VIDEONETICS

the future of video computing

MeraFace™

AI & Deep Learning Powered Face Recognition System

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AI & DEEP LEARNING POWERED FACE RECOGNITION SYSTEM

MeraFace™ is a versatile and intelligent Face Recognition System (FRS) developed by Videonetics using a rich set of Artificial Intelligence (AI) based algorithms and a computationally efficient modular architecture. The software is flexible and modular in nature, and hence suitable for deployment in both on-premise and on-cloud infrastructure with unlimited scalability. Due to the modular nature of the software, the underlying modules can be distributed across multiple edge or computing devices for flexible deployment and operational excellence. The simple web-based user interface is responsive and versatile.

The system has been designed to cater to the demands of various domains such as Contactless Biometrics, Identity Management, Law Enforcement, Border Security, Immigration, People Monitoring, Surveillance, Retail and Hospitality, Education, Access Control, Attendance Management, to name a few. It also aids management of challenges presented by pandemics such as COVID-19, by helping to identify and isolate persons violating health safety norms such as wearing of face mask or PPE.

The underlying technology and algorithms behind MeraFace™ have been benchmarked by the National Institute of Standards and Technology (NIST) through its Face Recognition Vendor Test (FRVT) activities. Several key parameters (such as template time, memory usage, detection of faces in outdoor environment, comparison time etc.) in NIST's FRVT are ranked much higher in the case of Videonetics technology, compared to its global peers. This is because of the innovative approach adopted in its design architecture, algorithms and their implementation techniques.

**FRVT report dated 2020-01-21*

Highlights

- Supports multiple resolutions such as QCIF, CIF, D1, 720p, 1080p, 4K, and is flexible to accommodate higher resolutions
- Supports a variety of image formats and compression standards – MJPEG, MPEG2/ MPEG4, H.264, H.265, H.265+
- Automatic face correction - Yaw, pitch and roll correction to recognise faces from different angles
- Faces of size as low as 25x25 can be detected and indexed, faces of size as low as 50x50 can be recognised with high accuracy
- Can handle large database of multi-million unique faces; group of images for each person can be tagged in a single database
- Innovative multi-layer face database architecture and hierarchical facial matching technique for quick face search
- Face recognition response time is less than 5 seconds to search a face database of 1 million persons (with multiple faces per person)
- Face recognition response time is less than 10 seconds to search a face database of 100 million persons (with multiple faces per person) distributed in multiple parallel database machines

- Clustering and indexing of multiple occurrences of unknown/ unregistered persons, to find navigation history
- Anti-spoofing feature is in-built
- Notifications and alerts to field operatives over cell phones
- Face recognition software module can be embedded in other devices like Access Control Unit, Turnstile, POS terminals etc.

Intelligent Search and Investigation

- Online face recognition using video from live IP camera – multiple cameras in parallel
- Offline face recognition from video clips, group photographs and facial images
- Facility to set configurable matching threshold and confidence factors as per the desired face recognition results
- 1:1 search -comparison of two faces and product similarity score
- 1:N search - comparison of a probe image with a set of input search images to produce similarity measures (Confidence Factor) against each search image
- Video search – given a probe image and a video clip, it finds all the occurrences of the probe image in the video file above a user-configured confidence factor. User can configure number of top matches to report, coupled with desired confidence factors
- Versatile face registration – single face registration, bulk face registration
- Face registration and search using cell phones (Android and iOS)

