

# Advanced Analytics and AI Accelerators in Video Management Systems (VMS)

Video Management Systems (VMS) are central to modern surveillance and security operations. They provide the infrastructure for capturing, storing, displaying, and analyzing video feeds from multiple sources. However, as the volume of video data increases, traditional VMS solutions struggle to keep up with the demand for real-time processing and actionable insights.

The advent of AI-driven analytics offers a transformative approach to enhance VMS capabilities, enabling more intelligent, responsive, and efficient systems.

This white paper explores the growing VMS market, the integration of AI analytics, and the role of AI accelerators, particularly the MemryX MX3, in revolutionizing VMS operations.



Figure 1: 81 decoded HD video streams on a YoloV5s model 320x320 resolution. Each video with 30 fps inference per video stream. Models run on four MemryX M.2 modules on a PCIe carrier card with less than 40W total AI accelerator power consumption. AMD x86 Ryzen processor used for demonstration.

## Why VMS Technology is Important

VMS systems are no longer just about displaying and storing video. They are evolving into intelligent platforms providing actionable insights, real-time alerts and automated responses.

- **Enhanced security and crime prevention**  
VMS systems detect and prevent criminal activities. By integrating AI analytics, they can identify suspicious behavior, recognize faces, and track people and things, enabling proactive security measures.
- **Improved operational efficiency**  
VMS systems help organizations streamline their operations by automating surveillance tasks and reducing the need for manual monitoring. This leads to cost savings and increased efficiency. They balance performance and efficiency, making them ideal for edge AI processing in VMS.
- **Data-driven insights for decision making**  
The data collected by VMS systems can be analyzed to extract valuable insights. These insights help organizations make better-informed decisions, optimize resource allocation, and improve overall operational effectiveness.

# 3.5X

Performance compared to Nvidia RTX 4060 and RTX A2000 GPUs. Measurements derived from over 100 different versions of the YOLOv5 and YOLOv8 object detection models. Model versions vary based on layer depth, input resolution, and model complexity. All measurements were made with Batch=1 and running on Intel Core i7-13700 CPU with 64 GBs of RAM.

## The Growth of VMS

The VMS market has witnessed significant growth over the past decade, driven by advances in technology and an increasing emphasis on security.

The global VMS market size is expected to reach approximately \$31 billion by 2027, growing at a CAGR of 23% from 2022 to 2027, according to Markets and Markets. This growth is fueled by several key factors including the rising demand for security and surveillance, smart city initiatives, and commercial and industrial expansion. As concerns over security and safety increase, VMS systems are well positioned for continued growth, providing critical infrastructure for monitoring and protecting people and assets.

Further with new AI analytics, VMS systems can offer more capabilities and expand their reach to new usage models.

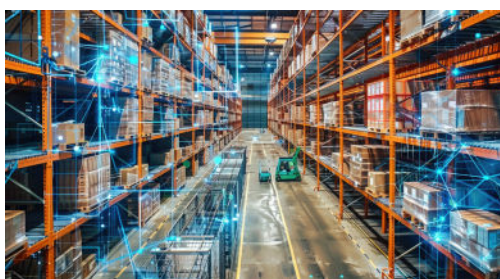
## The Role of AI Analytics in VMS

AI analytics involves the application of machine learning algorithms and deep learning models to analyze video data. In the context of VMS, AI analytics transforms vast amounts of raw video footage into meaningful information that can be used for various purposes, such as enhancing security, improving operational efficiency, and driving business intelligence.

AI analytics is a game-changer for VMS enabling the automation of complex tasks. These assignments were previously impossible or required significant human oversight. By processing video data in real time, AI analytics can detect anomalies, recognize patterns, and generate alerts, thereby enhancing VMS's overall effectiveness.

### Individual Recognition

Recognizing individuals by facial features, gait, clothing, or other means is one of VMS's most powerful applications of AI analytics. Identifying and tracking individuals enhances security in sensitive areas such as airports, government buildings, offices, and warehouses. By matching faces against a database of known individuals, facial recognition can help prevent unauthorized access and identify persons of interest.



