Hanshow Works with Intel and Microsoft to Accelerate Smart Retail Innovation

"As a key force driving the next generation of evolution in the global retail industry, AI helps retailers provide consumers with more personalized services, accelerates business operations and commodity circulation, and delivers more valuable data insights. Hanshow shall cooperate with leading international companies such as Intel and Microsoft to continuously explore the evolution of AI + retail, unlock the value of data, provide more retailers with better products and solutions, and contribute to the transformation of the global retail market."

– Liangyan Li
SVP, Head of Global Sales, Hanshow Technology

intel Hanshow Microsoft AI & IoT Insider Lab


SALE %

"Revolutions in the retail industry have always been driven by technology. With digital technologies such as AI, virtualization, IoT, and edge computing realizing the upgrade of personalized consumer experiences and the reshaping of innovation-driven retail, the industry is experiencing a lot of changes. Intel shall facilitate the construction of a healthy and active global smart retail ecosystem; solve critical compute, storage, network, algorithm, data, and other issues in smart retail development; drive further retail innovation and unlock new opportunities in the future."

– Guo Wei
GM, NEX and Channel DCAI Sales team, PRC Sales Organization, Intel

"AI and IoT are transforming business models by helping companies move from simply making products and services, to companies that give their customers desired outcomes and impeccable experience. The combination of AI and IoT is changing the landscape of retail industry and the relationships that businesses have with their customers. Microsoft's AI and IoT technologies not only lower the bar technically for data management, but also give retailers full access to monitor, analyze, manage data, to timely adjust business strategies, and deliver more substantial business value. At Microsoft AI & IoT Insider Lab, we work with innovation-driven retailers, leveraging Microsoft's avant-garde AI and IoT technologies to speed up the commercialization of various smart retail scenarios."

– Rashmi Misra
General Manager, Microsoft AI & Emerging Technologies

"Through the extensive application of AI, retail can become smart, providing better operational excellence, intelligent supply chain and stronger business intelligence. We are committed to collaborating with the industry and with our partners such as Intel and Hanshow to advance AI-driven innovation and build an active ecosystem to support the next generation of smart retail."

– Raj Raguneethan
Regional Business Lead
Retail & Consumer Goods, Microsoft Asia

"Adopting new technology and innovative solutions are what helps keeps Ahold Delhaize serving our brands' customers best and keeping us at the forefront of the retail industry. We have been using digital solutions in our store network for more than 20 years and this has given customers a more seamless shopping experience. This while working toward our sustainability goals, such as reducing food waste through the use of automated product discounts. AI technology is the next frontier in retail digitalization, and I believe these solutions are poised to have the most profound impact on the industry in the years to come."

– Ben Wishart
Chief Information Officer, Ahold Delhaize

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Summary

In the increasingly competitive retail market, digital innovation technologies such as AI, computer vision, and IoT are becoming one of the core competitiveness points of retailers. These technologies help retailers reduce operating costs, improve operating efficiency, and provide users with a unique shopping experience. Especially in the post-pandemic period, the digital transformation of the retail industry will help retailers to provide users with a unique and personalized offline service experience to regain their interest and achieve higher business growth.

Hanshow, a professional digital store solution provider (SP), has worked closely with Intel on AI infrastructure innovation and AI application optimization in retail scenarios to launch a loss prevention solution for digital stores and self-checkout cashiers based on Intel® architecture. Integrating Hanshow's long-term technical innovations and best practices in the retail + AI sector with Intel's full-stack hardware-software optimization, the solution helps retail users construct performant, insightful, cost-effective, and easy-to-deploy smart retail systems to solve problems in self-checkout, payment, loss prevention, and more.

Background: AI Technology Innovation and Challenges in the Retail Industry

Digitalization is currently reshaping the structure of the global retail industry. From customers and products to transactions and management, the automation, informatization, and digitalization of retail help improve the customer experience while gaining greater enterprise value. At the same time, following the full recovery of retail in the post-pandemic era, consumers will have higher requirements for offline retail. This forces retailers to create a safer shopping environment through digital technology and offer a convenient and unique service experience.

"As an organization applies digital transformation strategies to their business, the combination of IoT and AI begins to create a real disruption in each industry, and a genuine system dynamic in terms of value", says Rashmi Misra, GM of Microsoft AI & Emerging Technologies, "Leading retailers are reimagining their businesses by investing in platforms that integrate IoT, AI, and edge computing technologies, to be focused on increasing efficiencies, reducing costs, as well as reforming the relationships with their customers. This will be pivotal for retailers to stay vigorous in the post-COVID times."

In this context, AI has been widely used in the retail industry and gave birth to applications such as smart customer flow analysis, smart product inventory, smart loss prevention, and smart decision-making. AI helps achieve data intelligence and industry chain optimization and brings higher value to retail businesses through applications such as recognition and analysis of customers and products, customer flow analysis, product data recognition, display management and optimization, product automated inventory, and stack detection, etc.