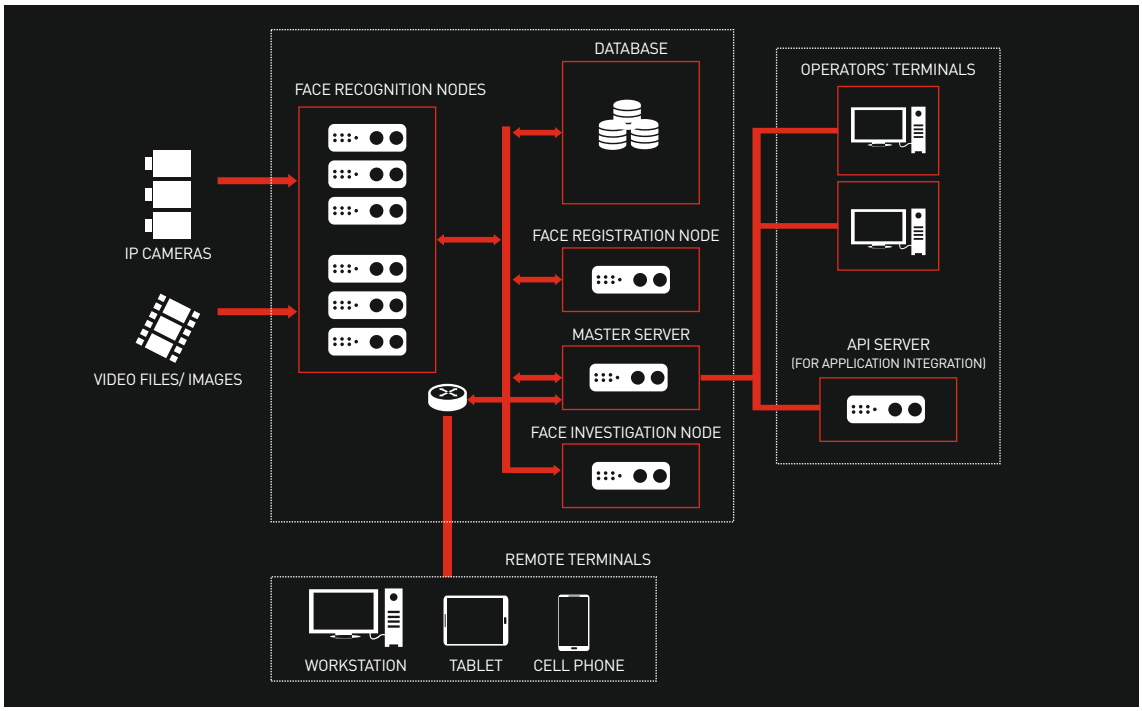
Easy Deployment and Maintenance

- Makes use of the existing surveillance infrastructure - supports fixed, PTZ, and body-worn cameras
- Integrated with Videonetics Intelligent Video Management Software (VMS)
- API for integration with third-party video management systems
- API integration with Attendance Management Systems, Event Management Systems, Command and Control Centre, and other IP devices and systems
- Supports centralised as well as distributed architecture environment
- Supports cloud deployment, as VSaaS model
- Web-based GUI
- Database redundancy and High Availability (HA) features for mission critical applications
- In-built system health dashboard
- Integrated with Videonetics Pandemic Management Suite (SAJAG) to recognise persons violating pandemic management norms (e.g. not wearing mask/ PPE/ hat etc. or committing other violations)

Architecture Overview

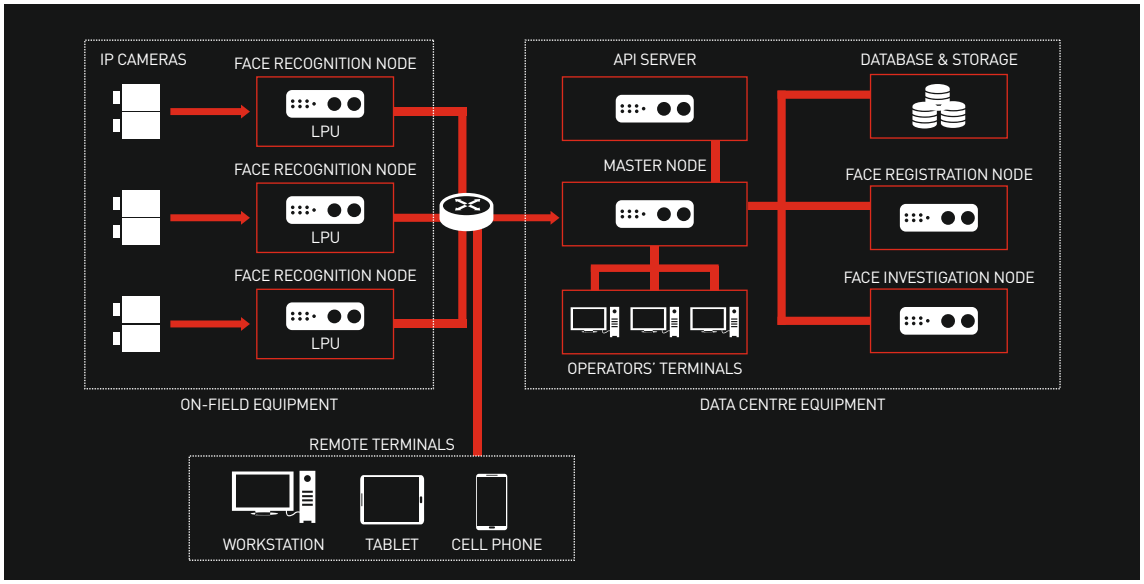
MeraFace™ is fully modular. The overall computing activity, from capturing video to recognising faces, is distributed across multiple computing engines called nodes. Single server hardware can accommodate one or more such nodes depending on the configuration of the hardware. On the other hand, the nodes can be distributed across multiple computing hardware.

