The Future of Intelligent Video Analytics Recorder IVAR

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Overview

Computer vision focuses on how computers can use digital images and captured data to make sense of what they "see" around them. By adding in an element of artificial intelligence (AI) and deep learning, computers can not only "see" the world around them, but can start to make sense of what they see and interpret that data to benefit humanity - whether that's solving day-to-day problems or complex challenges in multiple areas and applications - the possibilities are limitless.

By helping enterprises find greater cost savings and overall efficiencies in their daily processes, computer vision is now at the forefront of a growing field of technology - and with strong adoption taking hold, the market isn't slowing down anytime soon. Recent industry research suggests that the computer vision market is "likely to reach USD 17.38 billion by 2023." The trend upward in the industry is being driven in large part by increased adoption in autonomous and semi-autonomous vehicles and consumer drones, the smart camera and integrated vision software spaces, and the rising adoption of Industry 4.0.

One of the biggest uses of this technology is for security and intelligent video. This type of technology can help to search and track people, vehicles and other objects in support of overall security or to track behavior deemed "suspicious" or "important" by its users. Facial detection and recognition technology is also useful for projects in the workplace. For example, it can be used to trace people with predefined roles like employees, visitors and contractors, in order to grant or restrict access to specific areas where needed. A workplace may also find it useful to help alert and direct people to exit points during emergencies or for evacuations.

An early adopter of this technology was Intel®, who created the OpenVINO™ toolkit, otherwise known as the Open Visual Inference & Neural Network Optimization toolkit. At its heart, OpenVINO™ is a software optimizer created to fast-track the deployment of computer vision for edge computing in cameras and IoT devices. It can be used in developing applications and solutions that emulate human vision, which are specifically useful for addressing the growing markets in deep learning, video analytics and computer vision.

To make the most of these new advancements, companies are increasingly turning to AI at the edge – where data is processed at a network's edge on devices where it's originally created to help lessen the need for additional computation or power requirements of traditional hardware and software, not to mention the bandwidth needed in constantly pushing video data from edge to server.

Forrester analyst, James Staten, [wrote about the rise of edge computing](#) in a blog post from December 2018. He said:

"Every company needs edge computing on its technology road map starting in 2019. While many of you may see edge as exclusive to IoT, its value is much wider and will prove as critical to driving up customer experience as Content Delivery Networks (CDN) were in the early days of the web… which explains why you are now seeing edge compute and AI services from all the major cloud vendors and on the road maps of the leading telecom companies. And speaking of CDNs, nearly every one of these vendors is adding edge compute to their core market values."

This is a growing field, one with numerous applications, increasing investor interest, and no signs of slowing.

Computer Vision Today: IVAR™ Platform Overview

Enterprises, small business and smart cities are all realizing the benefits that an AI-solution optimizer like

OpenVINO™ holds. Fueled by the need to make sense of large data sets from video applications and the need for AI optimization, Gorilla Technology's IVAR™, the Intelligent Video Analytics Recorder, is a real-time video analytics solution that creates many benefits in the business and security intelligence fields by being an Intel certified Market Ready Solution (MRS), performance-driven edge AI and computer vision software.

A few key markets that have already started implementing this technology include:

- **Smart City** – For public safety, driverless cars and to monitor changes in the environment
- **Transportation** – Traffic monitoring, parking management and more
- **Business and Enterprise** – In building safety and security; employer/employee turnout
- **Retail and Hospitality** - For targeted marketing, customer management and loss prevention
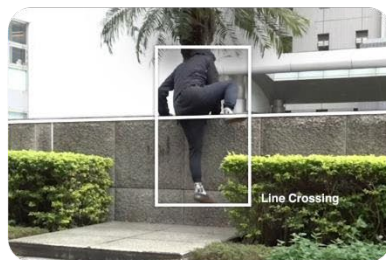- **Education** – For campus security; professor/student course engagement

People/Face
Recognition

Vehicle
Detection/Recognition

Object
Detection/Classification

Behavior Analysis

Business Intelligence

With its five core analytic types built into one complete solution, it can deliver actionable suspect and object identification results for law-enforcement and commercial entities, for example. Implementing IVAR on edge or server architectures ensures surveillance operations are maximized for efficiency and productivity, while business assets are kept secure.

