micron®

AHEAD

# Accelerate smart retail with computer vision and high-performance memory

## Solutions to make retail safe, secure, and efficient

AI-powered smart devices are disrupting nearly every industry, including physical retail stores. As the Internet of Things (IoT) converges with edge computing in the retail space, consumers benefit from faster, more personalized, and safer shopping experiences.

Even as shoppers and retailers adjust to this new technology, the smart retail boom shows no signs of slowing. The global smart retail market is expected to have a compounding annual growth rate of 22.8%[1] over the next five years. This will transform most aspects of the brick-and-mortar retail industry, from increasing supply chain transparency to improving the safety and efficiency of in-store operations.

In this whitepaper, we'll explore the rise of smart retail and some of the ways AI is currently being used in the retail industry. We'll also discuss the importance of physical security for retailers and how edge AI can improve safety and security. Then, we'll show how high-performance memory can be used to power smart retail devices and improve the retail experience for shoppers and businesses alike.

## Micron memory at a glance

Micron® DDR5 DRAM is built for high-performance computing. It's used to gain faster insights from AI in retail settings.

- Max speed: 5,600MT/s[2]
- Max density: 128GB
- Higher density components for doubly dense modules
- Performance: 2x better than DDR4[3] capacities

Learn more about Micron DDR5 DRAM

# What is smart retail?

Smart retail is the combination of traditional shopping in physical stores with emerging technologies like AI and edge devices to improve customer experiences and business operations. This started with automated checkouts and intelligent point-of-sale systems but has since expanded to many other areas of physical retail.

Many AI use cases create a smoother, more convenient retail experience. Examples include:

- **Optimization:** Stores use sensor data to track foot traffic, predict customer behavior, and optimize shopping experiences.
- **Transparency:** Automated inventory tracking leverages sensors, video cameras, or Radio Frequency Identification (RFID) tags to increase visibility into supply chain management.
- **Personalization:** Retailers use Bluetooth beacons that detect when consumers are in the vicinity and send personalized mobile push notifications about special events, discounts, and more.
- **Efficiency:** Devices track assets like shopping carts and baskets to help management keep track of supplies.

# AI's role in smart retail

Besides optimizing shopping experiences and store operations, AI and analytics can improve public safety and protect assets for retailers. This is made possible by computer vision and machine learning applications, which can analyze data collected by edge AI devices to uncover insights that might not have been possible with human security personnel alone.

For example, AI can be integrated with video management systems (VMS) and access control systems to prevent theft in real time. The surveillance system can use computer vision to analyze video feeds and detect potential shoplifters, and then connect to an intelligent access control system to stop the perpetrator by locking certain exit points.

In addition to preventing theft, retail stores can deploy edge AI cameras to detect spills or other potential hazards to prevent accidents like slips and falls. Smart surveillance systems can immediately notify maintenance staff so that they can remove the hazard, which would lead to much safer shopping experiences and less legal liability for retailers.

# Benefits of smart retail for customer experience and theft prevention

With smart cameras keeping an eye on the store, AI programs can immediately identify inefficiencies or potential threats. These systems can be used to assist in common retail challenges such as foot traffic flow, customer and employee safety, and theft prevention.

## Foot traffic flow

As customers move inside a busy store, it's natural to experience some congestion around popular products or lines in a queue. However, by employing smart technology, retail stores can improve the layout and efficiency of the environment

- **People counting:** Smart cameras can count the number of people entering and exiting the store, helping manage capacity and customer experience.
- **Heat mapping:** Programs can create real-time heat maps showing which areas of the store are most visited, so retailers can understand which displays attract attention and which shelves need restocking.
- **Queue management:** Monitoring checkout lines, cameras can alert staff to open additional registers when lines get too long.

## Customer and employee safety

Every business strives to keep safety a top priority, and smart retail can help. AI-powered cameras can take the pressure off security staff by proactively monitoring the location from every angle.