The system can be deployed over centralised or distributed architecture. In centralised architecture, multiple servers are installed in a central set up. The video source is connected to the server directly, either over network or using file system. In a typical installation, a single server accommodates multiple face recognition nodes, each node handles a single video source, and there can be multiple such servers, giving rise to unparalleled scalability for face capture and recognition.



Centralised deployment (server nodes in data centre)

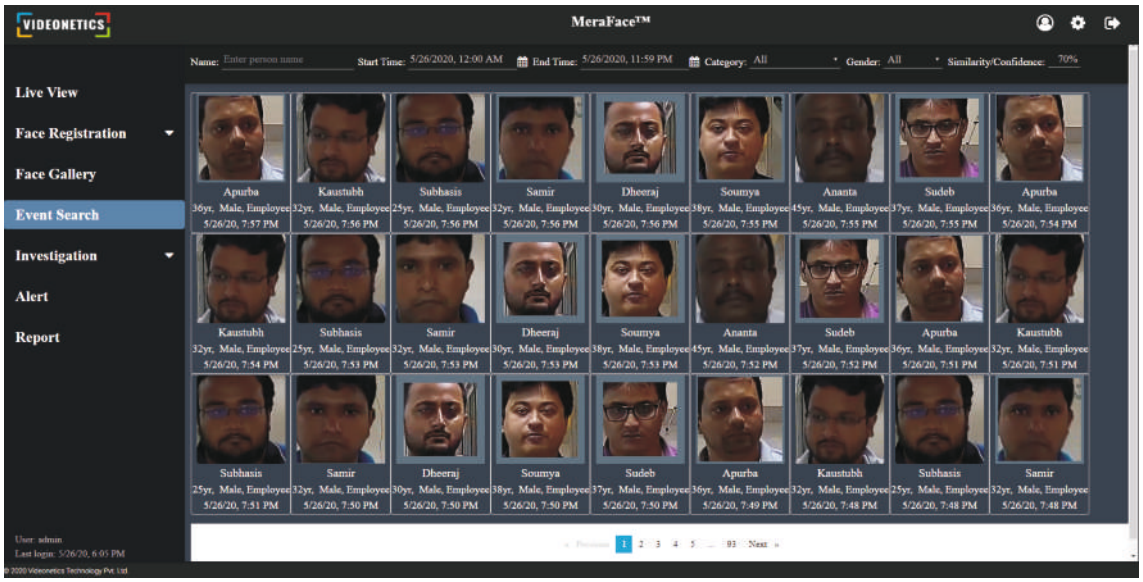
In a distributed architecture, the face recognition nodes can be installed in multiple computing devices that are installed across geographically separate regions. This includes Access Control System, POS terminals, or any dedicated Local Processing Unit (LPU). The other modules of the software are hosted in central servers or in cloud infrastructure.



Distributed deployment (Local Processing Unit acts as Face Recognition Node)

Modules and Components

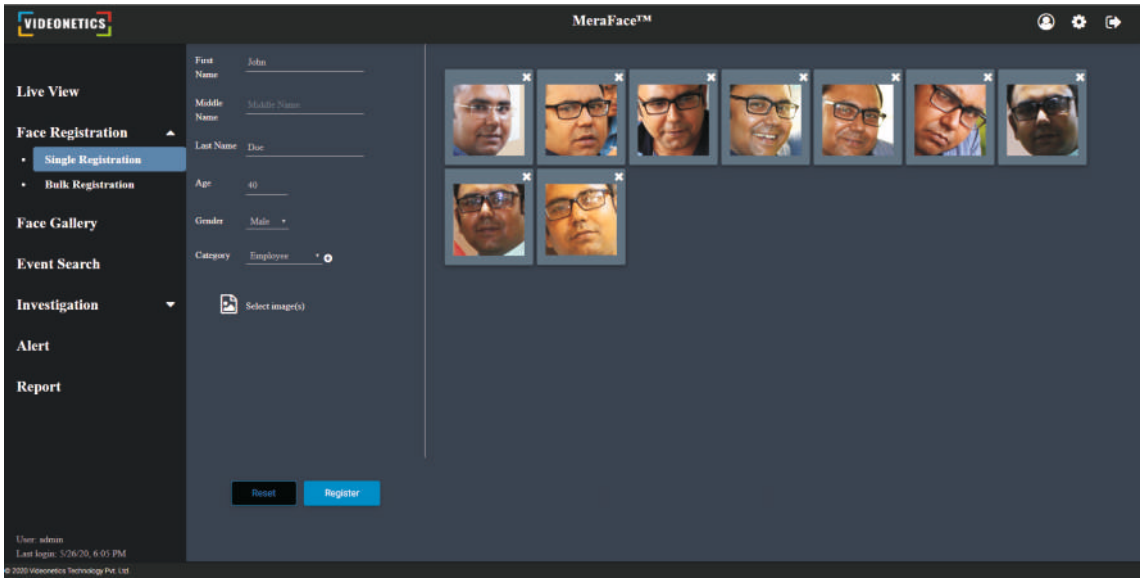
- **IP Cameras, Images and Video files:** They serve as primary inputs to the system. Images and video from these sources are analysed by the Face Recognition nodes to locate faces.
- **Face Registration Node:** It allows users to enroll face images of persons in the face database. MeraFace™ supports batch operations for registering large number of faces in a single go. There can be multiple face registration desks, all operating in parallel. Face registration node can also be installed in cell phones, so that users can register faces using such devices.



