

A woman with blonde hair, wearing a white t-shirt and a green apron, is standing in a grocery store aisle. She is holding a tablet in her left hand and reaching up with her right hand to adjust produce on a shelf. The shelves are filled with various fruits and vegetables, including yellow bell peppers, purple grapes, and green leafy vegetables. The background is slightly blurred, showing other parts of the store.

# Meet Today's Retail Challenges with Edge Computing and Artificial Intelligence

From operational processes like inventory management, to customer and employee experience, to data-driven upper management decisions, advanced analytics running at the edge in retail environments can help cut costs, drive sales and provide a competitive edge

intel.

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# Introduction

Retailers, whether online or brick-and-mortar, are under substantial pressure from two primary sources:

- **Inflation.** In the U.S., the average hourly wage increased by 5.1% between February 2021 and February 2022.<sup>1</sup> But wage increases were outpaced by an 8% rise in consumer prices over that same period, so the increased wages resulted in less purchasing power. Of the 79 large retailers that reported earnings between April 1 and May 23, 2022, 71% saw a decrease in estimates for 2023 earnings.<sup>2</sup> These shifts are affecting shopping behavior, with more U.S. consumers reporting that they switched brands and retailers in 2022 than at any time in recent years. And most of them intend to keep switching, with price topping the list of consumer motivations.<sup>3</sup> The bottom line? With inflation at a record high, more people are looking for value.



- **Nationwide skills shortage.** Talent shortages in the U.S. have more than tripled in the last ten years, with 69% of employers struggling to fill positions, up from just 14% in 2010.<sup>4</sup> For the retail industry, almost all (94%) retailers are “worried” about talent shortages in the retail industry, with 40% “extremely worried.”<sup>5</sup>

The technology-enabled competitive differentiators of a few years ago, such as online shopping and self-checkout, are now the norm. Today, retailers must ensure that they have a unified, omnichannel commerce strategy and that they can execute it seamlessly, at scale, while delivering a compelling and personalized customer experience. At the same time, they must constantly think of new ways to prevent economic loss from the shop floor to the warehouse; and they must anticipate and be ready to cope with broader industry trends such as rising energy costs, which can add further complexity to operational planning and reduce profitability.

Addressing all these challenges means tackling a range of separate but inter-connected issues – from empowering front-line staff to work smarter and faster, to optimizing operations across the supply chain, to driving corporate-level insights to enhance strategic decision making.





Key to doing all this is data. In many cases, retailers already have a wealth of data resources to tap into (such as data gleaned about customers through online interactions). In other areas, the data available is not so robust – especially in-store. Retailers typically hold data about inventory levels, sales and footfall, but they need to use edge devices such as sensors and cameras to capture – and analyze – more detailed, nuanced data about what’s going on in-store to bring it to the same level as their online-generated data.

The answer lies in digital transformation driven by artificial intelligence (AI) and advanced analytics at the edge that span premises, people, products and processes. With edge computing, data is collected, stored, and analyzed locally, keeping sensitive data at or near its source and avoiding the cost of sending data to the cloud and back. From using computer vision to customize promotions in real time to applying machine learning for real-time inventory management, retailers can harness AI to connect with their customers and operate more efficiently.

# Use Case: Maintain Competitiveness with Automated Quality Control

Maintaining an accurate inventory is a primary aspect of running a quality retail operation. Too much inventory drives up overhead; too little results in disappointed customers. With edge devices deployed throughout the premises combined with AI software solutions, retailers can apply AI to inventory management to gain a comprehensive view of store premises, shoppers, and products.





Some specific applications include the following:

- Cameras and sensors that provide real-time inventory feedback.
- Smart shelves that can quickly identify out-of-stock items and pricing errors.
- Inventory robots that can alert staff to low stock or misplaced items.
- Computer vision-enabled checkout systems.

All these AI-based use cases can help retailers run their stores more efficiently and securely and free up associates' time to focus on improving the shopping experience.



## Solution in Action:

Chipotle Mexican Grill teamed up with PreciTaste, a firm specializing in food industry automation, to help professional kitchen crews by eliminating manual estimation tasks. The solution uses cameras equipped with Intel® RealSense technology to keep track of how much food (like salsa, meats, and veggies) is on hand so the crews never run out of ingredients, and also informs the crew what to cook when so they are always serving the freshest food possible. The solution also implements order accuracy verification. The AI compute runs locally in the restaurant on small form factor edge devices.



According to a Chipotle spokesperson, “We’ve seen a real improvement in operational efficiency. The [solution] has alleviated manual tasks for our crew and given managers the tools they need to make informed, in-the-moment decisions.”

