NEUROtechnology

Core Technology for your Application

Company information

Neurotechnology is a developer of high-precision algorithms and software based on **deep neural network** (DNN) and other **artificial intelligence** powered technologies. Drawing from years of academic research in the fields of neuroinformatics, image processing and pattern recognition, Neurotechnology was founded in 1990 in Vilnius, Lithuania. Currently the company offers this range of products and technologies:

- **Biometric person identification** is applicable from small apps to national-scale solutions. Since 1997, more than 200 products and version upgrades have been released. Over 3,000 system integrators, security companies and hardware providers in more than 140 countries integrate the fingerprint, face, iris, voice and palm print biometric technologies into their solutions. The *MegaMatcher* line of products is used for both civil and forensic applications, including border crossings, criminal investigations, systems for voter registration, verification and duplication checking, passport issuance and other projects.

- **Computer vision** technologies are being actively developed for a variety of applications. For instance, they are used in *SentiSight.ai* web platform for developing AI-based image recognition applications. Also, they power *SentiVeillance* technology for live video streams analytics in real-time surveillance solutions.

- **AI-based stock rating** is the most recent development, available as *StockGeist.ai* web platform for monitoring the current popularity of publicly traded companies.

- **Engineering** R&D is focused on:
  - *SentiBotics* - mobile robotics software development kit.
  - *BrainAccess* - brain-computer interface solution for BCI applications.
  - *Focusonics* - directional speaker, based on a patent-pending method of using ultrasonic waves to reproduce sound.
  - Reserch in ultrasonic particle manipulation, parametric array and transducer technologies.

Technology Awards

- **IREX 10 Evaluation.** In 2020 Neurotechnology's iris recognition algorithm has been judged by NIST as the second most accurate among the IREX 10 participants. The submitted algorithm featured much faster template creation and search time, and much smaller template size than the only more accurate contender. Historically, Neurotechnology showed top results in the earlier IREX evaluations in 2009, 2012, 2013 and 2018.

- **FVC-onGoing.** In 2020 Neurotechnology's **fingerprint** recognition algorithm has shown the top result at the FVC-onGoing evaluation. The fingerprint extractor and matcher, which are included in the MegaMatcher SDK, were ranked as the most accurate for both FV-STD-1.0 and FV-HARD-1.0 benchmarks. In 2019 MegaMatcher SDK **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 contenders.

- **MINEX III Compliance.** In 2019 Neurotechnology's fingerprint template generator algorithm has been ranked **the first** in the NIST MINEX interoperability category; the fingerprint matching algorithm has also been ranked as the front-runner in terms of interoperability and, when combined, the two have become the supreme accuracy, high speed fingerprint recognition system. Also, in 2018 the latest fingerprint algorithm for smart cards submission has also demonstrated significant improvement in reliability with proven outstanding template generator at enhanced performance in the same year. From 2007, MegaMatcher SDK technology proved its full MINEX compliancy and leading accuracy during other NIST MINEX evaluations.

- **PFT II and PFT III Evaluations.** Our latest submissions to the NIST PFT II and the ongoing PFT III are in average the most accurate algorithms in all the experiments.

- **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.

- **Kaggle Competition on DNN-based species classification.** In 2017 Neurotechnology researchers won first place in a Kaggle competition with deep neural network based computer vision solution for classifying fish species.

- **WSQ 3.1 Certification.** In 2011 FBI certified Neurotechnology's implementation of WSQ image format support.

- From 2000, Neurotechnology has participated and won numerous awards in major technology evaluations and competitions, like MINEX Ongoing, FpVTE2003, FpVTE 2012, FIVE, FVC2006, FVC2004, FVC2002 and FVC2000.

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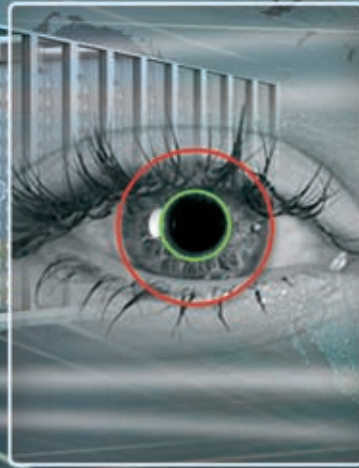
MegaMatcher Automated Biometric Identification System

Turnkey multi-biometric solution for national-scale identification projects

- Proven in national-scale projects
- Fingerprint, face, iris and palmprint modalities supported
- Data enrollment with quality assessment
- Identity records lifecycle management with adjudication
- **Galleries support to providie specific** access for different agencies
- Top accuracy at NIST MINEX III, PFT III, IREX 10 and FVC-onGoing
- Forensic analysis module for law enforcement applications available.
- Scalable, modular architecture
- Customization possible for project needs

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

MegaMatcher Automated Biometric Identification System (ABIS) 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 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.

MegaMatcher ABIS is available **as on-premise** solution and as **cloud** service:

- MegaMatcher ABIS **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 **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 is based on technologies, which have been **proven in national-scale projects**:

- **Voter registration** systems with user deduplication in DR Congo, Venezuela, Bangladesh, Sierra Leone.

- **Passport and ID** systems running in Indonesia, Ukraine, Mexico, El Salvador, Colombia, Bosnia & Herzegovina, Sri Lanka, as well as a number of local systems in India.

- **Criminal AFIS** running in several Indian states and Mexico Yukatan.

- Other solutions, like border control systems, banking solutions or access control systems deployed in more than 30 countries.

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 on-premise solution includes these services, modules and components:

- **MegaMatcher ABIS Client Applications** are modular web-based applications designed to operate with the MegaMatcher ABIS solution. They provide the following functionalities:

  - Enrollment – Biographic and biometric data registration toolset with enhanced data quality and integrity control, including quality assessment and **ICAO** compliancy check.

  - Identity Management - all necessary tools provided for maintaining identity registry, managing relationships between identities and processing exceptions, including **adjudication** for complex biometric operations and **galleries** support for grouping identities by certain attributes (i.e. geographic region, data owner), organizing them into separate and isolated watchlists and providing restricted access to each of them for specific users.

  - Data Analysis – includes a dedicated forensic analysis module for law enforcement applications, with fingerprint capturing and **latent editor** available out of the box.

  - System Administration - designed to manage MegaMatcher ABIS system using role-based access control.

- **MegaMatcher ABIS API** is a web services-based interface (RESTful) designed for easy and quick integration with third-party systems. Integrators can develop client-side applications using the API to meet specific requirements.

- **Management Service** is the core component of MegaMatcher ABIS responsible for orchestrating the work of all system services and managing the workflow of operations.

- **Image Processing Service** is used for biometric data quality assessment and biometric data extraction from fingerprint, palmprint, face and iris images.

- **Matching Service** is a high-performance biometric engine, which performs identity verification (1-to-1), person identification (1-to-all) and records deduplication operations (all-to-all).

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

MegaMatcher SDK

Proven in national-scale projects,
including passport issuance and voter deduplication

Large scale AFIS and multi-biometric identification

- NIST MINEX compliant algorithm
- **Multi-biometric: fingerprints,** faces, voiceprints, irises and palm prints
- Multiplatform: Microsoft Windows, Android, iOS, Linux and macOS
- ANSI and ISO biometric standards support
- Fingerprints, irises and faces can be matched on smart card using MegaMatcher On Card

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, face, voice, iris and palm print identification products for Microsoft Windows, Linux, macOS, iOS and Android platforms.

The most prominent MegaMatcher SDK integration examples are:

- **Bangladesh Voter Registration Project** registered more than 80 million citizens using biometric face and fingerprint technology.

- **Indian States Criminal AFIS** solution has been deployed in the police departments of seven Indian states and the National Institute of Criminology and Forensic Science of India.

- **Indonesia distributed passport issuance system** with a centralized biometric matching component based on MegaMatcher technology.

- **El Salvador's National Passport System** – the nationwide multi-biometric passport and immigration system based on MegaMatcher multi-biometric technology.

- **Bosnia and Herzegovina Biometric Passport and ID System** is based on MegaMatcher technology

- **Border control systems in Spanish airports** use MegaMatcher for multi-biometric face and fingerprint identification.

MegaMatcher SDK is available for a competitive price with flexible licensing options and free customer support.