With Gorilla IVAR's comprehensive interface, response times are significantly reduced by effectively alerting staff to take appropriate actions when defined incidents occur. It is able to extract security, business, and operational insights with snapshots across video surveillance systems from a single and centralized location to ensure management is kept informed about essential activities, whether benign or suspicious.
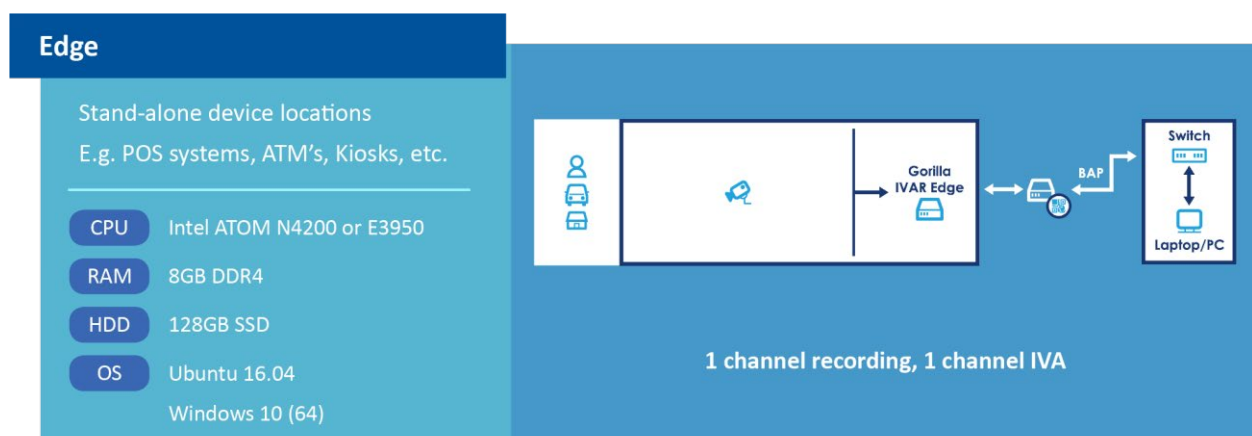
Diving into IVAR Technology

Gorilla's technology in IVAR makes up a comprehensive video surveillance system that is designed for CPU efficiency. Recognizing the high computing demand it needs, Gorilla's edge AI and deep learning technology can "piggyback" on big data at the edge, and with better algorithms, a new generation of video analytics is created. The result is increased accuracy with optimized video processing.

In addition, IVAR was also developed with full integration capabilities for existing camera/surveillance systems. For example, IVAR has integration capabilities with Video Management Systems (VMS), Network Video Recorders (NVR)and System Access Control. This is particularly integral as the focus on smart video surveillance and asset protection grows in importance and companies seek out advanced video analytics capabilities.

The edge-based intelligent video analytics system is ideal for real-time or forensic search and supports video feeds from Real-Time Streaming Protocol (RTSP) and third-party Open Network Video Interface Forum (ONVIF) Profile S camera compliance. Gorilla IVAR offers a total video security management solution that can integrate existing components into one easy-to-manage system, giving users complete control from a central hub, remotely or locally.