### Object Detection and Tracking

Object detection and tracking allow VMS systems to automatically identify and monitor objects of interest, such as vehicles, bags, and packages. This capability is particularly useful in applications like perimeter security, where detecting and tracking unauthorized intrusions is critical. AI-driven object detection also reduces the workload on human operators by automatically flagging potential threats.

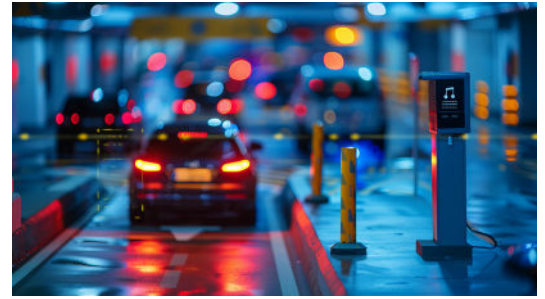
### Behavior Analysis

Behavior analysis involves monitoring and interpreting the actions of individuals or groups to identify unusual or suspicious behavior. For example, AI analytics can detect loitering, crowd formation, or sudden movements, which may indicate a security threat. By analyzing behavior patterns, VMS systems can generate alerts and enable preemptive actions to prevent incidents.



## License Plate Recognition or Automated Number Plate Reader (LPR or ANPR)

License plate recognition is widely used in traffic management and parking enforcement. AI-powered LPR systems can automatically read and record license plates, enabling efficient vehicle monitoring, toll collection, and access control. This technology enhances security by identifying stolen vehicles or those associated with criminal actions and proactively take steps to prevent.



## Crowd and Traffic Monitoring

Crowd and traffic monitoring applications leverage AI analytics to analyze the movement and density of people or vehicles in real time. This is particularly important in public safety scenarios, such as managing large events, optimizing traffic flow, and ensuring compliance with social distancing guidelines. By providing real-time insights, AI-driven VMS systems help authorities make informed decisions and respond quickly to potential issues.

## Approaches to AI Analytics in VMS

AI processing, which requires the use of specialized hardware, can occur at different stages in the video pipeline including at the camera, in on-premise Edge AI Servers, or in the Cloud.

After carefully reviewing the advantages/disadvantages, MemryX believes a balanced VMS system should prioritize AI processing in the on-premise Edge server for reduced operational cost, ease of AI updates/maintenance, enhanced functionality, and ensuring compliance with data privacy regulations.

Stage	Advantages	Disadvantages
Camera	<ul style="list-style-type: none"> <li>Lowest latency</li> <li>Preset simple AI modules</li> <li>Self contained solution</li> </ul>	<ul style="list-style-type: none"> <li>Limited power/storage capability</li> <li>Inability to run AI simultaneously across multiple cameras</li> </ul>
On Premise Edge AI Server	<ul style="list-style-type: none"> <li>Low latency</li> <li>Low transmission cost (only transmit relevant frames)</li> <li>Privacy</li> <li>Consolidated AI processing (ability to easily update AI modules/training sets)</li> <li>Utilizes existing camera infrastructure</li> </ul>	<ul style="list-style-type: none"> <li>Initial investment of AI Hardware</li> </ul>
Cloud	<ul style="list-style-type: none"> <li>Scalability</li> <li>Lower hardware cost</li> </ul>	<ul style="list-style-type: none"> <li>Longer latency</li> <li>Higher network traffic</li> <li>Reliance on Internet connection</li> <li>Cloud Computing Expense (data storage, data transmission, compute costs, etc)</li> </ul>

## Approaches to Providing AI Analytics: Hardware Solutions

### CPU-Based Processing

CPUs, like those provided by Intel, AMD, and others have traditionally been used to manage the flow of video in VMS systems. CPUs are cost-effective for managing video data flow but are not cost-effective for performing AI analytics functions.