The Global Retail Industry Is Entering the Era of AI

The significant value created by AI has received widespread attention from retailers around the world. Insight Partners predicts that from 2016 to 2025, the total market value of AI in the global retail market will increase from $712.6 million to $27,238.6 million–a 38-fold increase[1]. According to market research and industry reports, the application of AI technology in the retail industry shows the following trends:

- **Most Retailers Plan to Explore More in the Field of AI:** Retailers are increasing their investments in digital technologies such as AI to increase store technology and experiment with new digital forms of business to stand out in the dynamic market. A study of retailer CIOs and technology executives found that 73% of retailers plan to increase the proportion of their overall digital spending in 2022, and the same proportion plan to increase their digital absolute budget value in 2022[2].

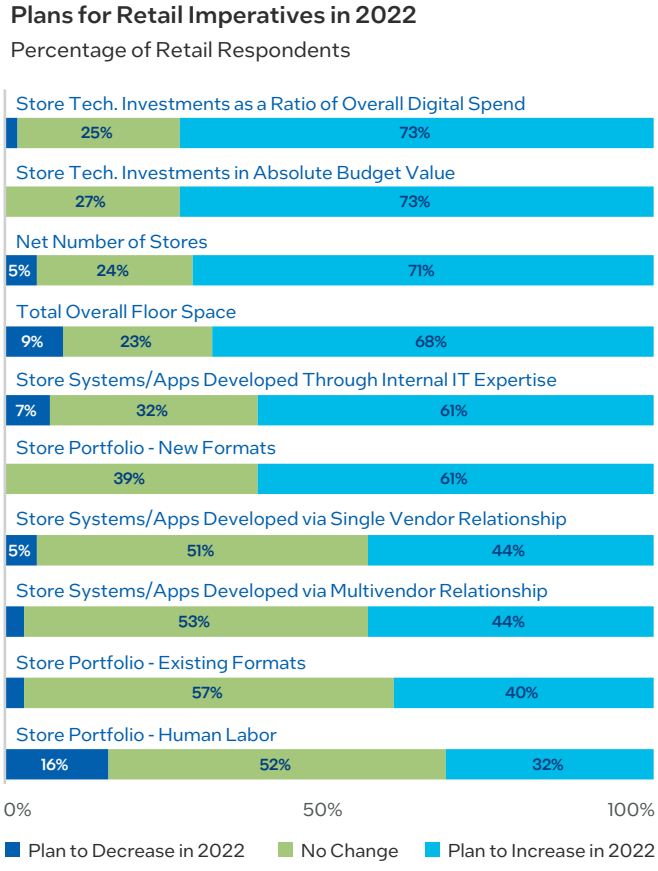

Figure 1. 2022 Retail development plan[3]

[1] Artificial Intelligence in Retail Market 2025 - Global Analysis and Forecasts by Deployment Type, Retail Type, Technology and Application.

[2] Robert Hetu. Retail 2022: Betting Big On Digitalized Stores.

[3] https://blogs.gartner.com/robert-hetu/retailers-bet-big-on-digitalized-stores-in-the-battle-for-the-customer/?_ga=2.15146486.1726584844.1644459876-536925492.1644459876

- **AI Will Play an Important Role in Boosting Retail Business Value:** A research report from Business Insider predicts that by 2035, AI will increase profit margins in retail and wholesale businesses by nearly 60%[4]. By applying AI technology to retail businesses, retailers will be able to gain insight into consumer preferences more effectively, provide consumers with personalized and unique services, and increase the attractiveness of their retail services. At the same time, AI will help retailers automate more processes and benefit from the acceleration in the creation of insights from massive retail data.

  - **Personalized Retail Experiences:** AI helps retailers integrate consumers' characteristics of consumers with the goods and services they offer to create a more personalized retail experience. For example, the deep insights into consumer preferences provided by AI allow retail stores to provide users with more personalized product recommendations and humanized services.

  - **Targeting Customers and Achieving Precise Marketing:** According to Forrester's research, with the current technological advancements, only 52% of companies report being able to manage real-time customer interactions with brands. This evidences a bottleneck in the traditional retail marketing system. In contrast, AI-driven marketing has significant advantages. It has a powerful ability to gain insights from a wide range of sources and large-scale, real-time consumption data. The report also revealed that 43% of companies said they plan to use AI-enhanced advanced analytics, 40% plan to use smart recommendation solutions, and 37% plan to use machine learning[5].

  - **Continuous Supply Chain Optimization:** By leveraging AI to analyze supply chain data, retailers can gain a more complete picture of the performance of their products, along with which need to be restocked. Through these valuable data-driven insights, retailers can make better-informed inventory management decisions to ensure they can deliver on customer demand.

  - **Enhanced Retail Efficiency:** Smart retail management systems allow consumers to quickly identify product information and make payments through a self-service checkout system, thereby greatly enhancing the efficiency of retail operations.

  - **Improved Store Safety:** The comprehensive insights delivered by smart retail would improve store safety. Through the application of computer vision cameras and AI to analyze customer data, retail stores can automatically identify safety hazards.