**Learn more:** Listen to the Intel Innovation keynote, [“Developing for Tomorrow Today: Open, Choice, Trust and Intel”](#) and [read the brief](#)

**What’s next:** By 2027, a tectonic shift to circular customer-inclusive merchandising processes will disrupt merchandising organizations as product hierarchies become extinct.<sup>6</sup>



# Use Case: Enhance the Customer Experience

From small grocery stores to supermalls, enabling customers to have the shopping experience they want and expect—such as convenience and personalization—is a huge part of retail success. Customers should be able to quickly find what they’re looking for, get help when they need it, and check out fast. In a world still stressed by the Covid-19 pandemic, shoppers may also be concerned about cleanliness and minimizing personal contact.

AI streamlines shopping activities, including finding products and checking out, to help create more satisfying customer experiences. For example, computer vision makes it possible to accurately “see” items in a customer’s cart.



Digital signage combined with computer vision can classify customer types and quantify customer engagement, enabling the retailer to present real-time advertising that connects with a specific customer. AI can also help collect data that can inform future promotions. Point of sale (POS) systems can capture data about what was purchased and use that data to generate new product recommendations for a given customer. Digital signage can collect data about which types of customers are shopping and when, leading to more accurate segmentation and experiences that are tailored to a customer's patterns and preferences.





## Solutions in Action:

Burger King is using AI to help customers feel pampered and well-understood (and increase sales, as well). The fast-food firm's recommender system proposes customized recommendations based on drive-through guest ordering behavior and context information such as weather, time and location. For example, suppose a customer ordered a donut at 9:00am and it's snowing. The AI system can use that information to suggest adding a hot cup of cocoa. But if it's 3:00pm and 95 degrees, the recommendation would be different—perhaps a milk shake.

AI can be used in much larger retail premises as well. Shopping malls can be a confusing place. Where is the nearest bathroom? Which floor is the sportswear store on? When does the cinema show the next movie?

Using a robotic solution, SM Supermalls (based in the Philippines) provides mall visitors with a fun, engaging, and useful tool that can shorten visitor wait times, decrease the burden placed on concierge staff, help promote compliance with social distancing guidelines and provide contactless assistance to customers. The result is an enhanced, personalized and streamlined customer experience across the shopping center locations. The AI solution garnered SM Supermalls a Gold award in the Innovation in Consumer Products & Services category of the 2020 Asia-Pacific Stevie Awards.

**Learn more:** [Watch the Burger King video](#) and [read the SM Supermall case study](#)

**What's next:** By 2027, 3D, augmented reality (AR)/ virtual reality (VR) and mixed reality technologies will be embedded into interactions in the metaverse and are set to form an integral part of the customer experience.<sup>7</sup>



# Use Case: Transform Loss Prevention

It is an unfortunate fact that retailers are often the target of theft and fraud. US retailers lose around \$15-\$20 billion each year to customer theft, and almost as much to employee theft.<sup>8</sup> Computer vision and AI models can help reduce loss in several ways. For example, cameras throughout the premises can monitor who enters the store (looking for persons of interest such as known felons), reduce loss at in-person and self-checkout counters and watch for suspicious activities at the loading dock and the storeroom. Additional tagging of items can help prevent theft. In any of these scenarios, the AI models gather data about behaviors and creating actions based on them, such as alerting security guards. AI won't solve the problem of theft and fraud, but it is certainly a tool that can help.





## Solutions in Action:

Retailers can choose between a number of options to help reduce in-store or in-warehouse loss. For example, the Mindtree Smart Digital Vision Analytics System can accurately identify individuals performing suspicious activities based on millisecond-fast activity detection and recognition capabilities. Its deep learning video-based algorithms process real-time CCTV-video and POS-transaction data to identify, record, and send alerts when events occur that are considered abnormal or suspicious. Another solution, OmniStore from Tata Consultancy Services (TCS), is a unified commerce platform with an extensive catalog of domain-driven APIs and microservices that enable seamless, multichannel customer journeys.

Among other features, TCS OmniStore includes APIs for self-check-out loss prevention. Sensormatic and Intel are collaborating to develop AI-driven technology that can improve the customer experience as well as aid in loss prevention.