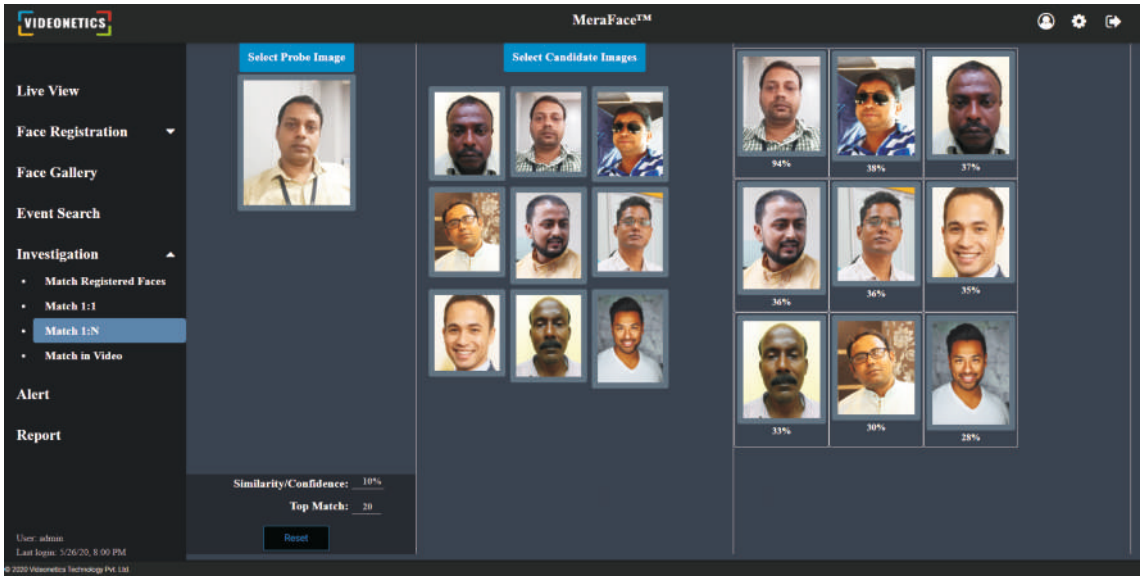
- **Face Recognition Node:** It analyses videos or images from various sources (IP cameras, media files) to detect and recognise faces. The detected faces are matched in real time with registered face database. Detected faces are also matched against all the unregistered faces that the system has captured, stored and indexed in the database in real time.
- **Face Database:** It stores enrolled and indexed faces of registered persons. MeraFace™ can handle up to 100 million unique faces in the database.
- **Event Database:** It stores indexed faces that the system has captured from the video or image sources in real time. The captured faces are matched against the faces that are enrolled in registered face database, and also against the faces that are captured in real time from multiple video sources by the face recognition nodes.
- **Master Node:** It monitors other computing nodes and coordinates their activities. It also provides graphical interface for user interaction with the system.
- **Face Investigation Node:** It is used for forensic investigation. The investigation node automatically detects faces from videos/ images and matches them against the enrolled faces. The faces in the video or image files can also be matched against captured faces from live video feed. User can choose various matching criteria on the fly, e.g. 1:1, 1:N or N:N.
- **API Server:** MeraFace™ is integrated with Videonetics unified API server, which allows external system to register faces and receive notifications with all the metadata, when faces are captured by the system.