- **Different Levels of Acceptance of AI Technologies and Applications among Retail Customers:** Although there is a wide range of AI applications in the industry today, their levels of acceptance by retail customers vary widely. Retail customers generally pay more attention to AI applications that can directly bring them economic benefits and reduce losses. According to a survey conducted by Robert Hetu, an analyst at Gartner, the top five AI applications in the global retail industry are demand forecasting, personalization of services, social media monitoring, telemarketing centers, and anti-theft and loss prevention[6]. A Business Insider survey shows that personalization is the area where AI will have the greatest impact on the retail industry, with sales of brands using personalization of services increased by 10%[7].

  By observing the application of AI in the retail industry, it can be found that the main technical application areas are as follows:

  - **Product-Oriented AI Recognition and Inference:** This is the most important AI application scenario in the current retail industry. Through visual inference and other methods, AI can infer and determine the attributes of products, including category, integrity and quantity, and support functions such as product self-service recognition and pricing, automatic restocking notification, and product loss prevention detection. These capabilities can meet the needs of applications such as smart shelves and vending machines.

  - **Behavior-Oriented AI Recognition and Inference:** Through behavior detection and recognition, retailers can achieve accurate membership management, provide consumers with personalized services, and collect accurate data references for business strategies. In addition, behavior-oriented recognition and inference also support abnormal behavior detection and reduce operating losses.

  - **Data Analysis Oriented to Business Forecasting:** By identifying consumer behavior and products, AI systems enable retailers to build big data models that enhance forward-looking insights into retail business operations.

- **Companies' Investment in Digital Technologies Such as AI Will Continue to Grow during the Pandemic:** A Gartner report shows that under the impact of the pandemic, 31% of companies surveyed said that they use digital twins to improve the safety of employees and customers, 25% promote remote access and zero-touch management, and another 23% chose compliance with procedures (safety automation measures) to reduce safety concerns related to the pandemic[8]. For example, businesses can use AI-powered real-time video streaming analytics to monitor

[4] Business Insider. THE FUTURE OF RETAIL 2018: ARTIFICIAL INTELLIGENCE.

[5] The Forrester Tech Tide™: AI And Analytics For Retail, Q2 2021.

[6] Robert Hetu. 23 Artificial Intelligence Use Cases for Retail.

[7] Business Insider. THE FUTURE OF RETAIL 2018: ARTIFICIAL INTELLIGENCE.

[8] Iot. Business. News. Gartner Survey Reveals 47% of Organizations Will Increase Investments in IoT Despite the Impact of COVID-19.

work areas and ensure social distancing compliance. As stores are places that attract crowds, retailers have a particular need to implement safety management through AI. At the same time, more retailers said that they would increase the number of their stores and resume retail business after the pandemic, which brings huge market opportunities for AI applications for retailers.

- **Backend-Oriented AI Applications Tend to Deliver Greater Benefits:** Although it is more common to hear speak about front-end business forms such as unmanned retailers and retail robots, a higher value can be brought by AI technology applications focusing on retail data insights, supply chain optimization, and related fields. Research from The Forrester Tech Tide shows that the most valuable (i.e. the most economical and efficient) solutions are often the "boring" back-end solutions, which have a more evident and faster ROI[9].

Typical Challenges for Retailers to Expand AI Applications

Although the application of AI has bright prospects and attracts the interest of retailers, its penetration in the retail industry also faces many obstacles that go from technology maturity to user acceptance and cost. According to a Gartner report, respondents chose lack of skills, fear of the unknown, and difficulty finding the right starting point for an AI strategy as the top three barriers to AI deployment. 56% of the surveyed companies believe that acquiring new skills is important, and 42% believe that there is a need to better understand the benefits that AI can bring to their businesses[10].

It can be seen that the skills of retailers and their subjective perception of AI and other digital technologies constitute the main challenge for the expansion of AI applications. From a technical perspective, the factors that prevent retailers from embracing AI technology include the following:

- **Huge Challenges Facing AI Performance:** During the digital transformation of the retail industry, the rapid growth of data, increased complexity of AI models, and increased user demand for timeliness poses serious challenges to smart retail applications in terms of performance.
- **Problem of Computing Power Distribution:** The inference of various AI algorithms in retail stores requires strong computing power. Moreover, a large number of distributed chain stores aggravates the situation because it incurs high costs to achieve unified processing of AI applications through the cloud or data centers. Therefore, more and more retailers are transferring applications such as video analytics and AI inference to edge computing terminals to reduce the latency of data processing by managing workloads nearby and saving investment in key resources such as bandwidth. At the same time, unified management across multiple stores is achieved through data convergence and processing in the cloud.
- **Integration of Innovative Technologies with the Landing Practice of AI Applications:** The deployment of AI in retail scenarios requires a large amount of industry experience but solves many practical problems such as the recognition accuracy and stability of product price tags.
- **Deployment and Maintenance Issues of Retail AI Applications:** Many enterprises in the retail industry cannot deploy and integrate complex applications such as retail + AI. They want a simplified solution that supports one-stop deployment, which requires providers to integrate a variety of complex technologies without adding further complexity.
- **Integration of Multiple Workloads:** Modern retailers need to run multiple AI digital workloads, and how to integrate them has become a key challenge.