- **Real-time monitoring:** Cameras provide live feeds and alerts to security personnel and provide automated responses to emergencies.
- **Incident detection:** AI can detect unusual or suspicious activities, such as someone falling over, or aggressive behavior, and automatically alert staff to intervene.
- **Access control:** Integrated access control, such as facial recognition, can ensure that only authorized personnel enter restricted areas.

## Theft and fraud

Shoplifting cost stores in the U.S. upwards of $121.6 billion[4] in 2023, and that number continues to rise each year. Luckily for business owners, the smart tools to combat retail theft are quickly evolving, with many purpose-built solutions for theft detection and prevention.

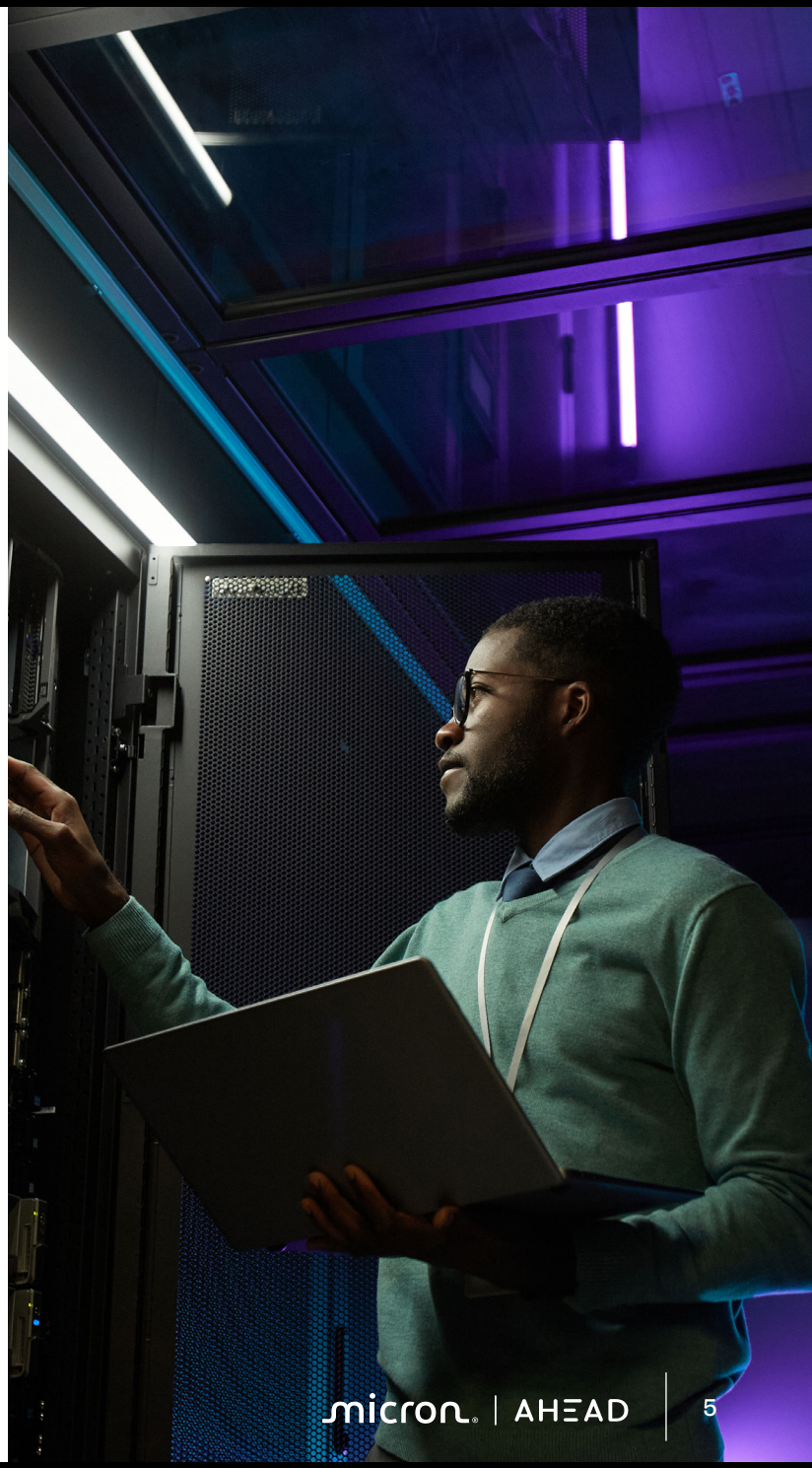
- **Shoplifting detection:** Cameras provide live feeds and alerts to security personnel and provide automated responses to emergencies.
- **Point of sale monitoring:** As customers check out, computer vision can detect fraudulent transactions or employee theft, such as under-ringing or fake returns.
- **Facial recognition:** Repeat offenders will be recognized by AI so retailers receive a notification when a familiar shoplifter shows their face.