Edge Configuration

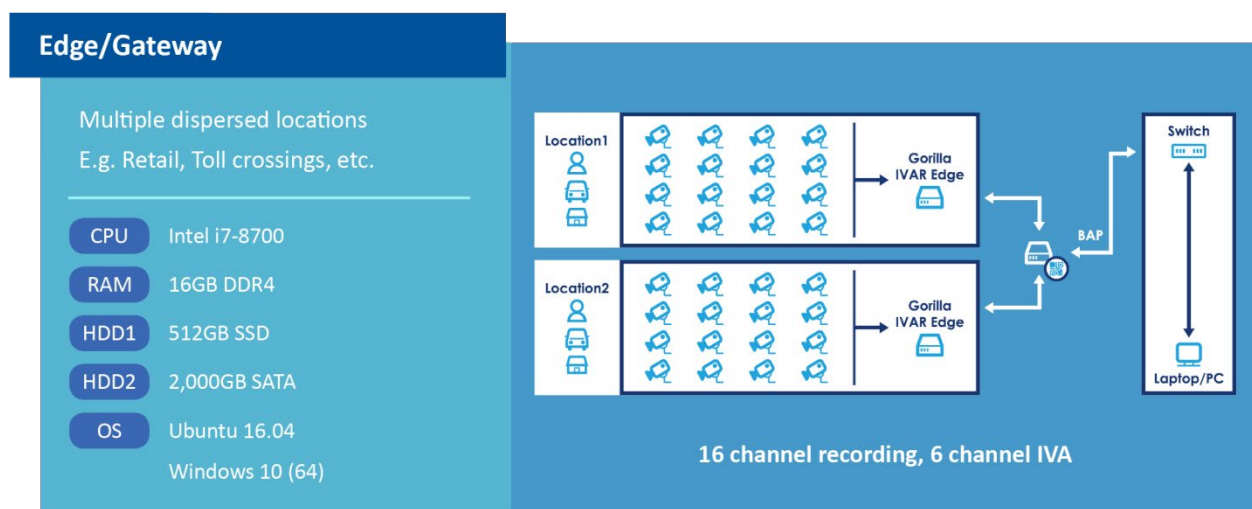| Edge	
Stand-alone device locations E.g. POS systems, ATM's, Kiosks, etc.	
CPU	Intel ATOM N4200 or E3950
RAM	8GB DDR4
HDD	128GB SSD
OS	Ubuntu 16.04 Windows 10 (64)

1 channel recording, 1 channel IVA

The Edge configuration is useful for single, stand-alone device locations. For example, in retail where a camera is positioned to focus on the point-of-sale area, or for a large bank that needs to monitor its ATM location, it is ideal for use in smaller configurations.

Edge/Gateway Configuration

Up to 16 feed recording; Up to 6 IVA (Intelligent Video Analytics) feeds

(based on an Intel® i7-8700 processor)

Edge/Gateway

Multiple dispersed locations
E.g. Retail, Toll crossings, etc.

| CPU | Intel i7-8700 |
RAM	16GB DDR4
HDD1	512GB SSD
HDD2	2,000GB SATA
OS	Ubuntu 16.04
	Windows 10 (64)

16 channel recording, 6 channel IVA

The Edge/Gateway configuration is useful in larger areas that encompass multiple moving pieces. For example, when The Taiwan Railways Administration (TRA), which operates 300 public transportation services at train stations across Taiwan, needed help from Gorilla Technology for its IVAR solution, which incorporates Intel® OpenVINO™ to help provide better services and improve security.

It also allows for flexibility in systems designed for single-site, multi-site/single-customer, and multisite/multi-customer management and handles scalability with all subsystem video channels. IVAR runs smoothly on Windows and Linux systems to give a seamless management of digital video and data across any IP network.