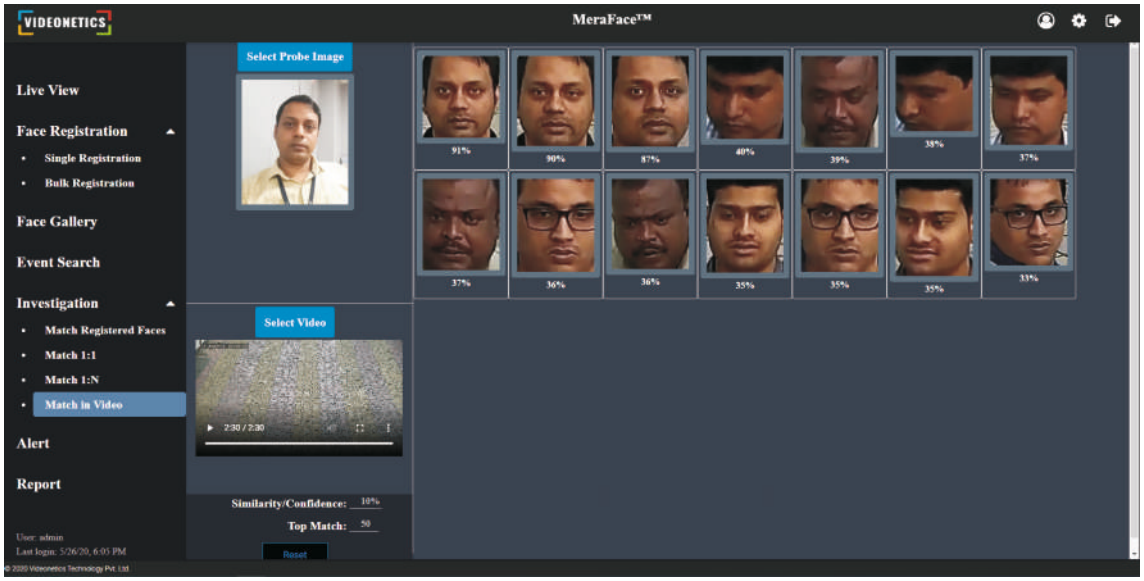
Key Features

- **Diverse Training Data:** The AI/ DL based system is trained with more than 1 billion faces that include standard benchmark face data as well as in-house collected face data, from various geographic regions and of wide age group and ethnicity, to represent characteristics of faces across the diverse world population.
- **Robust and Efficient:** The AI and DL based system is robust enough to detect and identify faces with face region as low as 30 x 30 pixels, under various lighting conditions, or even faces which are partially occluded. MeraFace™ supports yaw, pitch and roll displacement corrections to detect faces from different angles. It is also reasonably agnostic to the following facial attributes – age, sex, demography, facial expression, masked face, head pose, hair style, facial hair, moustache, facial cosmetics, sun glasses, head dress, body piercing in nose, ear, eye brow, lip etc.
- **Face Registration:** MeraFace™ allows enrollment of faces for individuals one-by-one or in bulk. Multiple face images can be enrolled for the same person. Cell phone camera and cell phone apps can be used to register faces. The software also supports auto registration, where faces are automatically detected in live camera view, and are registered by the system without any operator intervention. The system is compatible with ISO/ IEC 19794- 5:2005(E) face image data standards.



- **Attribute Detection:** It detects additional attributes, e.g. age range, gender etc. during face detection and recognition. Attribute detection is an optional feature.
- **Face Deduplication:** It supports automatic detection and identification of multiple entries of the same person in the database, while preventing duplicate entries.
- **Expression Analysis:** It identifies facial expressions like a smile or a frown quite efficiently.
- **Live Alerts and Past Occurrence:** It displays the faces which are detected live in the surveillance camera. The operator can probe a face and view the past occurrence of the same person across all the connected cameras in the network.
- **Facial Search and Investigation:** It can process both still images and live/ recorded video footage. It allows the user to import and probe facial images from pen drives, hard disks or other devices connected to the operator terminal. The user can view the top 'X' search results above a user-defined facial matching threshold level, in order of similarity score, sorted from the highest to lowest. 'X' is configurable by the user. The facial match with the highest similarity score is highlighted.