See **demo video**:
https://youtu.be/x9v9m5LezSg
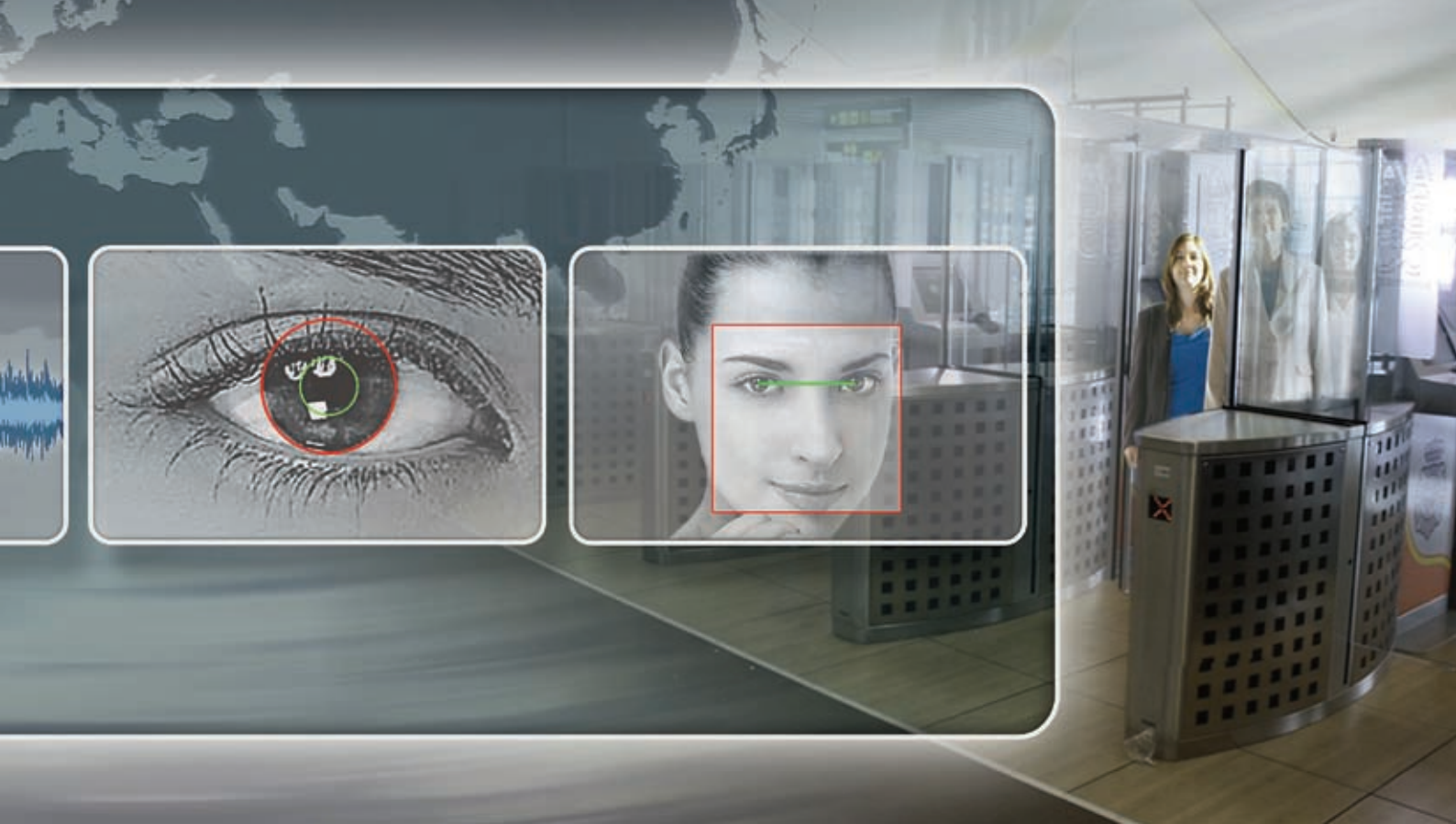
These types of MegaMatcher SDK are available:

- **MegaMatcher Standard SDK** for developing a client/server based multi-biometric fingerprint-face-voice-iris identification product. This SDK is suitable for network-based and web-based systems with database size ranging from several thousand records up to million records. The SDK includes ready-to-use server-side software and a set of components for developing client-side applications on Microsoft Windows, Android, iOS, Linux and macOS.

- **MegaMatcher Extended SDK** for developing a large-scale network-based AFIS or multi-biometric identification product. The fault-tolerant **scalable cluster** software allows to perform fast parallel matching, processes high number of identification requests and handles databases with practically **unlimited size**. The SDK includes all components of MegaMatcher Standard SDK and MegaMatcher Accelerator software. This SDK also allows to develop **network-based** and **web-based** systems.

MegaMatcher 12.1 SDK biometric engines technical specifications [1]						
		Fingerprints	Faces	Irises	Voiceprints[2]	Palmprints
Minimal image resolution or size		500 ppi	64 pixels between eyes	640 x 480 pixels	-	500 ppi
Template **extraction** speed (per minute)	on a smartphone[3]	50	50	50	50	*not supported*
	on a PC[4]	100	100	100	100	15
	on a server[5]	3,000	3,000	3,000	3,000	350
Template size (kilobytes)		0.8 - 8.0	0.2 - 0.3	2.4	3.5 - 4.5	33.0
Matching speed[4] (templates per second)		200,000	200,000	200,000	8,000	4,000

(1) Here a template contains one biometric record (fingerprint, palmprint, face, voiceprint or iris respectively). MegaMatcher SDK allows to store multiple biometric records (fingerprints, palmprints faces, voiceprints and irises) in a single template.

(2) Voiceprint engine specifications are provided for 5-second long voice samples.

(3) Android or iOS device (smartphone or tablet) with at least Snapdragon S4 SoC, running at 1.5 GHz.

(4) PC with at least Intel Core i7-8xxx family processor.

(5) Server hardware with at least Dual Intel Xeon Gold 6126 processors, running at 2.6 GHz.

MegaMatcher **SDK Trial** and **product brochure** can be downloaded from Neurotechnology web site.

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MegaMatcher Accelerator

Solution for large-scale AFIS or multi-biometric systems

- Ready-to-use
- Fast matching
- Multiple modalities support
- Scalable architecture
- ISO & ANSI standards support
- Suitable for duplicates search

MegaMatcher Accelerator 12.1 is a hardware/software solution that provides high speed, high volume biometric identification for national-scale projects. The **Exreme** and **Extended** version are designed to run on **server hardware** and perform fast biometric template matching on the server-side of a large-scale AFIS or multi-modal system. The **Standard** version and **Development Edition** are designed to be run on a **common PC**. All version require minimal configuration and accept requests from client software via network or the Web.

The most prominent MegaMatcher Accelerator integration examples are:

- **DR Congo Voter Registration Project** has used 11 MegaMatcher Accelerator Extreme units to perform massive, simultaneous deduplication of **46.5 million** enrolled voters for the DRC 2018 elections; the records were processed in less than **2 months**.

- **Venezuela Voter Registration System** proved its speed and accuracy with biometric data from nearly **18 million** registered people during the 2012 Venezuelan presidential election.

- **Ukraine's National ID System** is intended for creating a data bank with Ukrainian citizens biometric information. More than **12 million** people have been enrolled by the end of 2018.

- **Mexico Multi-Biometric Enrollment System** has been implement for high-volume iris, face and fingerprint identification, with 5 million taxpayers enrolled by the end of 2014.

MegaMatcher Accelerator can be used within a biometric system that contains templates with any number of fingerprint, palmprint, iris and/or face records. The technology provides enough speed to provide adequate response time for national-scale systems, as well as complete duplicate searching in a reasonable time. The scalable architecture allows the combination of multiple MegaMatcher Accelerator units into a cluster for tasks involving larger databases.

The MegaMatcher Accelerator 12.1 Extreme software is designed to run on server hardware with dual Xeon processors and at least 512 MB of memory. Each MegaMatcher Accelerator 12.1 Extreme unit can store **160,000,000 fingerprints** and 200,000,000 **iris**es and 40,000,000 faces.

The MegaMatcher Accelerator 12.1 Extended software is designed to run on server hardware with dual Xeon processors and at least 128 MB of memory. Each MegaMatcher Accelerator 12.1 Extended unit can store **40,000,000 fingerprints** and 50,000,000 **iris**es and 10,000,000 faces and 4,000,000 **palmprint**s.

The MegaMatcher Accelerator 12.1 Standard and Development Edition software are intended to run on a PC with Intel Core i7 processor and 16 GB of memory. Each PC with MegaMatcher Accelerator 12.1 Standard or Development Edition software can store **4,000,000 fingerprints** and 5,000,000 **iris**es and 1,000,000 faces and 400,000 **palmprint**s.

MegaMatcher Accelerator 12.1 Extreme, Extended, Standard and Development Edition licenses can be purchased by new and existing MegaMatcher Extended SDK customers. Server hardware is optionally available.

The table below shows the performance of MegaMatcher Accelerator fast fingerprint, face and iris matching engines

Matching speed for a single MegaMatcher Accelerator 12.1 unit (templates per second)				
One template contains:	Extreme	Extended	Standard	Development Edition
1 fingerprint record	1,200,000,000	100,000,000	35,000,000	1,000,000
2 fingerprint records	600,000,000	55,000,000	18,000,000	500,000
4 fingerprint records	300,000,000	27,000,000	8,000,000	250,000
10 fingerprint records	120,000,000	10,500,000	3,500,000	100,000
1 face record	1,200,000,000	100,000,000	35,000,000	1,000,000
1 iris record	1,200,000,000	200,000,000	70,000,000	1,000,000
2 iris records	600,000,000	100,000,000	35,000,000	500,000
1 palmprint record	*not supported*	2,000,000	600,000	20,000
2 palmprint records	*not supported*	1,000,000	300,000	10,000

The MegaMatcher Accelerator 12.1 Development Edition **30-day trial** is available for **download**.

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MegaMatcher On Card SDK

Smart card multi-biometrics

- NIST MINEX-compliant algorithm
- **PC-like verification accuracy**
- **Configurable verification modes**
- Security and privacy
- Multibiometrics support
- ISO/IEC standards support
- Easy integration
- Multiplatform

MegaMatcher On Card SDK offers matching on card technology that stores person's fingerprint, iris and face templates on a smart card and performs template matching in a microprocessor embedded in the card, instead of matching biometric information on a PC's processor. This method ensures that personal biometric information does not transfer to an external computer as it would in a more basic template-on-card system.

The MegaMatcher On Card SDK is developed utilizing a set of ISO/IEC standards to enable interoperability with and easy integration into existing smart card and/or biometric systems.

MegaMatcher On Card algorithm for fingerprint matching on a smart card is compliant with the same NIST MINEX III criteria used to evaluate much more resource-intensive PC-based algorithms. MegaMatcher On Card provides a number of advantages over a standard fingerprint/iris/face identification system or similar products for smart cards, including:

- **Accuracy.** MegaMatcher On Card provides the same level of accuracy of an AFIS system in a verification process using ISO/IEC 19794-2 compact card minutiae format templates together with the security of storage of biometric templates and matching algorithm on a smart card. Face and iris modalities on-card verification precision conforms to the large scale multi-biometric MegaMatcher SDK accuracy rates of Neurotechnology's compact format templates matching.

- **Configurability.** MegaMatcher On Card fingerprint algorithm has different performance configurations that can be chosen according to the operating scenario, the requirements to matching accuracy, the smart card platform speed and memory constraints.