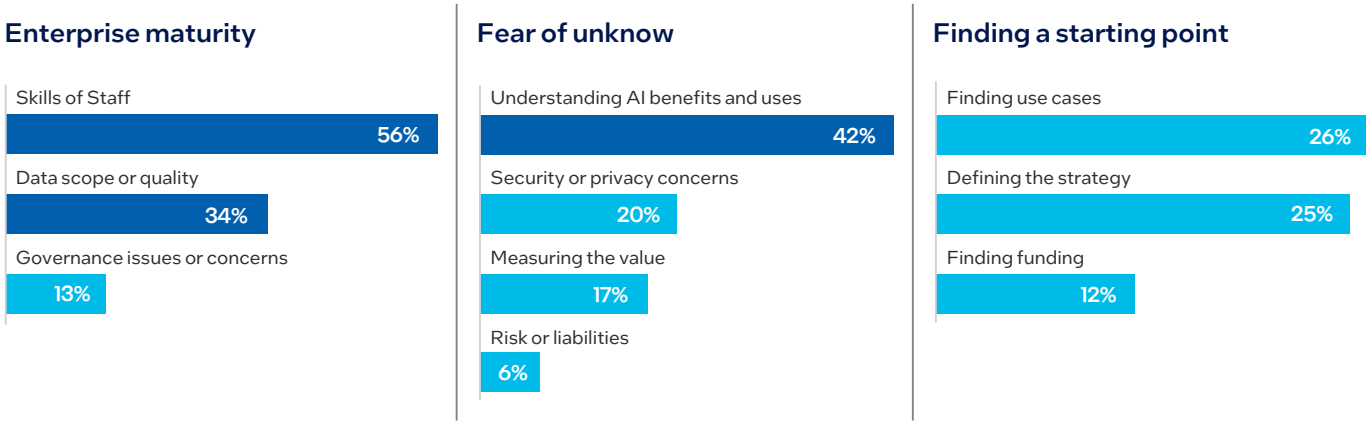

Figure 2. Top 3 barriers to AI/ML adoption[11]

[9] The Forrester Tech Tide™: AI And Analytics For Retail, Q2 2021.

[10, 11] Gartner. 3 Barriers to AI Adoption.

Solution: Hanshow Retail AI Solution Based on Intel Architecture

As a leader in digital retail technology, Hanshow aims to help stores rebuild a relationship between people, products, and markets by providing digital store solutions that integrate software and hardware, creating digital application scenarios, and improving overall operations and management efficiency. In recent years, Hanshow has invested heavily in AI and other digital innovation technologies, while carrying out extensive cooperation with partners such as Intel in areas such as digital store infrastructure innovation, application optimization, and ecosystem construction.

This section outlines the results of Hanshow's partnership with Intel in the field of retail AI, with a focus on smart shelf management and self-checkout loss prevention applications in digital stores.

AI Digital Stores – Smart Shelf Management

Digital stores are a collection of digital technologies and applications from a variety of sectors, in which shelf management plays a key role. The importance of shelf management to the retail business means that improving on-shelf availability (OSA) has always been a top priority. A study by the IHL Group found that the out-of-stock (OOS) ratio of the retail industry reached as high as 8%, accounting for 4.1% of lost revenue for the average retailer. Another study found that more than 50% of OOS was caused by poor shelf operation[12], namely inaccurate inventory, misplaced SKUs, and related shelf inventory issues.

The conventional method of strengthening shelf management has been manual observation, recording, and review. There are however many problems with this method. Supermarkets are typically made up of a large number of shelves holding a wide variety of products. Manual shelf management carries a high manpower cost and can only be carried out at a defined frequency, making it difficult to realize timely insights.

To solve these problems, shelf management solutions based on AI, computer vision, and other technologies have emerged. Through the identification, classification, and inventory of shelf items with algorithms such as price tag recognition, product recognition, OOS detection, activity recognition, and optical character recognition (OCR), these solutions are capable of automatically determining OOS items, incorrect placements, and other issues. Relevant data can also be transmitted to backend systems for processing to support further data processing and decision-making.

The Hanshow AI digital store solution provides a variety of shelf management options, including fixed camera, smartphone camera, and robot inspection. In specific, the fixed camera solution is suited for scenarios in which displays change frequently and must be checked for abnormalities in real-time. The solution allows retailers to conduct real-time display monitoring and product recognition while obtaining data related to human-product interaction. The smartphone camera solution is suited for scenarios with low-frequency inspection requirements. The solution allows personnel to obtain the display status of products by taking pictures with their smartphones. The robot inspection solution is suited for scenarios that have a large number of products, but no high-frequency requirements.

The solution realizes the collection, monitoring, and verification of display data through electronic price tag and product recognition, ensuring that retailers are notified of any OOS or other abnormal events promptly. While ensuring compliance with consumer privacy and data protection laws and regulations, the solution also realizes the recognition and tracking of consumer attributes, record data such as consumer browsing time and location, generate in-store heat maps and customer flows, and assist in targeted marketing.