# Challenges integrating AI into physical security systems

Recognizing the benefits of smart retail technology, an increasing number of businesses are rushing to integrate the technology into their retail locations. Yet while demand increases for smart physical security devices, there remain obstacles for retailers to overcome.

When integrating AI into physical security systems, six key challenges arise:

1. Compatibility and integration: As hardware quickly evolves, compatibility issues can arise between different generations of devices and software applications.
2. Cost of upgrades: Frequent hardware changes can be expensive as businesses struggle to keep up with the latest developments.
3. Training and expertise: Implementing AI-driven systems requires specialized knowledge, which means additional training for retail staff.
4. Scalability: When retailers expand their operations, the security systems need to grow with them.
5. User-friendly design: Despite the complex processes behind AI technology, the user experience needs to be easy to use and understand to ensure it's used effectively.
6. Maintenance and support: Regular updates, troubleshooting, and upgrades in the field can be overwhelming for IT teams already strapped for resources.



# Addressing AI integration challenges

To effectively tackle the integration challenges, retailers should consider collaborative partnerships with technology providers that have deep experience in operationalizing AI for businesses, as well as the infrastructure expertise to apply the right technology for the application.

## AHEAD hardware building blocks: Pre-certified reference architecture designed to accelerate large-scale edge AI deployments

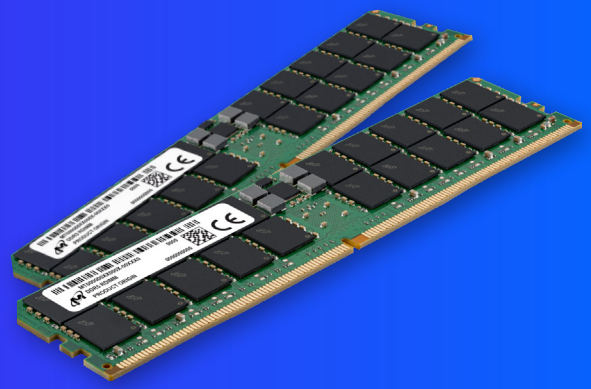
Architecting smart edge devices from scratch can be complicated, time consuming, and expensive. The alternative is using predesigned reference architecture as a starting point and, from there, only customize what's necessary.

IT solution providers like AHEAD have a strong engineering bench and the ability to design a portfolio of predesigned options that not only cover the broad applications of edge AI, but are also well researched, tested, validated, lifecycle managed, and standardized for optimal performance.

# The importance of memory in smart retail applications

When integrating smart retail, it's important to consider the role of memory in AI applications. Fast, efficient memory plays a critical role in supporting the real-time responsiveness required in edge environments.

That's why modern edge hardware relies on DDR5 memory, which offers a significant performance boost compared to its predecessor, DDR4.



## DDR5: A big step up from DDR4

With DDR5, it's possible to accomplish some edge workloads more than seven times faster[5] than DDR4. This results in smart retail that is more powerful, secure, and efficient.