- **Multi-biometrics.** The face and iris matching engines can be used as an additional or alternative factor of authentication that enhances the fingerprint verification. Fingerprint, iris and face templates can be stored on a single card together with the fingerprint, iris and face matching algorithms.
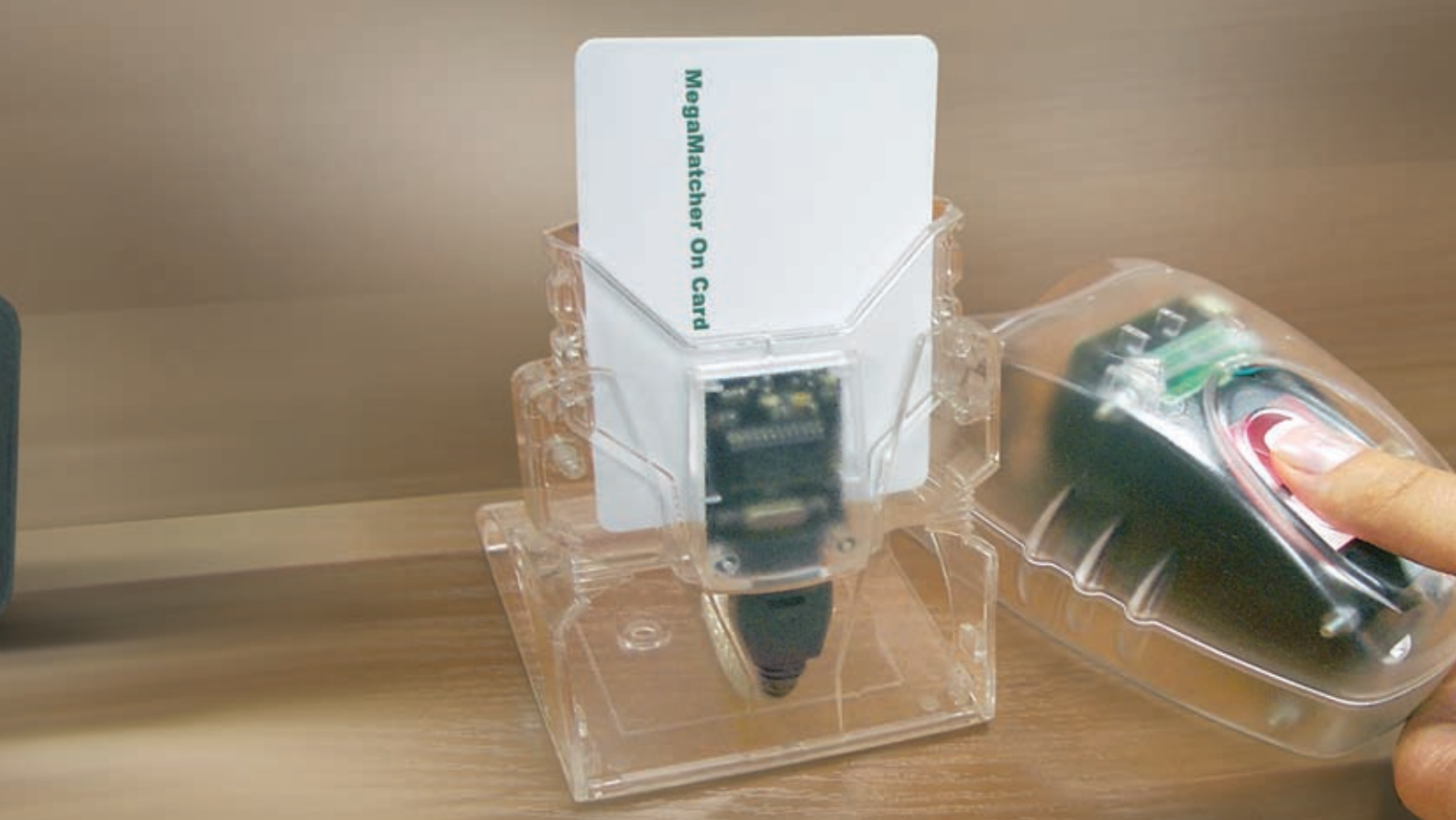
MegaMatcher On Card SDK provides a number of advantages over a standard fingerprint, iris and face identification system or similar products for smart cards, including:

- **Easy integration.** Implementing the system will not require major overhauls of existing infrastructure, as MegaMatcher on card is developed utilizing a set of ISO/IEC standards (7816-3, 7816-4, 7816-9, 7816-11 and 19794-2) to enable interoperability with and easy integration into existing smart card and/or biometric systems.

- **Different smart card platforms supported.** MegaMatcher On Card can be integrated at different stages of the card life cycle for various smart cards platforms. The post-issuance library gives the possibility to rapidly integrate match- on-card in projects where time constraints are critical. On the other hand the possibility to store the code directly into the ROM mask and the partnership with several card vendors offer a faster matching on card solution and the possibility to maintain more EEPROM available for post-issuance applications.

- **Security and privacy.** Biometric verification can replace or be combined with less secure (e.g., PIN) authentication techniques to achieve higher security. The original template remains on the smart card, providing a safeguard against misuse of information or fraudulent scanning systems.

Memory requirements for MegaMatcher On Card 11.2 biometric verification engines			
	Code size	Required RAM [3]	Template size
Fingerprint verification engine [1]	6.1 - 11.0 kilobytes	960 - 2,200 bytes	600 - 2,100 bytes
Fingerprint verification engine [2]	less than 13.7 kilobytes	less than 600 bytes	less than 1024 bytes
Face verification engine [2]	less than 6.1 kilobytes	less than 150 bytes	less than 850 bytes
Iris verification engine [2]	less than 8.9 kilobytes	less than 650 bytes	less than 1150 bytes
Tri-modal verification engine [2]	less than 24.9 kilobytes	less than 750 bytes	see specific modalities above

(1) Native level integration (maximized accuracy configuration)
(2) Java Card post-issuance libraries (maximized speed configuration)
(3) The Java Card post-issuance libraries utilize Java level RAM for internal matching engine routines. The native level integrations temporary utilize RAM available at the native level while the internal routines run, thus consuming no static Java level RAM.

Template matching speed depends on microcontrolller capabilities and operating system of a specific smart card model.

MegaMatcher On Card SDK **product brochure** is available for downloading from Neurotechnology web site.

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VeriFinger SDK

Used in more than 1500 end-user product brands in 100+ countries over the past 23 years.

Fingerprint identification for stand-alone or Web solutions

- NIST MINEX proven reliability
- Technology awards since 2000
- Multiplatform: Microsoft Windows, Android, iOS, Linux and macOS
- Numerous programming samples
- 150+ scanner models from 50+ manufactures are supported

VeriFinger is a fingerprint identification technology designed for biometric systems developers and integrators. The technology assures system performance with fast, reliable fingerprint matching in 1-to-1 and 1-to-many modes.

VeriFinger is available as a software development kit that allows development of stand-alone and Web-based solutions on Microsoft Windows, Linux, macOS, iOS and Android platforms.

The VeriFinger algorithm is based on deep neural networks and follows the commonly accepted fingerprint identification scheme, which uses a set of specific fingerprint points (minutiae) along with a number of proprietary algorithmic solutions that enhance system performance and reliability.:

- **Rolled-to-flat** fingerprints matching.
- Tolerance to fingerprint translation, rotation and deformation.
- Identification capability.
- Image quality determination.
- Spoof fingerprint detection.
- Adaptive image filtration.
- Features generalization mode.
- Compact fingerprint template.
- Scanner-specific algorithm optimizations for better performance.

The following VeriFinger SDKs are available:

- **VeriFinger Standard SDK** is designed for PC-based, embedded and mobile biometric application development. It includes Fingerprint Matcher and Extractor component licenses, programming samples and tutorials, fingerprint scanner support modules and software documentation. The SDK allows the development of biometric applications for Microsoft Windows, Linux, macOS, iOS and Android operating systems.

- **VeriFinger Extended SDK** is designed for biometric Web-based and network application development. It contains all features and components of the Standard SDK. Additionally, the SDK includes Fingerprint Client component licenses for PCs and mobile clients, sample client applications, tutorials and a ready-to-use matching server component.

VeriFinger 12.1 algorithm technical specifications (for a PC with Intel Core i7-8xxx family processor)	
Scanner resolution	500 ppi recommended 250 ppi minimal
Template extraction time	0.6 seconds
Matching speed	40,000 fingerprints per second
Template size (configurable)	800 – 8,000 bytes
Maximum database size	Limited by the amount of free RAM

VeriFinger **algorithm demo** application, **30-day SDK Trial** and product **brochure** are available for downloading from Neurotechnology web site.

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VeriLook SDK

Millions of algorithm deployments worldwide over the past 17 years.

Face identification for stand-alone or Web applications

- Live face detection
- Face with mask recognition
- **Gender classification**
- Age evaluation
- Emotions recognition
- Smile, open-mouth, closed-eyes, glasses and facial hair detection
- Near-infrared and visible light spectrum facial images matching
- Multiplatform: Microsoft Windows, Android, iOS, Linux and macOS

VeriLook facial identification technology is designed for biometric systems developers and integrators. The technology assures system performance and reliability with live face detection, simultaneous multiple face recognition and face matching in 1-to-1 and 1-to-many modes.

VeriLook is available as a software development kit that allows development of stand-alone and Web-based solutions on Microsoft Windows, Android, iOS, Linux and macOS platforms.