With Microsoft Azure Cognitive Services, our solution can deliver low-friction, state-of-the-art algorithm model, with a seamless and highly secured user experience. No machine-learning expertise is required. The terminal device can accurately execute assigned tasks even in an intensive space, which greatly improves data accuracy and integrity. Meanwhile, Microsoft Azure Machine Learning is adopted in the aim of accelerating time to value with industry-leading MLOps and integrated machine learning tools. Azure Machine Learning also allows you to access timely and accurate data analysis and forecasting with its high transparency, reliability and compliance.

[12] Source: IHL Group.

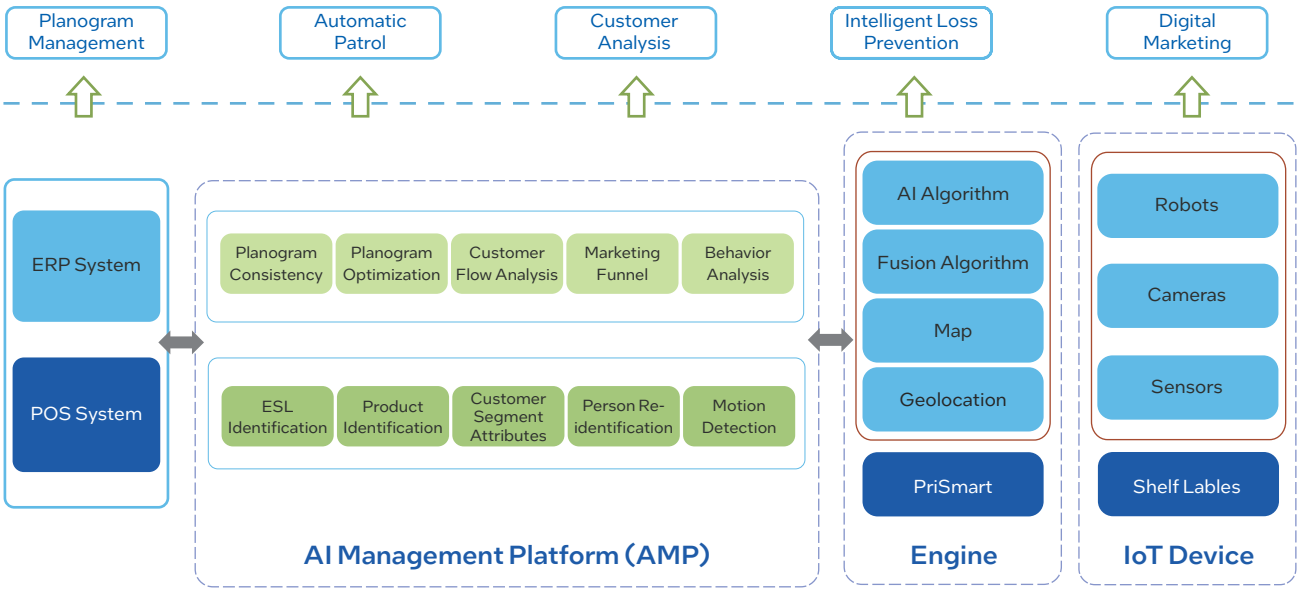

Figure 3. The overall architecture of the Hanshow AI digital store solution

The solution is capable of meeting the demanding performance requirements of workloads such as AI model inference through an edge server/Intel Video AI Box equipped with Intel® Core™ processors. Intel Core processors offer excellent performance per watt, powerful graphics, I/O integration functionality, and support for a variety of image sensors. The processors come integrated with Intel® Iris® Xe graphics for complex AI workloads and hardware acceleration via Intel® Media SDK for faster video transcoding, image processing, and media workflows.