- **Alerts History:** It allows users to search captured faces across various cameras with various filtering criteria , e.g. date range, attributes - gender, age range, name of the person etc.
- **Watch-list and Notification:** It supports creation of multiple watch-lists based on categories of people (e.g. employee, suppliers, guests, etc.), and creates specific notification rules on each of the watch-lists. The notifications can be sent over SMS, email etc. to the designated recipients.
- **Face Gallery:** It provides facility to create and edit face database (face gallery) in multiple user-friendly ways. New face images can be added, or existing images can be removed at any later point of time by authenticated users. An individual who is no more needed in the system, can be deleted as well (e.g. an ex-employee).
- **User and Role Management:** It provides multiple user roles and role-based access control to use various functionalities of the system.

- **Anti-Spoofing Enabled:** It supports liveliness test to defeat attempts at impersonation by automatically detecting faces that are captured from placards, digital media (e.g. cell phones) etc. as opposed to faces that are captured live from cameras.
- **Fast and Responsive:** It uses fast and computationally efficient CNN-based feature extraction techniques for recognition and matching of faces. The algorithms are ported both in CPU and GPU architectures. MeraFace™ can recognise a face from a million faces in less than 2 seconds, and less than 10 seconds from 100 million faces.
- **Easy Deployment and Maintenance:** Containerised and micro-service-based architecture supports both centralised and distributed computing. MeraFace™ has in-built health status monitoring to monitor health of cameras, servers and other components in the system.
- **User Interface:** It is easy to use, intuitive and responsive, both on browsers and on cell phones/ tablets (iOS, Android). The web-based user interface is compatible with major browsers (Safari, Chrome, IE, Opera etc.) and supports multiple display resolutions – large monitor, desktop etc.
- **OS Agnostic:** Being operating systems agnostic, it can work on multiple OS - Windows, Linux, UNIX etc.
- **External Integration:** It provides API for integration with external systems, such as Video Management Systems, Access Control Systems, Attendance Management Systems etc.
- **Dashboard & Report:** Various dashboards and reports are available, such as number of unknown faces. Gender wise distribution, age wise distribution etc.
- **Audit Log:** Logs of various user activities are maintained and can be exported as MIS reports.
- **Edge-to-Cloud Elastic Architecture:** Videonetics indigenous edge-to-cloud stack and modular design of MeraFace™ enables the user to distribute the computation as:
  (a) entirely on edge devices,
  (b) face capture at the edge and recognition at the cloud,
  (c) face detection, face feature extraction at the edge and face database matching at the cloud, and
  (d) entirely at the cloud.

Applications

Security and Surveillance

- Keeping watch on public and private places (like malls, airports, banks, stores, borders, prisons and offices etc.) for appearance of suspected faces

Retail and Hospitality

- Providing various important business intelligence like customer count, customer flow, waiting/ transit time for queue management etc.
- Identifying repeat customers, VIP/ valued customers, shoplifters, persons of interest etc.

Access Control

- Non-intrusive system for access control
- Detecting various anti-spoofed faces and protect from intruders/ mischievous persons

Attendance Management

- School, office attendance management
- Eliminating proxy attendance
- Monitoring movement of people across various zones

Law Enforcement

- Aid to forensic/ criminal investigation
- Finding missing persons etc.

Immigration/ Border Control

- Passport Control, preventing illegal immigration, criminal identification, non-invasive person identification etc.

Analytics

- People tracking, people counting, people presence, intrusion detection, object detection, loitering, multi-camera tracking, person re-identification, trajectory analysis and prediction, speed analysis, entry-exit monitoring etc.

Videonetics's Unified Video Computing Platform™ helps you make sense of surveillance, by providing you with an end-to-end solution for a wide range of applications. The platform is powered by our Artificial Intelligence and Deep Learning engine, which is trained on humongous data sets, making our solutions incredibly robust and smart. All our products and solutions are integrated yet modular, ONVIF compliant, OS and hardware agnostic, scalable and interoperable.

Videonetics has been ranked #1 Video Management Software provider in India, and among the top 5 in Asia (IHS/Informa Tech Research). We remain driven by innovation, and committed to making the world a safer, smarter, happier place.

Providing an end-to-end solution for a wide range of applications

- Intelligent VMS
- AI Enabled Video Analytics
- Facial Recognition
- Intelligent Traffic Management System
- Video Command & Control Centre
- VCPaaS™ Video Computing Platform as a Service

Technology leader across verticals, in different parts of the world

- CITIES & NATION
- AVIATION & TRANSPORTATION
- COMMERCIAL BUILDINGS
- INDUSTRIAL
- FINANCIAL & LEGAL
- EDUCATION
- CRITICAL INFRASTRUCTURE

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