The VeriLook algorithm implements advanced face localization, enrollment and matching using robust digital image processing algorithms, which are based on deep neural networks:

- Multiple face detection in a single frame with simultaneous processing.
- Gender, age, the presense of open-mouth, closed-eyes, glasses, dark-glasses, beard and mustache, as well as person's emotions can be optionally determined for each face in an image.
- Live face detection prevents breaching the system with photos in front of a camera.
- Partially occluded faces (face mask or respirator) can be recognized.
- Tolerance to face posture allows for ±180 degrees of head roll, ±15 degrees of head pitch (nod) and ±90 degrees of head yaw (bobble).
- Multiple samples of the same face can be stored in a biometric template.
- Identification capability.
- Near-infrared and visible light spectrum face images can be used for face recognition and matched against each other.
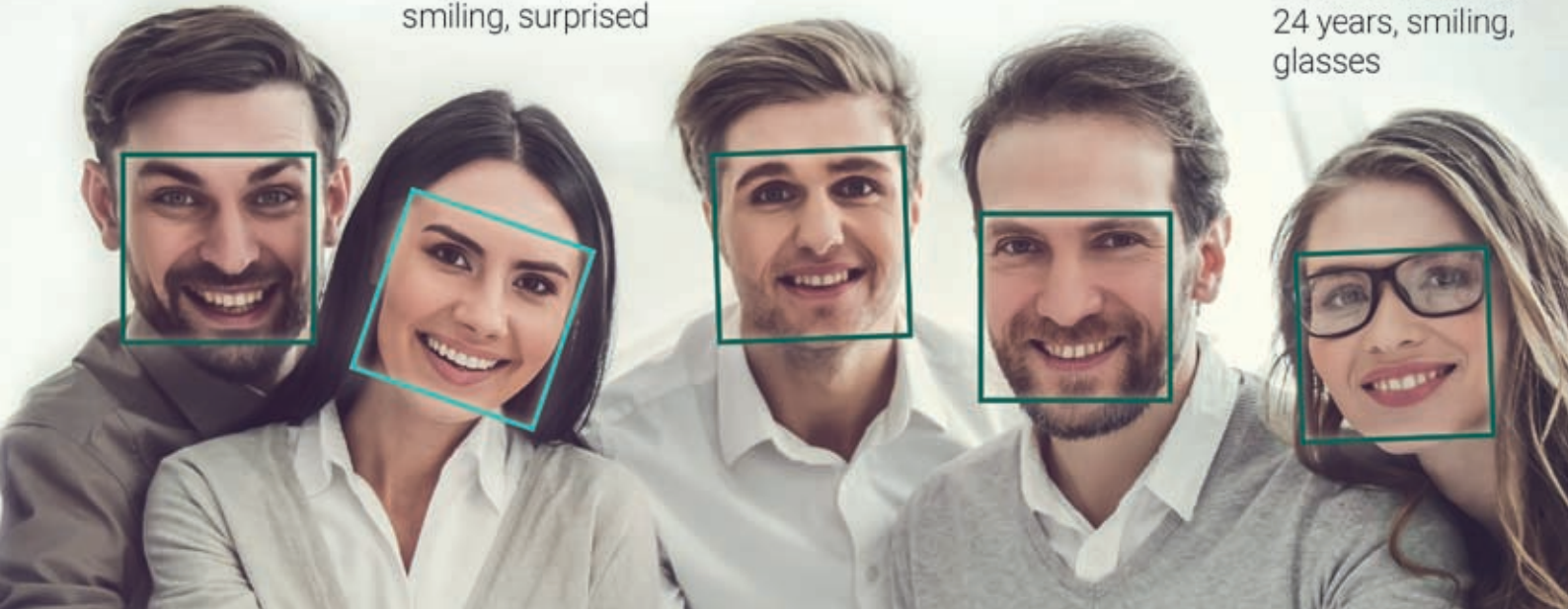
Unknown male, 27 years, beard & mustache, happy

Identified: Maria Taylor, female, 29 years, smiling, surprised

Unknown male, 24 years, neutral, open-mouth

Unknown male, 32 years, smiling, beard & mustache

Unknown female, 24 years, smiling, glasses

The following VeriLook SDKs are available:

- **VeriLook Standard SDK** is designed for **PC-based, embedded or mobile** biometric application development. It includes Face Matcher, Face Extractor and Face Verification component licenses, programming samples and tutorials and software documentation. The SDK allows the development of biometric applications for Microsoft Windows, Linux, macOS, iOS or Android operating systems.

- **VeriLook Extended SDK** is designed for biometric **Web-based** and network application development. It includes all features and components of the Standard SDK. Additionally, the SDK contains Face Client component licenses for PCs and mobile / embedded devices, sample client apps, tutorials and a **ready-to-use matching server** component.

VeriLook 12.1 algorithm technical specifications (for a PC with Intel Core i7-8xxx family processor)	
Minimal face size on an image	32 pixels between eyes
Recommended face size on an image	64 or more pixels between eyes
Single face template extraction time	0.6 seconds
Matching speed	40,000 faces per second
Template size (configurable)	194 or 322 bytes
Maximum database size	Limited by the amount of free RAM

VeriLook **algorithm demo** application, **30-day SDK Trials** and product **brochure** are available for downloading from Neurotechnology web site.

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VeriEye SDK

Iris identification for stand-alone and Web solutions

- NIST IREX proven accuracy
- Original proprietary algorithm
- Contact lens detection can prevent fake iris image spoof
- Gazing-away eyes are recognized
- Multiplatform: Microsoft Windows, Android, iOS, Linux and macOS
- Numerous programming samples

VeriEye iris identification technology is designed for biometric systems developers and integrators. The technology includes many proprietary solutions that enable robust eye iris enrollment under various conditions and fast iris matching in 1-to-1 and 1-to-many modes.

VeriEye is available as a software development kit that allows development of stand-alone and Web-based solutions on Microsoft Windows, Linux, macOS, iOS and Android platforms.

The proprietary algorithm implements advanced iris segmentation, enrollment and matching using robust digital image processing algorithms:

- Robust eye iris detection even when there are obstructions to the image, visual noise and/or different levels of illumination.
- Automatic interlacing detection and correction results in maximum quality of iris features templates from moving iris images.
- Image quality estimation can be used during iris enrollment to ensure that only the best quality iris template will be stored into database. Also, cosmetic (decorative) contact lens, which obscure an iris with some artistic or fake iris texture and/or change iris color, can be detected.
- Gazing-away eyes are correctly detected, segmented and transformed as if looking directly into the camera.
- Correct iris segmentation is obtained even when irises or their boundaries are not perfect circles and even not ellipses or the centers of the iris inner and outer boundaries are different.
- Eyelids, which partially occlude an iris, are detected and segmented from the iris image.

VeriEye is available as the following SDKs:

- **VeriEye Standard SDK** is designed for **PC-based, embedded and mobile** biometric application development. It includes Iris Matcher and Extractor component licenses, programming samples and tutorials, iris scanner support modules and software documentation. The SDK allows the development of biometric applications for Microsoft Windows, Linux, macOS, iOS and Android operating systems.

- **VeriEye Extended SDK** is designed for biometric **web-based** and network application development. It includes all features and components of the Standard SDK. Additionally, the SDK contains Iris Client component licenses for PCs and mobile devices, sample client applications, tutorials and a **ready-to-use matching** server component.

VeriEye 12.1 algorithm technical specifications (for a PC with Intel Core i7-8xxx family processor)	
Minimal iris image diameter	64 pixels
Recommended iris illumination	Near-infrared
Iris template extraction time	0.6 seconds
Matching speed	40,000 irises per second
Template size	2.4 kilobytes
Maximum database size	Limited by the amount of free RAM

VeriEye **algorithm demo** application, **30-day SDK Trial** and product **brochure** are available for downloading from Neurotechnology web site.

VeriSpeak SDK

Speaker recognition for stand-alone and Web applications

- Text-dependent and text-independent algorithms
- Two-factor authentication with voice biometrics check and **passphrase verification**
- Regular microphones are suitable
- Multiplatform: Microsoft Windows, Android, Linux, iOS and macOS

VeriSpeak voice identification technology is designed for biometric system developers and integrators. The text-dependent speaker recognition algorithm assures system security by checking both voice and phrase authenticity. Voiceprint templates can be matched in 1-to-1 (verification) and 1-to-many (identification) modes.

VeriSpeak is available as a software development kit that enables the development of stand-alone and Web-based applications on Microsoft Windows, Linux, macOS, iOS and Android platforms.

The VeriSpeak algorithm implements advanced voice enrollment and voiceprint matching using proprietary sound processing technologies:

- Text-dependent algorithm. The text-dependent speaker recognition is based on saying the **same phrase for enrollment and verification**. VeriSpeak determines if a voice sample matches the template that was extracted from a specific phrase enrolled by the person. This method assures protection against the use of a covertly recorded random phrase from that person. It may be also used for **liveness check** by requesting users to pronounce a specific phrase and prevent the using of voice recording.

- Two-factor authentication with a passphrase. VeriSpeak can be configured to work in a scenario where each user records a **unique phrase** (such as passphrase or an answer to a "secret question" that is **known only by the person** being enrolled). Later a person is recognized by his or her own specific phrase.

- Text-independent algorithm. Different phrases for user enrollment and recognition are more convenient, as this method does not require each user to remember the passphrase. It may be combined with the text-dependent algorithm to perform faster text-independent search and then verify with the more reliable text-dependent algorithm.
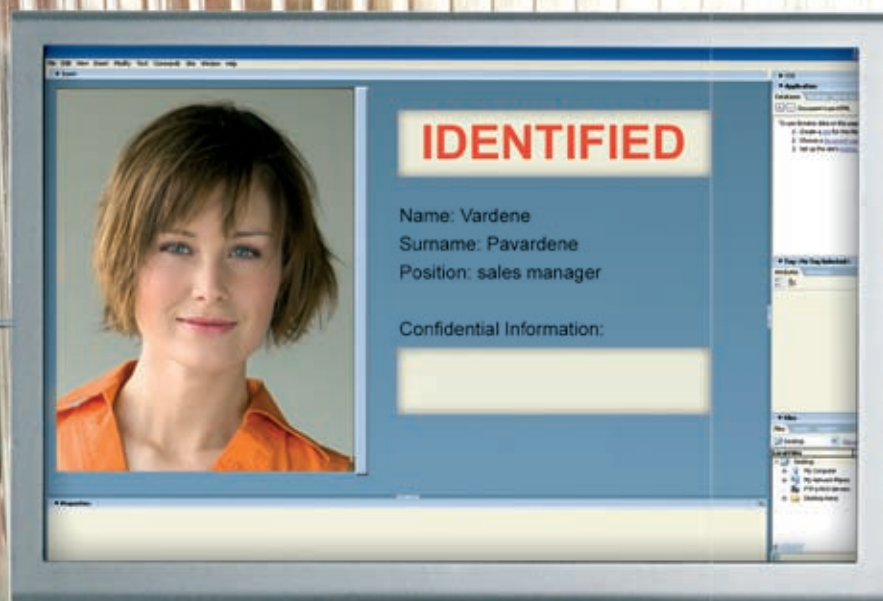
VeriSpeak is available as the following SDKs:

- **VeriSpeak Standard SDK** is designed for PC-based, embedded or mobile biometric application development. It includes Voice Matcher and Extractor component licenses, programming samples and tutorials and software documentation. The SDK enables the development of biometric applications for Microsoft Windows, Linux, macOS, iOS or Android operating systems.