**Learn more:** Read the [Mindtree solution brief](#), [TCS OmniStore product brief](#) and the [Sensormatic article](#)

**What's next:** 81% of loss prevention and asset protection (LP/AP) teams have integrated LP analytics tools and department data streams, maximizing the ROI on tech investments.<sup>9</sup>





# Use Case: Improve Employee Experience, Productivity and Value

As mentioned earlier, labor shortages in the retail industry are a real challenge. Staffing shortages create a vicious cycle by making the work environment more difficult, which fuels more turnover and discourages workers from entering the sector. Additionally, these labor factors degrade the customer experience, from transaction accuracy and service speed to the attitudes of employees. AI and edge computing offer a solution by providing employees with richer, more timely information to enable them to do their jobs more effectively while saving them from having to engage in more mundane, low-value tasks. In this context, AI is not meant to replace employees, but to give them a helping hand and make their work environment more positive and rewarding.



## Solution in Action:

At the fast-food franchise Lee's Famous Recipe Chicken, staff shortages were causing employee friction and customer dissatisfaction. Faced with multiple tasks including running the counter as well as the drive-through, employees became frustrated and distracted, which led to declining order accuracy. To take the load off staff, the chain is testing a conversational AI virtual attendant solution. The system greets the customer, takes orders and responds to questions. Once the order is complete, the virtual attendant thanks the customer and gives them their total. Integration with existing systems such as headsets and POS systems ensures the order flows seamlessly to the order displays in the kitchen and the cash register at the pickup window.





The system's accuracy is 95%, compared to only 84.4% accuracy from human cashiers and improves upselling results. But while customer satisfaction and franchise revenue has increased, the real win is that reducing employee stress has had an equally large impact. Employees now have time and energy to focus on helping customers, greeting them with a smile, and making them feel welcome—priceless qualities in any retail endeavor.

**Learn more:** [Read the case study](#)

**What's next:** 63% of retailers are investing in employee experience in 2022. Why? Because nearly 40% of retail workers don't feel heard and want to quit.<sup>10</sup>

# Use Case: Provide Insight to Corporate Management

When retail management understands customer behaviors and trends, they can better manage demand forecasting and pricing decisions and present customers with targeted products. For example, AI and heat mapping can be used in store premises to reveal which products are picked up, which are put back, and where the customer goes after leaving the shelf. Retailers can use this information to create targeted experiences that promote engagement with products. As another example, retail sales revenue is a key performance metric, but in-depth analysis of poor sales performance is rare. By combining vision analytics with transaction data, retailers can gain insights into sales performance during periods of high and low traffic for each store. AI and analytics, running on edge devices, help uncover and replicate best practices across multiple stores.





## Solution in Action:

Town Talk Foods is a Texas-based grocery chain. In one of Town Talk's stores, sales were flat, and profitability was marginal, despite a growing local population. Town Talk needed insight into in-store visitor patterns to optimize their product and price mix and attract more customers. To gain that insight, the retailer implemented an AI-based solution, i3Di (whose name stands for "in-store three-dimensional insights"). By combining demographic data with information about shopper location and shelf contents, i3Di delivers near-real-time insights about shopping behaviors, buying preferences, outage notifications and demand forecasting. Six months' worth of actionable insights from i3Di on shopper demographics, hours of operation, inventory outages, customer journey maps, and footfall projections enabled the retailer to optimize its marketing, operations, and merchandising and achieve 2021 sales targets with two months left to go in the year.

VSBLTY technology, such as VisionCaptor and DataCaptor software, combines motion graphics and interactive brand messaging with cutting-edge computer vision measurement and insights. Retailers can use the VSBLTY solutions to deliver personalized ads on digital signage—even on things like beverage coolers—as well as monitor security and safety in retail spaces. For example, VSBLTY is building a media and security network in five countries in Latin American convenience stores in partnership with Grupo Modelo, with over 1000 deployments already and several more thousand expected over the next few years.

**Learn more:** [Read the Town Talk Foods case study](#) and [watch the VSBLTY video](#)

**What's next:** By 2024, augmented in-store associates in at least 10 Tier 1 retailers will execute inventory audits to support automated precision merchandising at the edge.<sup>11</sup>



# Take the Next Step

The use cases and case studies described in this guide offer tangible proof that edge computing and AI can add business value across the retail workflow, from supply chain and inventory management all the way through to customer/employee experience and corporate-level decision making. Intel works with the retail ecosystem to deliver integrated, AI-powered solutions that solve real problems, and Intel® technologies enable a wide range of AI capabilities, including intelligent display ads, smart shelves, endless aisle kiosks, enhanced inventory control, and smart self-checkout.

Intel is also an active member of the [Open Retail Initiative](#), which is a collaborative community of organizations using open-source projects and vendor-proprietary solutions to drive digital transformation in retail. To put AI, advanced analytics and edge computing to work in your retail establishment, read the implementation guide, "[Steps to Taking AI to the Next Level in Retail](#)".

Speak to your  
Intel representative  
today about how  
Intel can help  
further transform  
your retail business.



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