- **7.3x gain**[5] in classifying images
- **40% higher**[5] sustained memory bandwidth

# Combine Micron DDR5 and AHEAD building blocks for optimal performance in smart retail

When considering smart retail solutions, one of the most powerful options is to combine Micron DDR5 memory with AHEAD reference architecture. Together, they provide a reliable and performant computer vision solution at the retail edge.

## Micron DDR5 + AHEAD reference architecture

Micron DDR5 memory[6] delivers higher bandwidth along with improved reliability, availability, and scaling, when compared to DDR4. It's ideal for resource-intensive tasks at the edge.

- **Speed (MT/s):** 4800, 5600
- **Densities:** 16GB, 24GB, 32GB, 48GB, 64GB, 96GB, 128GB
- **Form factor:** RDIMM, ECC UDIMM, ECC SODIMM
- **Warranty:** 3-year limited warranty

DDR5 in AHEAD's reference platforms enhances edge AI applications through performance and power efficiency. For example, DDR5 and modern computing architectures are used in Kori, a compact, mobile platform[7] designed to bring computer vision to medical, safety and security, retail, and industrial settings.

# Conclusion

Smart retail is changing the way stores stock shelves, monitor aisles, and keep customers safe. As the industry adopts this innovative new technology, it shows massive potential to improve the retail experience for both customers and businesses.

By combining smart edge solutions from AHEAD with the speed of Micron DDR5 memory, retailers gain access to unprecedented insights into their retail locations.  Leveraging these smart technologies can help ensure the future of retail is more safe, secure, and efficient.

## Discover smart retail solutions

Businesses can get started in the world of smart retail by connecting with experts who can help them along every step, from planning, to integrating, and finally testing and validating the results.

# About Micron

Micron is an industry leader in innovative memory and storage solutions, transforming how the world uses information to enrich life for all. With a relentless focus on customers, technology leadership and manufacturing and operational excellence, we deliver a rich portfolio of high-performance DRAM, NAND and NOR memory and storage products through our Micron® and Crucial® brands.

Learn more at micron.com

# About AHEAD

AHEAD engineers digital platforms that power the most successful organizations in the world. Our consultative approach, technical expertise, and innovative solutions combine to accelerate the impact of technology in every client we serve.

Learn more at ahead.com

## Footnotes

1. Zion Market Research. (2022, June 21). Smart Retail Market By System, Application, Retail Offering, And Region - Global And Regional Industry Overview, Market Intelligence, Comprehensive Analysis, Historical Data, And Forecasts 2022 – 2028I.
2. DDR5 launch data rate of 4800MT/s transfers 1.5x (50%) more data than the maximum standard DDR4 data rate of 3200MT/s. JEDEC projected speeds of 8800MT/s are 2.75x faster than DDR4's maximum standard data rate of 3200MT/s.
3. Under memory-intensive workloads, DDR5 is designed to deliver 2x the bandwidth as a result of double burst length, double the banks and bank groups, and significantly higher speed than DDR4, as established by JEDEC, an independent organization that develops open standards for the microelectronics industry.
4. Capital One Shopping Team. (2024). Retail Theft Impact on Revenue by State in 2022.
5. Micron's Data Center Workload Engineering (DCWE) team performed testing and validation in collaboration with Supermicro and Intel to determine an ideal CPU-powered platform optimized for AI inference workloads. Workload tests performed by Micron focused on MLPerf (Machine Learning Performance) inference benchmarking, which measures how fast systems run models in a deployment scenario that includes NLP using BERT (Bidirectional Encoder Representations from Transformers); DLRM (Deep Learning Recommendation Model); and Image classification using ResNet. Actual results may vary. Learn more: Micron Server DDR5 AI Use Case Test Results eBook (EN) (microncpg.com)
6. Micron Technology, Inc. (2024). DDR5 DRAM.
7. AHEAD. (2024). KORI: Modular Mobile Platform for Camera-Based Applications.