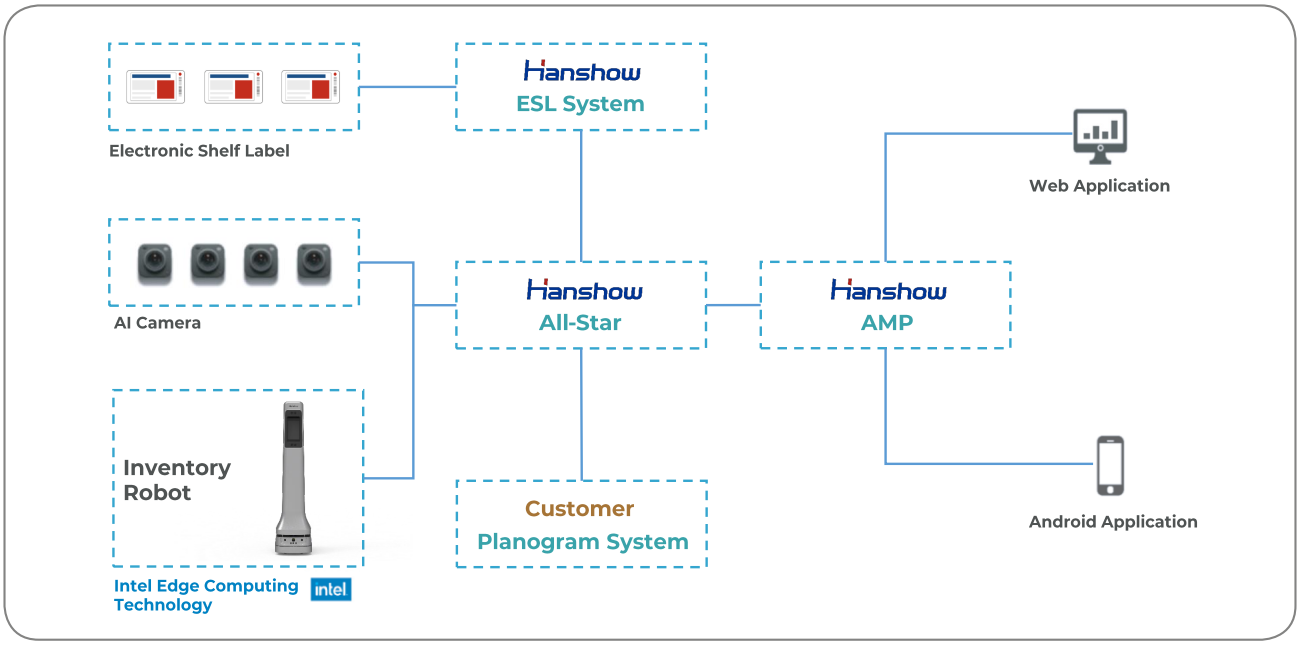

Figure 4. Deployment architecture of the Hanshow AI digital store solution

The solution offers a variety of advantages.

- The integration of product and price tag recognition algorithms increases display inspection accuracy and lowers image training costs. Price tags allow the Hanshow solution to realize a recognition accuracy of over 95% for display and OOS inspection.[13]
- With Microsoft Power BI, you can flexibly and securely unify data from various sources to create interactive, immersive dashboards and reports that provide actionable insights and drive business results.
- Intel Core Processors allow the edge devices of the solution to provide computing power capable of supporting demanding workloads such as AI while also ensuring the protection of sensitive data.
- The integration of smartphone cameras, fixed cameras, and robot device provides flexible solutions that can be tailored to store-specific scenarios.
- Hanshow solutions can be quickly trained and adapted for a variety of detection scenarios.

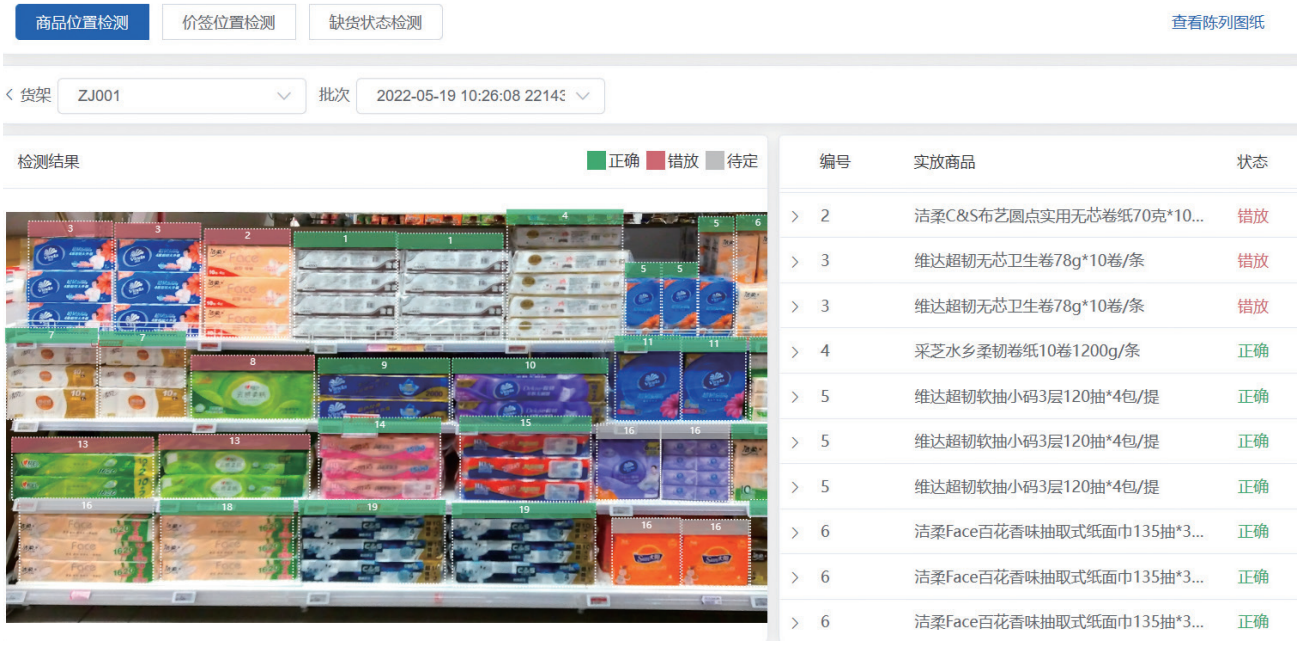

Figure 5. Product recognition scenario of the Hanshow AI digital store solution

[13] Data from internal test results of Hanshow.