- **VeriSpeak Extended SDK** is designed for biometric **web-based** and network application development. It includes all features and components of the Standard SDK with the addition of Voice Client component licenses for PCs and Android devices, sample client applications, tutorials and a **ready-to-use matching server** component.

VeriSpeak 12.1 algorithm technical specifications (for a PC with Intel Core i7-8xxx family processor)	
Minimal audio sampling rate	11025 Hz
Minimal audio bit depth	16-bit
Voice template extraction time	0.6 seconds
Matching speed (unique phrase mode)	1,700 voiceprints per second
Matching speed (fixed phrase mode)	8,000 voiceprints per second
Template size	3.5 – 4.5 kilobytes
Maximum database size	Limited by the amount of free RAM

The specifications are given for 5-second long voice samples.

VeriSpeak **30-day SDK Trial** and **product brochure** are available for downloading from Neurotechnology web site.

Face Verification SDK

Biometric identity verification for large-scale high-security applications

- Compact library for deployment on mobile devices.
- Based on VeriLook technology with millions of deployments worldwide.
- Live face detection prevents **spoofing.**
- Android, iOS, Microsoft Windows, macOS and Linux supported.
- Programming samples in multiple languages included.

The Face Verification SDK is designed for integration of facial authentication into enterprise and consumer applications for mobile devices and PCs. The simple API of the library component helps to implement solutions like payment, e-services and all other apps that need enhanced security through biometric face recognition, while keeping their overall size small for easy deployment to millions of users.

Available on Android, iOS, Microsoft Windows, macOS and Linux platforms.

The Face Verification SDK is intended for developing applications which perform end-user identity verification in mass scale systems like:

- online banking and e-shops;
- government e-services;
- social networks and media sharing services.

The SDK is based on the VeriLook algorithm, which provides advanced face localization, enrollment and matching using robust digital image processing algorithms based on deep neural networks.

Different **face liveness detection** functionalities are included to implement anti-spoofing mechanism with the possibility of configuring the balance between security and usability of the application. The Face Verification SDK is able to prevent a security breach with placing a photo in front of the camera by determining whether a face in a video stream is "live" or a photograph. The liveness detection can be performed in passive mode, when the engine evaluates certain facial features, and in active mode, when the engine evaluates user's response to perform actions like blinking or head movements.
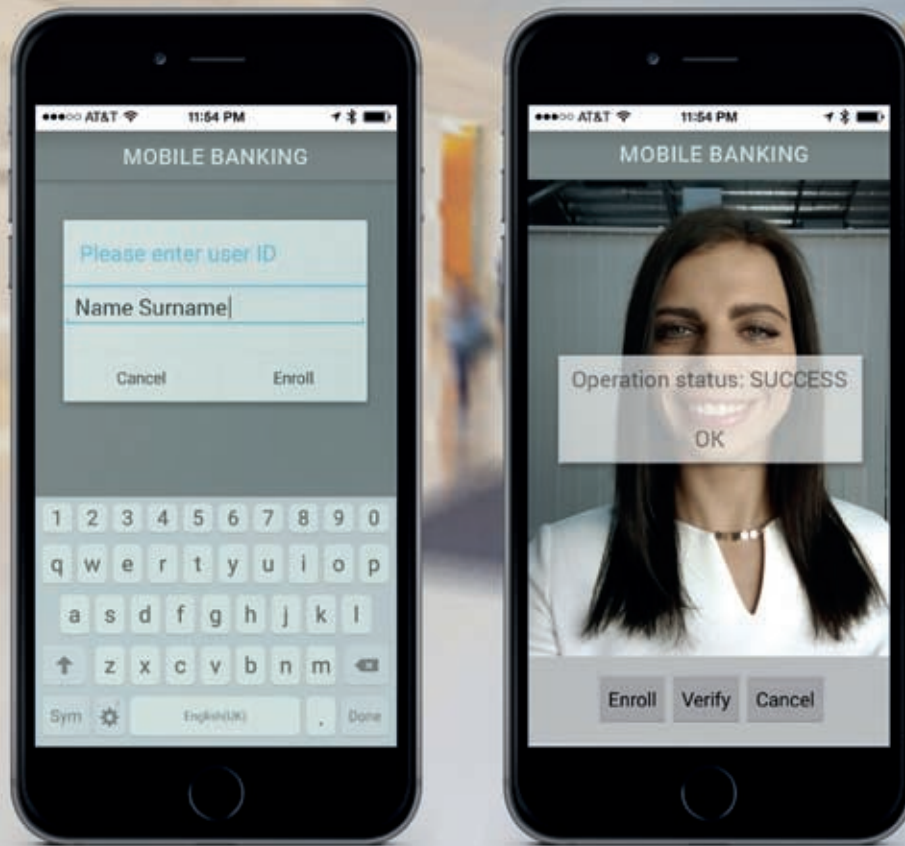
Face Verification SDK offers these functions and features for large-scale identity verification systems:

- **Simple, high-level API.** The API provides operations for creating face templates from camera or still image, face verification against a specific previously created face template, importing face templates which were created with VeriLook algorithm, as well as performing face liveness check.

- **Privacy and security.** The face images and biometric templates are kept on the client-side and do not leave the end-user device. The face images are required only for template creation and face liveness detection, thus they can be disposed just after performing these operations.

- **Live face detection.** A conventional face identification system can be tricked by placing a photo in front of the camera. Face Verification SDK is able to prevent this kind of security breach by determining whether a face in a video stream is "live" or a photograph. ICAO compliance check can be optionally used to strengthen the liveness check.

- **Face image quality determination.** A quality threshold can be used during face enrollment to ensure that only the best quality face template will be stored into database.

- **Tolerance to face position.** The Face Verification SDK allows head roll, pitch and yaw variation up to 15 degrees in each direction from the frontal position during face detection and up to 45 degrees in each direction during face tracking.

- **Transaction-based licensing.** Face Verification SDK is licensed for each successful biometric operation. This model requires to pay only for successfuly created biometric templates or passed liveness check operations, while having unlimited free template verification operations.

- **Centralized transaction accounting.** Biometric transactions licensing and accounting is performed by the Face Verification Server component which can be run on customer's premise or at Neurotechnology-hosted cloud. This licensing architecture allows the user to track easily how much biometric transactions are performed. The connection to the Server component is usually required only during new user enrollment, and the verify operation is designed to be performed completely offline.

An **algorithm demo** app for Android, **SDK Trial** for all platforms and product **brochure** are available for downloading from Neurotechnology web site.

FingerCell SDK

## Fingerprint identification for embedded platforms

- Fast performance even on low speed processors
- **Verification and identification**
- **Compact fingerprint template** and unlimited database size
- ISO biometric standards support.
- Cross platform algorithm with compact portable source code
- FingerCell Demo Unit with pre-installed algorithm is optionally available

FingerCell technology is designed for embedded biometric systems developers and features **compact**, **sensor-independent** and **cross-platform** fingerprint recognition algorithm. It offers decent **performance** on various embedded devices based on low-power microcontrollers or processors.

FingerCell is available for integrators as Software Development Kits (SDK) with FingerCell library or source code for developing a fast and reliable system on embedded or mobile platform.

FingerCell is designed to provide decent reliability and identification speed for various embedded devices and platforms. The FingerCell algorithm includes these proprietary solutions:

- Fingerprint template extraction from an image and verification against another template is performed in less than **less than 0.7 seconds** on a **168 MHz ARM Cortex-M4** family processor, which is acceptable for embedded systems.

- FingerCell is suitable not only for fingerprint verification (1-to-1 matching), but also for identification (1-to-many matching).

- FingerCell is designed for easy implementation into very various and specific applications. The algorithm's **source code** is sensor independent; therefore it can be ported to various platforms and hardware. Compiled code and internal data arrays require only **128 kB** of memory and therefore can be implemented in low memory microchips, thus reducing hardware costs. Larger fingerprints processing will need some additional memory.