Server Configuration

32 feed recording and up to 24 IVA feeds (based on a Xeon server)
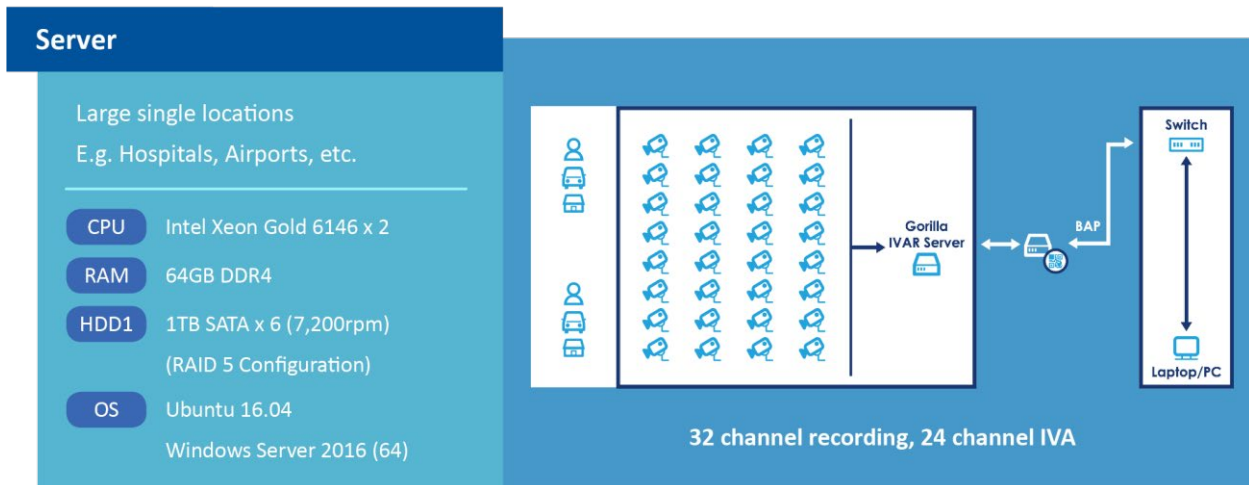
The largest of the three, the Server configuration ensures very large areas like hospitals, airports and smart cities can keep their citizens safe.

IVAR supports always-on, 24/7 needs, with recording and playback that can be handled in tandem to ensure complete analytical data capture.

Gorilla & IVAR provide the most flexible and cost-effective solution on the market in many ways. For example, it supports the following industry standard video protocols, interfaces and cameras:

- Universal camera protocols, including RTSP(H.264), the standard protocol for streaming over the internet. Through the protocol, IVAR can connect to most existing IP cameras to get streams for video playback, storage and analytics.
- ONVIF Profile S, is designed for IP-based video systems. An ONVIF Profile S device (e.g., an IP network camera or video encoder) is one that can send video data over an IP network to a Profile S client like IVAR. A Profile S client (e.g., IVAR) is one that can configure, request, and control video streaming over an IP network from a Profile S device. Profile S also covers ONVIF specifications for PTZ (Pivot Tilt Zoom) control.
- RGB (Red Green Blue) & YUV (Y in YUV stands for "luma," which is brightness, or lightness, and black and white TVs decode only the Y part of the signal. U and V provide

color information and are "color difference" signals of blue minus luma (B-Y) and red minus luma (R-Y)) web cameras. ● Minimum Resolution for IVA Data: 720p @15 frames per second

Users and developers for the technology can also expect an intuitive UI (User Interface) and API (Application Programming Interface) from IVAR for both users and developers. This includes an array of possibilities:

- For users: IVAR's UI is accessed by using a typical Chrome, Firefox, or Edge internet browser to perform all IVAR operations including (but not limited to):
  ○ camera management
  ○ video playback, recording and storage
  ○ comprehensive IVA options
  ○ cross-camera flexible IVA scheduling
  ○ event notification

- For developers: IVAR provides a standard HTTP API for all operations, which can also serve as a video analytics engine for applications such as access control or signage. The HTTP API is a cross-platform interface that makes it flexible and easy to integrate, including third-party platforms.

Of note, Gorilla's deep learning-based engines are actually developed in-house, where they are optimized to provide higher accuracy. Using Convolutional Neural Network (CNN) based deep learning technologies, Gorilla selects proper network topologies to create various inference engines for object detection, recognition and classification. Combining that with accumulated data from various fields, Gorilla can then train engines to identify objects such as faces, people, vehicles and license plates, and then perform classification and tracking. All of the above engines are parts of Gorilla IVAR and are optimized with Intel® OpenVINO™, support CPU computing, and allows users to leverage computing power from Intel's Movidius VPU's (Visual Processing Unit) and FPGA (Field-programmable Gate Array) cards. This translates to an increase in analytic frames per second and analytic channel capability, respectively.

Gorilla IVAR in Action

The Taiwan Railways Administration (TRA), which oversees rail networks and operates 300 public transportation services at train stations across Taiwan, wanted to provide better services and improve security management for daily onslaught of commuters. As the TRA's extensive service offering stretches from coast to coast, this was no small undertaking.