AI Self-Checkout Loss Prevention

No matter their differences in scale or business model, almost all retailers lose money from the loss of merchandise. A survey by the National Retail Federation (NRF) in 2015 found that retailers had a net profit margin of 3%[14], while another of its reports found that the cost of theft exceeded 1.38%[15] of turnover in the same year. If the cost of theft and damage was halved, the average profitability of the retail industry would increase from 3% to 3.69%, representing a growth of more than 20%. The majority of the financial impact of inventory loss in retail occurs in stores where point-of-sale (POS) terminals are deployed. The prevention of scanning errors such as missed scans and barcode substitution is critical to reducing loss.

Retailers face significant loss prevention challenges, especially in self-checkout scenarios. As these scenarios typically involve customers checking out without the assistance of staff, there is a higher chance of incorrect payments due to lack of knowledge and fraud through missed scans, barcode substitution, and other methods. Though certain retailers may be able to monitor such behavior through IP cameras and other methods, such measures are retrospective and inefficient, making it difficult to effectively prevent the loss of products. Industry reports show that the cost savings achieved through self-checkout may not make up for the resulting increase in thefts and losses.

Key Metrics	Loss Rate
Average Utilization (Value)[16]	**27%[17]**
SCO Theft as a Percentage of SCO Sales	0.44%
SCO Theft as a Percentage of Total Revenue Churn	9.48%
SCO Theft as a Percentage of Total Sales	0.12%

Table 1. The rate of self-checkout (SCO) theft loss[18]

Such risks can be effectively reduced through AI self-checkout loss prevention applications that utilize computer vision technology to identify loss-causing abnormal shopping behaviors such as missed scans, non-payments, and price mismatches in real-time and without the need for perception. Unlike traditional measures, the solution realizes real-time alerts, eliminating the tracing costs associated with post-event alerts, effectively reducing losses caused by abnormal behaviors during payment, identifying abnormal behaviors that are difficult for a human to detect, and improving the overall shopping experience.

Through the integration of technologies such as pedestrian detection, pedestrian re-identification, product recognition, product retrieval, and multi-target tracking, Hanshow has realized an algorithm accuracy of over 98% on the scale of millions of pieces of data. Hanshow has also developed a self-checkout loss prevention solution capable of stable real-time operations under complex ambient lighting environments of supermarkets to effectively solve missed scans, non-payments, price mismatches, and other problems in a variety of scenarios. The solution boasts strong adaptability to new products and can be applied to cash registers without the need for retraining.

The solution runs depth estimation workloads through self-checkout cash registers powered by Intel processors while accelerating depth estimation performance through OpenVINO™, a comprehensive toolkit for the fast development of applications and solutions that solve various tasks (including human visual simulation, automatic speech recognition, natural language processing, recommendation systems, etc.). The toolkit is based on the latest generation of artificial neural networks, including convolutional neural networks (CNNs), recurrent network and attention-based networks capable of scaling computer vision, and non-visual workloads across Intel hardware to maximize performance. It accelerates applications through the high-performance, AI, and deep learning inference deployed from the edge to the cloud.

According to internal test data from Hanshow, the optimizations provided by the OpenVINO toolkit improve the recognition performance of the solution's depth estimation algorithm to 40 FPS[19], fully meeting the application requirements of self-checkout loss prevention.

[14] https://nrf.com/blog/2017-top-250-global-powers-retailing

[15] https://losspreventionmedia.com/retail-theft-loss-prevention-analytics/

[16] Refer to the value of transactions that are processed through a given form of checkout technology.

[17] Refer to the value that is processed through a given form of checkout technology in the overall value.

[18] NCR, *Self-checkout in Retail: Measuring the Loss*.

[19] Test conducted by Hanshow in January 2022 using devices running Intel® Core™ i7 processor and the OpenVINO™ toolkit and benchmarking with the speed of inference of detection model algorithms popular in computer vision. Test and comparison objects are other common deep learning frameworks or tools, including Pytorch, OpenCV DNN, ONNXRUNTIME, etc. These frameworks are deep learning tool libraries with different characteristics, including a series of functions related to the deployment of deep learning models, such as inference libraries and model optimization. Performance tests were performed on Intel® Core™ processors and Intel® GPUs and can roughly reflect the performance of the OpenVINO™ toolkit. Intel does not control or audit third-party data. You should consult other sources to evaluate accuracy.

Application in Practice: Accelerating the Application of AI by Global Retail Customers

With leading advantages in areas such as electronic price tags and long-term expertise and innovation in AI + retail, Hanshow has accelerated the smart retail transformation of customers around the world. At present, Hanshow digital retail solutions have seen a wide range of successful applications in more than 50 countries and regions, including France, Germany, Belgium, and Japan, and are in the process of entering the Americas, Oceania, and other regions.