- FingerCell Demo Unit. Neurotechnology offers pre-installed FingerCell algorithm on testing hardware for the technology evaluation. The Demo Unit is available on request.
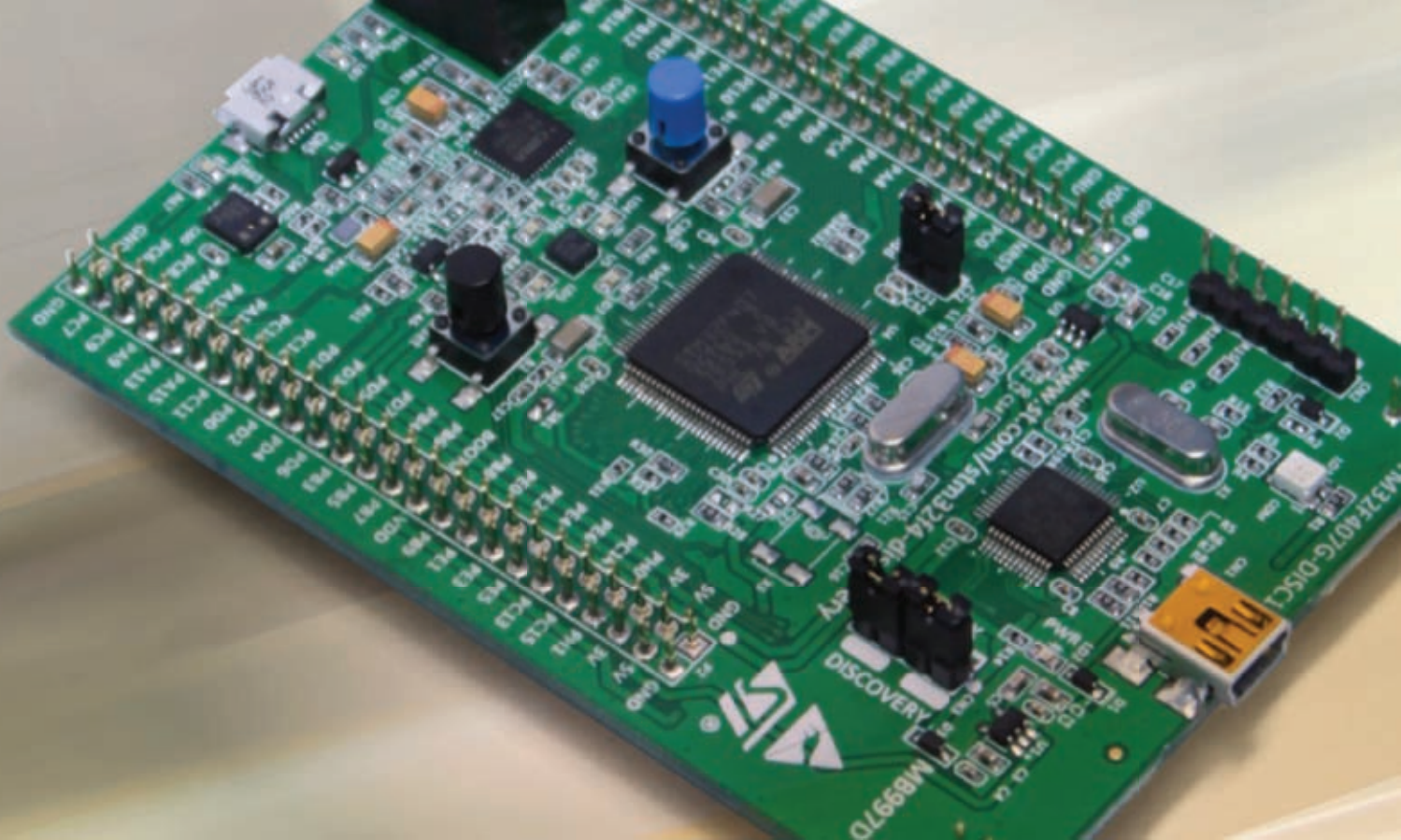
FingerCell SDK provides interoperability with other Neurotechnology biometric SDKs or third party products, as it can generate and match templates in **ISO** formats. FingerCell SDK components are designed for using in different scenarios:

- Template **extraction and matching on embedded device**. This scenario offers privacy and security, as biometric templates do not leave the device.

- Template **extraction on embedded device**, template **matching on smart card.** Privacy and security is achieved by smart card usage for identity verification, as biometric information is only transferred from embedded device to smart card and is not exposed. *MegaMatcher On Card* or other vendors match-on-card technologies can be used.

- Template **extraction on embedded device**, template **matching on server or cloud**.

- Template **extraction on PC or mobile device**, template **matching on embedded device**.

FinerCell 3.3 algorithm technical specifications (for embedded hardware based on ARM Cortex-M4F microcontroller, running at 168 MHz)	
Minimal recommended fingerprint image resolution	385 ppi
Template extraction time	650 ms
Template verification time	4 ms
Matching speed	250 fingerpints per second
Template size with 16 | 64 feature points (minutiae)	152 | 488 bytes
Maximum database size	Limited by the amount of free RAM

FingerCell technology capabilities can be **evaluated** with **30-day SDK Trial** for Microsoft Windows. The trial is available for downloading from Neurotechnology web site.

NEUROtechnology

SentiVeillance Server and SDK

Persons or vehicles recognition and tracking for surveillance systems and VMS

- **Biometric persons identification** and tracking
- Pedestrians and vehicles tracking **and classification**
- Automated license plate recognition (ALPR) for moving vehicles
- Real-time watch list check with automatic event triggering, logging and reporting.
- Search for events in a timeframe by person ID, gender or age.
- Large surveillance systems support with multiple video stream processing.

SentiVeillance Server is a ready-to-use software for easy integration of biometric **face identification**, **vehicle and pedestrian classification and tracking**, as well as automatic license plate recognition into operating **video management systems (VMS)**. The ready-to-use software analyzes live video streams, which are served by a VMS from surveillance cameras.

A video management system (VMS) usually provides only motion detection functionality and can help to filter out parts of video from surveillance cameras when there is no movement. SentiVeillance Server software enhances existing VMS with these features and functions:

- Ready-to-use software needs only configuration for connecting VMS.
- Compatible with Milestone XProtect VMS and Luxriot Evo S and Evo Global video management systems.
- All video streams received from connected VMS are analyzed in parallel. Biometric recognition is performed in **real-time**. All watch list match events trigger alerts, which are sent back to the VMS.
- Each SentiVeillance Server can analyze up to 10 video streams in parallel. Several Servers can connect to the same VMS, as well as several VMS can be connected to the same Server, meaning surveillance systems with **any number of cameras** supported.
- **SentiVeillance SDK** is optionally available for **developing software** that performs biometric face identification, vehicles and pedestrians classification and tracking, with optional license plate recognition for detected vehicles.

List of possible uses includes law enforcement, traffic monitoring, security, attendance control, visitor counting, traffic monitoring and other applications.

alpr #1

Detection Confidence: 100.00

🚗 Car (99.12)

⚪ White (70.83)

AI · 66795

License plate: AI66795

Vehicle Details

Models:
Mercedes-Benz (100.00)
  A-Klasse (92.57)
Tags:
SUV (51.19)
Orientation:
Front - 261.45° (99.99)

License Plate Details

License Plate: AI66795
Origin:
Detection confidence: 83.02
OCR confidence: 91.60

Type Details

Detection Confidence: 100.00

🚗 Car, confidence 99.12

Face Details

Face Quality: 49

Age: 33

♀ Gender: Female, confidence: 23.00

Glasses: No, confidence 17.00

Dark Glasses: No, confidence 18.00

Beard: No, confidence 46.00

Mustache: No, confidence 100.00

Smile: No, confidence: 32.00

Blink: Yes, confidence 0.00

Mouth Open: Yes, confidence 30.00

The technology, which powers the SentiVeillance Server software and SentiVeillance SDK, features **real time performance**, capability to process data from **multiple video streams** in parallel and **automatic events logging and reporting**. The technology supports these modalities:

- **Biometric face recognition** – based on deep neural networks, it provides reliable face detection and tracking with accurate identification against **large watch list** databases. Optionally, **gender classification** and age estimation, as well as **facial attributes** detection (smile, glasses, beard etc) can be performed.

- **Vehicle or human detection, classification and movement tracking** – performs object detection of moving and static objects in the scene, their classification and tracking until they disappear. This modality can determine object type (**pedestrian**, **car**, **bike**, **truck** or **bus**), as well as perform its **color** and **movement vector** estimation.

- **Automated license plate recognition (ALPR)** – SentiVeillance ALPR algorithm can process **traffic data** by simultaneously reading vehicle license plates from multiple moving vehicles. The algorithm is **tolerant to camera position** and can read license plates from longer distance and higher angle. Vehicle recognition and ALPR modalities can be used together to **prevent cheating with replaced license plates** by checking if recognized license plate corresponds other registration data, like vehicle color or type, and not being spoofed or moved from another vehicle.

The SentiVeillance SDK also provides these specific capabilities for software developers:

- **Automatic enrollment** for unknown persons with further identification of these persons.

- **Video files processing**, either in real time as coming from a virtual camera, or at maximum possible speed depending on available hardware resourses.

- **Programming samples and tutorials** for each of the supported modalities are intended for helping software developers to integrate the needed functionality into their systems.

- **Flexible licensing**, based on the number of processed video streams.

SentiVeillance **algorithm demo** application, **30-day Server software Trial** and **SDK Trial** are available for downloading from Neurotechnology web site.

NEUROtechnology

SentiBotics Navigation SDK

Imitation learning-based autonomous robot navigation kit

- Proprietary algorithm, based on deep neural networks
- Autonomous navigation over long distances
- Object learning and recognition engine included
- **Based on Tensorflow and ROS (Robot Operating System)**
- Gazebo simulator is fully integrated with the kit
- Complete source code for the robotics algorithms is included
- **Detailed specifications for the robotics hardware are included**
- Ready-to-run mobile robot prototype is optionally available

See **demo video**:
*https://youtu.be/szkdsh3KETA*

The software development kit is designed for researchers and engineers working on autonomous robot navigation projects. The kit may be also used for educational purposes in universities and other education institutions.

SentiBotics Navigation SDK relies on a single **webcam** and two low cost **ultrasonic range finders** for input and allows autonomous navigation over **long distances** (hundreds of meters or more). The new SDK enables navigation system **training** with further **adaptation to visual changes** in the environment through additional user input. The SDK features:

- **Imitation learning** based **autonomous robot navigation** – a user first runs the robot in the desired closed trajectory using the control interface. During this process, a deep neural network is **trained** on captured images of the environment and control pad commands. Once the training is complete, the robot may be placed at **any point** along the learned trajectory and it will function autonomously within that environment.
- **Object learning and recognition** – users may enroll objects of interest into the included object recognition engine for additional enhancement of the controller-learned space.
- **Robot and environment simulation** – a test environment, complete with an office layout and simulated SentiBotics robot, is included.
- **Basic obstacle handling** – the robot can use its two front-facing ultrasonic sensors to detect obstacles, such as a person crossing the trajectory.
- **Autonomous recharging** – a robot can be trained to look for the charging station and connect to it when needed, using its object recognition and precise positioning capabilities.