Rail authorities wanted to detect abnormal behavior and identify potential threats from a busy station with over 17,000 travelers with limited security staff. The staff and administrators needed real-time alerts notifying their team of any blacklisted persons (e.g. people banned from the trains and railway/those known for skipping payment/etc.) from entering the train station to give authorities enough time to take preventative measures. They were also looking for a way to control train traffic, whether that meant adding more service or decreasing the number of trains based on traveler foot traffic, as needed over several platforms over long weekends and holidays when people are plentiful or less frequent.

The TRA turned to Gorilla Technology for its IVAR solution, incorporating Intel® OpenVINO™, which enables IVAR to achieve a 50 percent increase in CPU performance so that low-end edge devices can analyze 1.5x more frames per second in real time. The OpenVINO™ toolkit, combined with the other Intel® solutions, translates to more video channels on the same hardware, flexibility to meet system requirements, and a faster response time for Gorilla's customers.

With this in mind, Gorilla IVAR quickly went into action and identified people on watchlists, monitored footfall traffic, analyzed abnormal behavior, detected unlawful intrusions and monitored abandoned luggage. Based on its built-in Internet of Things (IoT) sensors, IVAR was also used to detect fires and intrusions on tracks and other restricted areas so authorities could take appropriate action and riders were kept safer.
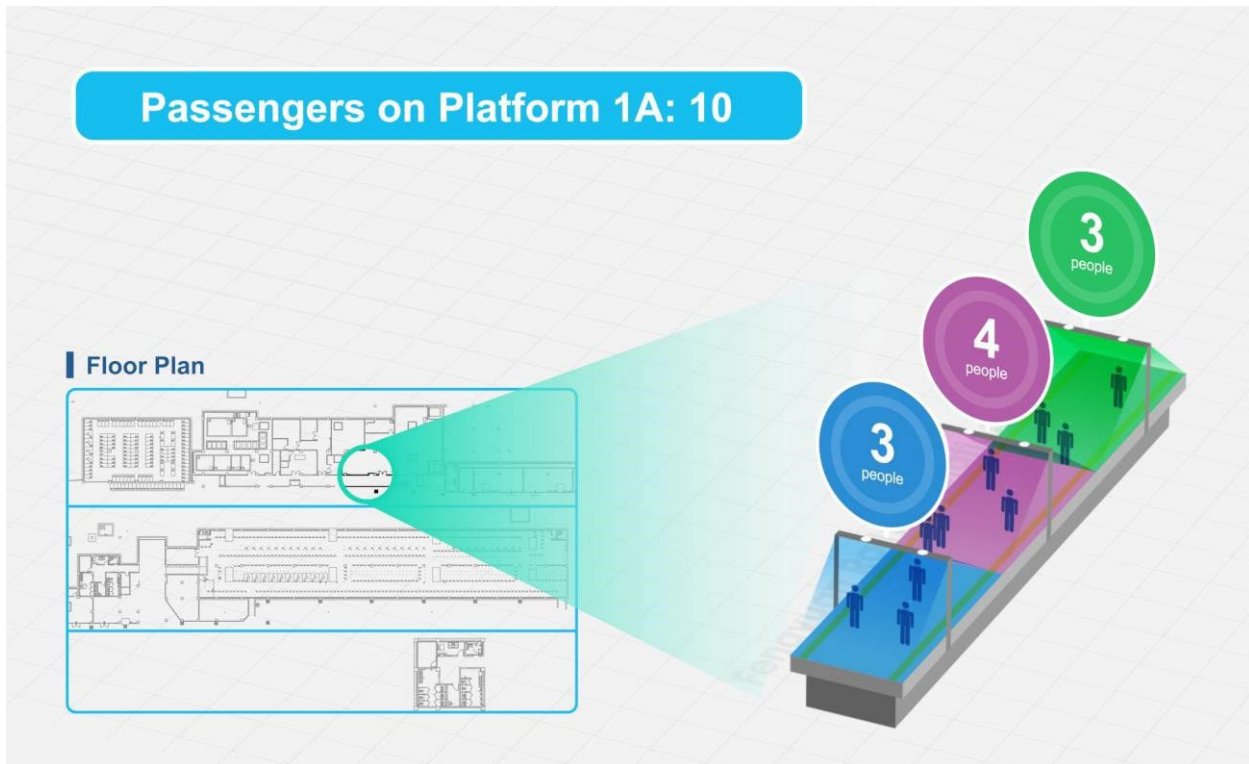
Figure: TRA stations use multiple intelligent analytics to increase customer satisfaction and safety.

