demographic data, additional data fields).

Neurotechnology offers **custom project development** service for providing a customized MegaMatcher ABIS based solution, as well as implementing additional functionality.
Cloud Service

MegaMatcher Automated Biometric Identification System (ABIS) cloud service is designed to make the system more accessible from multiple platforms and locations. The **30-day trial** and **subscription** for the service are available at [www.MegaMatcher.online](http://www.MegaMatcher.online).

The cloud service is based on the same MegaMatcher ABIS technology, which is used for on-premise systems. There is no need to purchase any hardware, as all resource-demanding tasks are performed on the cloud. In addition to the general advantages of using cloud architecture, the service features:

- **Flexible resources** – enough **data storage** space and **processing power** can be offered based on the current project requirements. The **subscription-based** licensing allows to choose the required system performance for reaching project goals, while paying a **reasonable price** for the services. Such flexibility is especially useful for short-time tasks like **database deduplication**, as well as **scalable** systems.

- **Easy integration** – web service-based **RESTful API** is designed for easy and quick integration with third-party systems. Additionally, **Java** and **.NET** SDK libraries are provided.

- **Security** – the cloud service uses role-based **access control** with industry-standard authentication mechanisms. System activities are assessable for audit.
System requirements

We recommend to run each component on dedicated server hardware, PC or device, unless it is specified otherwise. Network connection is required for communication between the components of MegaMatcher Automated Biometric Identification System (ABIS).

Below are minimal requirements for each component:

- **Image Processing Service** – each node should be installed on hardware with the following specifications:
  - Server hardware with Intel Xeon Gold 6126 processor (12 cores, 19.25M cache, 2.6 GHz) or equivalent hardware.
  - At least 32 GB of RAM.

- **Matching Service** – depending on the edition, each node should be installed on hardware with the following specifications:
  - Development Edition and Standard Edition:
    - PC or server hardware with at least Intel Core i7-4771 processor (4 cores, 3.5 GHz) or equivalent; 
    - 16 GB of RAM.
  - Extended Edition needs the same hardware as MegaMatcher Accelerator Extended, including:
    - HPE ProLiant DL360 Gen10 Server.
    - 2 x Intel Xeon Gold 6126 processor (12 cores, 19.25M cache, 2.6 GHz) or equivalent hardware.
    - 128 / 256 / 384 / 512 GB of RAM for single / two / three / four biometric modalities correspondingly,
    - 6 x 300 GB HDD.
  - Extreme Edition needs the same hardware as MegaMatcher Accelerator Extreme, including:
    - HPE ProLiant ML350 Gen10 Server.
    - 2 x Intel Xeon Gold 6126 processor (12 cores, 19.25M cache, 2.6 GHz) or equivalent hardware.
    - 4 x GPU units (NVIDIA TITAN X, TITAN V and Tesla V100 GPUs are supported).
    - 512 GB of RAM for one or two biometric modalities; 1024 GB of RAM for three biometric modalities,
    - 2 x 400 GB SSD or HDD with similar capacity.

- **Management Service** and **Administration Service** can be run on the same machine with the following specifications:
  - Server hardware with Intel Xeon Gold 6126 processor (12 cores, 19.25M cache, 2.6 GHz) or equivalent hardware.
  - At least 32 GB of RAM.
  - An application server to run the Management Service.
  - A web server for accessing the Administration Service.

- **MegaMatcher ABIS Client Application** can be run on the following platforms:
  - PC or tablet, running Microsoft Windows OS or Linux
  - Mac, running macOS
  - Smartphone or tablet running Android 4.4 or later
  - iPhone or iPad running iOS
Related Products

These products are related to MegaMatcher ABIS:

- **MegaMatcher Accelerator 11.1** – a software/hardware solution for building the server-side of a large-scale AFIS or multi-biometric system; available in these versions:
  - **Standard version** – a single MegaMatcher Accelerator Standard unit matches 35 million fingerprints per second or 35 million faces per second or 70 million irises per second;
  - **Extended version** – a single MegaMatcher Accelerator Extended unit matches 100 million fingerprints per second or 100 million faces per second or 200 million irises per second;
  - **Extreme version** – a single MegaMatcher Accelerator Extreme unit matches 1.2 billion fingerprints per second or 1.2 billion faces per second or 700 million irises per second.

MegaMatcher Accelerator performance can be scaled up by connecting multiple units into a cluster. The Matching Service in the MegaMatcher ABIS 11.1 is based on MegaMatcher Accelerator 11.1 technology.

- **MegaMatcher SDK** – for development of AFIS or multi-biometric fingerprint, iris, face, voice and palm print identification products. Includes biometric components for template extraction and matching on client-side and server-side of a client-server system. The Image Processing Service, Adjudication Application and MegaMatcher ABIS Client application are based on MegaMatcher 11.1 SDK technology.

- **MegaMatcher On Card SDK** – a product for fingerprint, iris and face matching on smart cards.
Licensing Model and Pricing

MegaMatcher Automated Biometric Identification System (MegaMatcher ABIS 11.1) includes a number of components, each particular component is designed for a specific functionality. A license for an individual MegaMatcher ABIS 11.1 component is required for each computer or device that run that component. An integrator should obtain the MegaMatcher ABIS 11.1 Starting Kit and an appropriate quantity of components installation licenses for development and deployment.

MegaMatcher ABIS 11.1 Starting Kit includes the following components:

- Management Service – 1 single computer license;
- Image Processing Service – 1 single computer license;
- Matching Service Development Edition – 1 single computer license;
- MegaMatcher ABIS Client Application – 10 single computer licenses.

The required additional components installation licenses and/or customization for specific project needs can be ordered at any time. The prices for the components of MegaMatcher ABIS 11.1 are available on the next page.

Please contact us for more information about licensing MegaMatcher ABIS 11.1.
Pricing

- The prices are effective March 26, 2019. 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.

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### MegaMatcher Accelerator 11.1 fingerprint engine installations

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### MegaMatcher Accelerator 11.1 face engine installations

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### MegaMatcher Accelerator 11.1 palmprint engine installations

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<td>€ 4,500.00</td>
<td>€ 30,000.00</td>
<td>€ 76,500.00</td>
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<td>2</td>
<td>€ 4,200.00</td>
<td>€ 27,900.00</td>
<td>€ 71,400.00</td>
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<td>3</td>
<td>€ 3,950.00</td>
<td>€ 26,300.00</td>
<td>€ 67,100.00</td>
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<tr>
<td>4</td>
<td>€ 3,780.00</td>
<td>€ 25,200.00</td>
<td>€ 64,100.00</td>
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<td>5</td>
<td>€ 3,650.00</td>
<td>€ 24,300.00</td>
<td>€ 62,000.00</td>
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<td>6 and more</td>
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### Additional services for MegaMatcher ABIS customers

<table>
<thead>
<tr>
<th>Service</th>
<th>Contact us</th>
</tr>
</thead>
<tbody>
<tr>
<td>Custom development</td>
<td></td>
</tr>
<tr>
<td>Support and maintenance for custom solutions</td>
<td>Contact us</td>
</tr>
<tr>
<td>Training service</td>
<td>Contact us</td>
</tr>
</tbody>
</table>