Available as either a **software-only** option for integration into existing robotics hardware, or as a **ready-to-run robotics system** that includes Neurotechnology's mobile reference platform prototype.
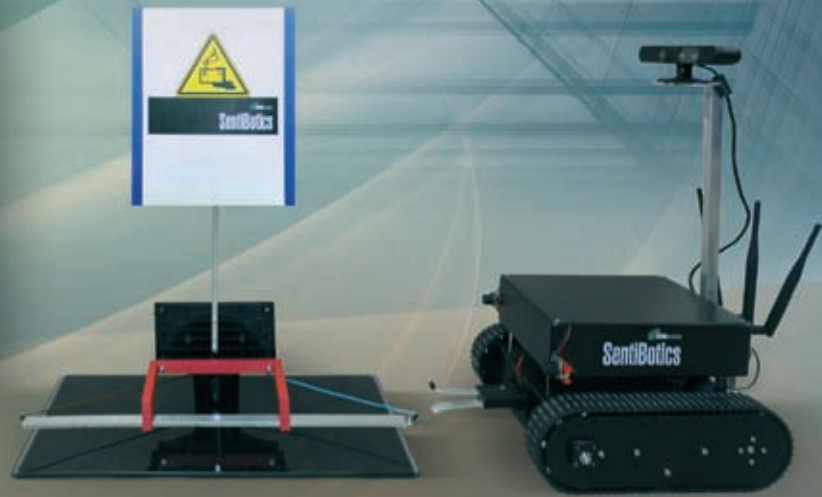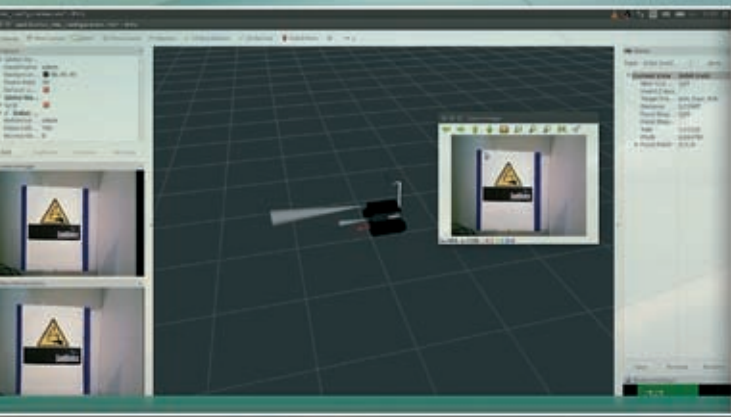
A robotics kit with ready-to-run mobile robot prototype is optionally available with SentiBotics Navigation SDK. The robotic hardware consists of:

- **Tracked platform**, capable of carrying a payload of up to 10 kg.
- **Two 3D cameras** that allow the robot to "see" and recognize objects at a range of 0.15 to 3.5 meters.
- **Onboard computer** (Intel NUC i5 computer with 8 GB of RAM, 64 GB SSD drive, 802.11n interface).
- **Battery** (20 Ah 4-cell LiFePO$_4$) with charger.
- **Autonomous recharging** hardware with a docking station.
- RGB camera and 3D sensor:
- Control pad.

The SentiBotics Navigation Software Development Kit (SDK) is intended to be used either with a robot, based on SentiBotics platform or in a Gazebo simulation. The SDK also provides easy integration with custom mobile robot hardware. SentiBotics Navigation SDK includes:

- One SentiBotics Navigation component installation license.
- Set of ROS packages including source codes (in Python and C++) of all algorithms and full documentation.
- ROS-based infrastructure that allows users to rapidly integrate third party robotics algorithms, migrate to other hardware (or modify existing hardware) and provides a unified framework for robotic algorithm development.
- Video tutorials how to train and run navigation controllers, learn and recognize objects.
- SDK documentation.
- Robot hardware specifications.

30-day SDK trial is available for running in Gazebo robotics simulator.

Please contact us for more information on licensing SentiBotics kit and ordering it.

SentiMask SDK

3D face tracking for augmented reality apps and digital characters control

- Real-time face detection and tracking
- Facial pose, landmarks, shape and expression estimation
- 3D facial mesh generation
- Gender and age estimation
- Glasses, beard, mustache and hat detection
- Works with regular webcams and smartphone cameras
- Integration with other software

See **demo video**:

http://youtu.be/z_zRa6S9oV0

SentiMask is designed for development of augmented reality applications, which use **real-time 3D face tracking** technologies for motion capture and controlling 3D digital character's facial expressions or mapping animated avatars on user's face. The technology works with **regular cameras** and **common PC** or **smartphones** and is available as a software development kit that provides for the development of 3D face tracking systems for Microsoft Windows, Android, iOS, macOS and Linux.

The possible **applications of the SentiMask technology** include:
- **Motion capture** for 3D characters' **face animation** in entertainment applications, like computer games, communication apps etc.;
- **Augmented reality** applications, like virtual makeup, appearance changes evaluation, etc.
- **Facial features analytics** for interactive applications, which provide user experience based on person's gender, age or facial expression.

The technology has these **capabilities** for 3D face tracking applications:
- Facial features detection and tracking from live video is performed in **real time** on a regular PC or smartphone.
- **Face-based analytics** allow to estimate person's **age** and **gender**, as well as recognize 23 different **facial expressions** and determine if the person has **beard**, **mustache**, **glasses** or **hat**.
- **3D facial mesh** (wireframe model) is reconstructed from a facial image. A custom texture can be applied to the mesh, or the mesh points can be used as a reference for changing the appearance of an animated character.
- SentiMask-generated data can be used in a **custom application** or passed to a 3D modelling software, as well as game engines.

SentiMask SDK distribution package contains:

- One SentiMask component installation license for PC or Mac;
- One Mobile SentiMask component installation license for iOS or Android;
- SentiMask algorithm;
- Device Manager Library for video capture;
- Programming samples in C++ for Microsoft Windows, macOS and Linux;
- Programming samples in Objective C for iOS;
- Programming samples in Java for Android;
- SentiMask SDK documentation.

SentiMask has these specifications and usage recommendations:

- Only one face in a frame is processed. If there are more than one face in a frame, the largest one is processed.
- 32 pixels is the minimal distance between eyes for a face on video stream to perform face detection reliably.
- Face posture tolerance allows ±180 degrees head roll, ±25 degrees head pitch and ±35 degrees head yaw.
- Face detection and facial features estimation in a video frame is performed in 8 milliseconds on a PC with Intel Core i7-4790 processor running at 3.6 GHz clock rate.

SentiMask **30-day SDK Trial** and **product brochure** are available for downloading from Neurotechnology web site.

SentiSight.ai

Interactive web platform for developing AI-based applications

- Interactive online environment
- Image labeling toolkit
- AI model training
- Performance statistics
- Online model use
- No coding required

SentiSight.ai is a place to build task-specific AI models for image recognition using modern deep-learning techniques. The platform provides capabilities for object detection and image classification.

It is easy to use and automatically performs most of the image-processing tasks. No coding is required.

The generated AI models can be used for a wide variety of image analysis tasks in this application fields:

- **Industry** - detect corrupted products on conveyors, like damaged boxes or rotten apples.
- **Agriculture** - recognize culture in large fields, detect plants which need watering, separate ripe and raw fruits.
- **Medicine** - detect tissue anomalies in microscopic images, like corrupted cells.
- **Retail** - identify or validate items at a self-service cash register.
- **Social media** - moderate, validate and filter user content, like detecting nudity or guns, as well as block photos with embedded logos, spam text or QR codes.
- **Data management** - group pictures by type, shape, size or similarities, like classify animal species or identify activity type.
- **Infrastructure** - analyze aerial photos to locate i.e. road potholes, broken rails, damaged solar panels etc.
- **E-commerce** - tag product images by extracting information from them, like item type, color or printed logo, as well as offer similar products based on provided photo or image.
- **Advertising** - capture face images and analyze them for emotional reactions after showing certain ad or content.