Gorilla IVAR eliminated the need to hire additional security staff because the technology could monitor entire areas with real-time alerts into potential threats. This helped to reduce manual checks and ultimately reduced operational costs, while also adding to customer satisfaction.

Gorilla IVAR's also included capabilities for analytic scheduling, which is important for image quality evaluation because it is based on what the customer can track at any given time on the video camera. This needs to be good enough for the end user who is actually using the technology - in this case, the station agents and other train personnel.

With this in mind, station agents had the ability to arrange analytic schedules to meet their needs for any time of day by simply selecting predefined profiles. Each profile typically contains camera source, analytic types and configuration, as well as various specified timings, allowing the agents to simply switch between different analytics in each channel without extensive consideration or set-up.

To accomplish the flexibility of scheduling, Gorilla IVAR standardized the performance required by each inference engine, including:

- input video resolution
- frame rate requirements
- RAM consumption
- computing capability requirements

However, successful video analytics require good inference engines and proper video quality. It is often challenging to educate users on how to provide proper video streams, which is why Gorilla provides an Image Quality Evaluation Tool (IQE tool) along with IVAR. If the agents want additional analysis, they can use the IQE tool. This is useful when there are several cameras (e.g. at a train station) and someone needs a central IVAR manager to help make certain that the camera settings are optimal. The application of this technology is especially useful for law enforcement, where higher resolution cameras are often required to monitor large areas.

Accelerate response time by increasing situational awareness and detecting suspicious events quickly

Heighten operational performance by reducing human error, centralizing facility management, and optimizing monitoring functions

Maximize asset value by using existing video surveillance systems and scaling with reliable server/edge architecture

Figure: With Intel® OpenVINO™ technology, the IVAR solution offers strong business benefits.

To help IVAR users understand video quality during the camera installation phase of system implementation, the IQE tool provides users a way to evaluate image quality by:

- object size
- clearance
- brightness
- title degree

In the end, the results were clear. After IVAR deployment, security at TRA has become a well-leveraged central management system to surveil watch-listed people, traveler traffic, abnormal behavior, intruders and abandoned luggage at real-time pace. Staff can now better handle areas where there are queued passengers, and authorities can easily apply platform entry policies where too many people overcrowd platform space to ensure the safety for all passengers.

A Future Friendly Edge AI with Gorilla IVAR

Gorilla is poised and ready for the future of edge AI computing with Gorilla IVAR, which has already shown itself to be a valuable analytics solution creating numerous benefits for both the business and security intelligence fields.

And in order to remain ahead of the competition, Gorilla also offers comprehensive backend services to expand IVAR capabilities, including:

- Gorilla IVAR Manager (IVARM): Allowing users to perform cross-camera IVAR video playback, event search and upgrade.
- Gorilla Fast Video Search (FVS): A service providing a database for cross IVAR event storage. FVS also allow users to perform advanced event search such as face similarity search and content search. The identified objects then can be tracked cross cameras.
- Gorilla Biometric Authentication Platform (BAP): A facial database to manage all faces for recognition.
- Gorilla Retail Service: Using IVAR events to generate in-store analytics results for retail stores.
- Gorilla Event Video Management System (EVMS): This consolidates all events from IVAR, and provides capacities for event interaction, event link-analysis, situation management and SOP notification.

If none of the above are quite what a business is looking for, Gorilla also accepts user requests for customization.

Overall, the market is poised for growth. While some education for the AI market is still needed, the future looks positive. By featuring their solutions together with industry partners like Intel®, Gorilla is committed to staying at the forefront of this technology, leading the push to stay on the edge and ahead of the competition.

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