### GPU-Based Processing

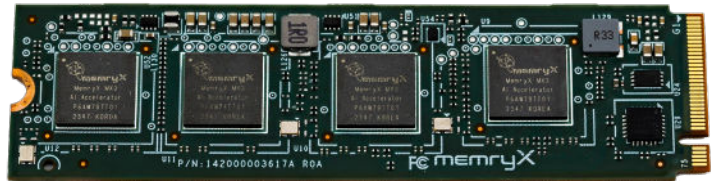
Graphics Processing Units (GPUs), like those provided by Nvidia and AMD, offer a significant performance boost over CPUs by enabling parallel data processing. This makes them a popular choice for AI-driven VMS applications. GPUs perform well in scenarios that require intensive computation, such as AI inference. Despite their performance advantages, GPUs have high energy consumption, which leads to increased operational costs, particularly in large installations. Additionally, the heat generated by GPUs typically requires specialized cooling solutions.

### AI Accelerators

AI accelerators are specialized electronics modules designed specifically to perform AI inferencing. They balance performance and efficiency, making them ideal for edge AI processing in VMS. AI accelerators, such as the MemryX MX3, are designed to handle the processing demands of AI algorithms more efficiently than either CPUs or GPUs. They are optimized for inference workloads and critical for real-time video analytics. AI accelerators consume significantly less power than GPUs while delivering comparable or superior performance. This makes them particularly well-suited for edge deployments where power efficiency is crucial.

## MemryX MX3: The Ideal Edge AI Accelerator

The MemryX MX3 is an AI accelerator designed specifically for VMS systems and other edge AI applications. It combines high performance with low power consumption, making it ideal for processing intensive AI workloads in real time.



- **Ease of use**

The MX3 supports a wide range of AI models and frameworks, making it easy to integrate into existing VMS infrastructures.

- **High efficiency**

The MemryX MX3 delivers top-tier AI processing capabilities while consuming significantly less power than traditional GPU-based solutions.

- **Scalability**

The MX3 is designed to be scalable, allowing it to be deployed in various configurations depending on the needs of the VMS system.

**2X**

Performance compared to best of class M.2 AI accelerator competition across a set of 50 different AI vision model benchmarks provided on the competitor's website.

Models compiled for competition and the MemryX MX3 using each company's SDK tools and measured on similar x86 host platforms.

## MemryX MX3: Ideal for VMS AI Analytics

- **Superior Performance for Edge AI Processing:** The MX3 provides the necessary processing power to handle real-time analytics at the edge, ensuring that VMS systems can quickly respond to threats and anomalies.
- **Low Power Consumption:** By minimizing power usage, the MX3 reduces operational costs and heat generation, making it suitable for deployment in various environments, including those with limited cooling infrastructure.
- **Easy Integration:** The MX3 is designed for seamless integration into existing VMS systems, allowing organizations to enhance their capabilities without overhauling their current infrastructure.
- **Scalability for Future-Proofing VMS Deployments:** The MemryX MX3 is built to support the growing demands of AI-driven VMS systems, ensuring that organizations can scale their deployments as needed.

## MemryX's Advantage

The MemryX MX3 outperforms other solutions by offering a unique combination of high performance, low power consumption, and easy integration. In VMS applications, this translates into faster, more efficient processing of video data, enabling organizations to leverage advanced AI analytics without compromising on cost or complexity.

For example, in a large-scale deployment at a smart city project, the MemryX MX3 could process video feeds from thousands of cameras in real-time, detecting anomalies, tracking objects, and providing actionable insights to city officials. The low power consumption and ease of integration ensure the system remains cost-effective and scalable, even as the city's surveillance needs grow.

## Conclusion

In this white paper, we have explored the critical role of AI analytics in modern VMS systems and the various approaches to implementing these analytics. We have demonstrated that edge processing offers significant advantages over cloud and camera-based solutions, particularly regarding real-time decision-making, latency reduction, and data privacy.

We have also highlighted the importance of selecting the proper hardware for AI analytics, with AI accelerators like the MemryX MX3 emerging as the ideal solution for VMS systems. The MemryX MX3 combines high performance, low power consumption, and scalability, making it the best choice for organizations looking to future-proof their VMS deployments.

For organizations looking to enhance their VMS capabilities with advanced AI analytics, the MemryX MX3 offers an unparalleled solution. Its superior performance and efficiency make it the perfect fit for various VMS applications, from security and surveillance to traffic management.

To learn more about how the MemryX MX3 can transform your VMS system or to discuss potential deployments, please contact us at [memryx.com/contact](https://memryx.com/contact).