Try it online:
https://www.sentisight.ai/
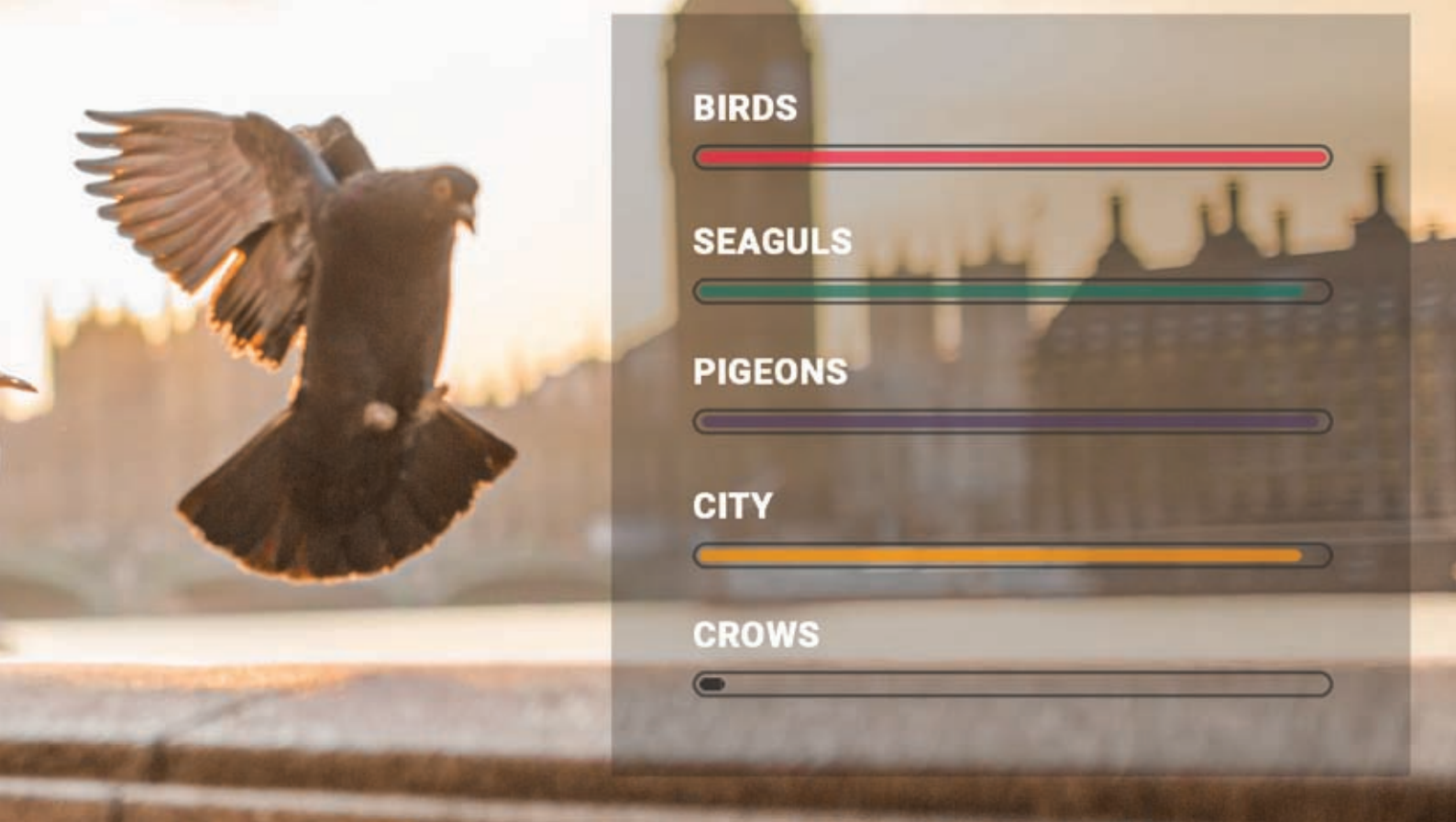
The interactive environment of SentiSight.ai is designed for training deep-learning models and provides these capabilities:

- **Image annotation tool** – allows attaching labels to images for image classification, object detection and image segmentation models. An intuitive interface makes labeling faster and easier. Output labels are automatically saved in a format suitable for deep-learning algorithms.

- **Training environment** – a model can be trained on the prepared images without any coding via the intuitive user interface.

- **Pre-trained models** – several image recognition models are ready to be used out-of-the-box without any training. These models include general classification, places recognition, people counting, content moderation, text recognition (OCR) and more.

- **Interactive statistics** – information about the model's performance is produced after the training process. Prediction accuracy, precision, recall and many other metrics allow users to measure their models' performance. This information can be immediately viewed and filtered to briefly state how efficient the model is as well as give guidance on its improvement.

- **Online model use** – all models trained by a user can be employed to make predictions based on new, previously unseen images. The models can be used online inside the SentiSight.ai platform or via a REST API.

- **Offline models** – a trained model can be downloaded by the user and used without internet connection. The downloaded model has 30-day trial period, during which it can be used for free. Later, the user has an option to purchase a specific license for using this model.

- **Similarity Search** – users have a possibility to use a similarity search tool that compares images. A user can perform either 1-to-many similarity search, which retrieves all images similar to the query image, or many-to-many similarity search, where all similar image pairs are found in the data set. This tool is ready to use out-of-the-box, without any training.

- **Shared labeling projects and time tracking** – large annotation projects can be shared among multiple users for collaborative work. The project manager can quickly filter and review the images labeled by a particular project member, track each person's progress and time spent on labeling, as well as manage user roles and permissions.

A **custom project** can be ordered if a task seems to be "non-standard" or rather complicated. In this case our experts will take care of the model's setup and training. The user just needs to take care of image labeling.

See the **www.sentisight.ai** website for more information.

NEUROtechnology

StockGeist.ai

Interactive platform for monitoring the current popularity of publicly traded companies

- AI-based stock ranking
- Real-time watchlist
- Mass scale news monitoring
- Sentiment analysis
- **Key financial information**

The StockGeist platform is intended for investors and stock traders who need a simple and convenient tool for analyzing news on a massive scale. The platform uses AI-based technologies to calculate sentiment that prevails in social media towards a particular company.

The covered companies are from the S&P 500 and NASDAQ 100 indices, as well as all the businesses in the publicly traded biotechnology and technology sectors.

The user of our platform can select any of the 2200+ company tickers to obtain a glimpse on the sentiment that prevails in social media towards a particular company. Timeframe for calculating sentiment levels can be selected as either the last five minutes, one hour, or one day.

In addition to sentiment data, StockGeist displays information on the number of messages received by a company, its current rank and changes in the ranking as well as some key data on the fundamentals of the company. To learn about the context of messages, the most popular word pairs can be seen in the form of a wordcloud.

At StockGeist we use AI-based technologies to help us calculate the sentiment along with analyzing messages and articles. Traders of the 21st century should be equipped with a tool to let them analyze the data on a massive scale. Our platform makes such a tool available to everybody and we will continue developing solutions to bridge the gap between the average trader and the market.

Try it online:
https://www.stockgeist.ai/

StockGeist.ai provides key information users need to know on the companies of their choice, including:

- **Ranking** – the top companies receiving the most attention in social media, as well as number of messages relating to each company are shown.

- **Watchlist** – interactive charts from a selected set of tickers can be built. For each ticker on the watchlist, the platform plots the total number of social media posts, cumulative message count, message ratio and positivity index.

- **News timeline** – timelines of the public news related to a company of the user's choice can be created, including summaries of the most recent news. News stories are labeled by their sentiment as either positive, negative or neutral. Also, sentiment span within the news summaries is shown.

- **Social sentiment** – distribution plots of the social sentiment in the posts received within a selected timeframe are shown. Separate plots show two categories of informative and emotional messages.

- **Wordcloud** – the most frequently encountered keyword pairs in social media will help the user quickly get a general idea of what the news is all about.

- **Fundamentals** – important, relevant data on the fundamentals as well as general information on the company selected are shown.

See the **www.stockgeist.ai** website for more information.

NEUROtechnology

BrainAccess Development Kit

Compact solution for brain-computer interface (BCI) systems based on dry electroencephalography (EEG)

- BCI software, EEG headwear and electroencephalograph included
- Shape-conforming dry-contact gold electrodes
- Flexible EEG headwear **configuration**
- Three ready-to-use BCI algorithms included
- Direct access to real-time EEG data.

BrainAccess is a kit intended for researchers and developers who need an easy-to-use and reasonably-priced EEG solution for BCI applications.

Available as BrainAccess Standard Kit and BrainAccess Extended Kit which include electroencephalographs, headwear with a set of dry-contact electrodes and software for EEG signal acquisition and processing. The kits also include ready-to-use algorithms which can be used for BCI applications.

The BrainAccess technology has these **capabilities** for dry EEG-based BCI applications:

- **Ready-to-use BCI algorithms** - three sample algorithms designed for brain-computer interface (BCI) applications working with signals from the dry contact EEG electrodes are included in the BrainAccess BCI Library. The algorithms are able to recognize EEG patterns related to user actions (facial movements, visual focus, relaxation state).

- **Direct access to real-time EEG data** - the BrainAccess Core library provides the developers with direct access to the measured EEG data which can be used for the development of **custom BCI algorithms**.

- **Flexible EEG headwear** - the included band or cap headwear uses our own **dry-contact** gold electrodes, which are shape-conforming and **do not need any skin preparation or gel** compared to conventional dry-contact electrodes. The band and the cap are both flexible and adjustable further improving the fitting of the electrodes. .

- **Portable electroencephalographs** - the EEG signals are measured by battery-powered electroencephalographs and then sent to a host computer via wireless communication. Depending on the model, the number of supported EEG channels range from 16 to 128.

Two variants of BrainAccess Kit are available and their contents are summarized below:

- **BrainAccess Standard Kit** – intended for experiments and applications with small number of EEG channels. Includes a 16-channel ultra-portable electroencephalograph, and BrainAccess BAND headwear for EEG measurements over occipital and/or forehead regions.

- **BrainAccess Extended Kit** – intended for experiments and applications with large number of EEG channels. The kit features electroencephalograph with 32 acquisition channels and BrainAccess CAP with 32 dry-contact electrodes for high-density coverage of cerebral cortex.

Both variants of BrainAccess Kit include this software:

- **BrainAccess Core** – a library for EEG data signal acquisition and processing. The library provides an interface with BrainAccess electroencephalograph, as well as enables configuration of acquisition parameters, streaming of EEG data to computer and monitoring the state of the electroencephalograph. Users have direct access to real-time EEG data and therefore can design their own neuroscience experiments, BCI algorithms, applications and other.

- **BrainAccess viewer** – an app for viewing the acquired EEG data signals. The app provides a GUI that exposes some functionality of the BrainAccess Core library. It is designed for checking signal quality, electrode fitting and recording EEG data that does not need to be time-triggered.

- **BrainAccess BCI library** – the library with a set of BCI algorithms, based on different BCI paradigms:

  - **Motion classifier algorithm** - recognizes EEG signal patterns related to facial movements performed by a user: eye blinks, eye movements upwards and downwards and teeth clenching. These motions can be mapped to various software control actions.

  - **SSVEP detector algorithm** - based on steady-state visually-evoked potential. If a user is exposed to visual flickers of different frequencies the algorithm detects at which flicker the user has his/her visual focus. Therefore, the user can select various commands depending on which flicker he/she has concentrated on.

  - **Alpha detector algorithm** - estimates the level of alpha brainwaves produced by the user. The level of alpha brainwaves increases when a person is relaxed and has his/her eyes closed and decreases when a person is in alert and concentrated state. The detector can serve as an approximate measure of how the person is relaxed.

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