European Retailer

The customer is a leading large-scale supermarket chain with over 10,000 stores across the world. The scope of its business cover more than 20 countries in Europe, America, Asia, and other regions.

The customer was facing two urgent issues – (1) There was a frequent shortage of fresh food in its stores. The clear lag between the occurrence of a shortage, identification by employees, and replenishment of products had a negative impact on sales. (2) The customer did not have a way to monitor the number of SKUs in each store in real-time, making it difficult to confirm whether a purchase plan was implemented.

In response to these pain points, Hanshow provided a stack recognition solution based on AI cameras that took high-frequency images of fresh food stacks to upload information such as display area and location in real-time. The solution can capture images in intervals as frequent as 2 minutes. For sensitive data (such as biological features), the AI camera performs data culling, significantly improving data security.

After deployment of the solution, the product display rate increased from 93% to 97%, while the product OOS duration dropped from 2.5 hours to 1.5 hours, representing a total reduction of 40%[20]. The solution reduces the need for 1-2 rounds of manual display inspection each day, allowing store employees to focus on other tasks. The solution also allows the customer to check the product status of all its stores at any time, saving on the labor cost of on-site visits.

For the next step, the customer plans to perform big data mining, establish a dynamic price change model, and automatically push price updates to electronic price tags for display.

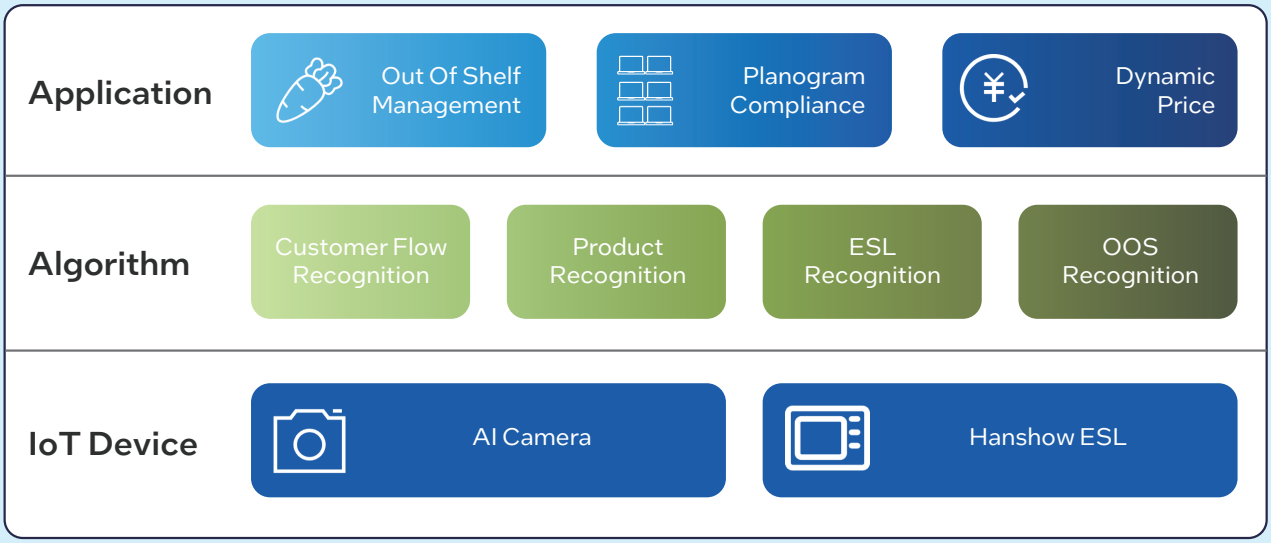

Figure 6. The technical architecture of the Hanshow solution for a European retailer

[20] Data from internal test results of the customer.

Japanese Retailer

The customer is one of the largest department store retailers in Japan and Asia, with tens of thousands of employees around the world. It was named in the Fortune Global 600 for 2020.

The primary pain points faced by the customer were the insufficient digitalization of physical stores, the relatvie simplicity of marketing methods, and an inability to effectively understand the preferences and shopping habits of customers.

Hanshow provided the customer with a digital shelf solution covering digital marketing, OOS management, customer group insights, smart pricing, and other digital transformation solutions, connecting shipping links across its stores. In addition to the application of digital marketing solutions provided by Hanshow in food areas, deep learning cameras were also widely used in other product areas for data collection, consumer insight analysis, human-product interaction analysis, theft prevention, consumer shopping demand analysis, and store environment and shelf simulation. The solution uses commercial display hardware, intelligent sensors, software systems, communications, and other equipment to provide ad placement management, human-product interaction, data collection, and other functionality.

Operational analysis showed that the implementation of single product recommendations in the digital shelf area boosted the sales of active products by nearly 20%. Through the analysis of customer flow and consumer attributes with AI, stores were able to optimize displays more purposefully, improve the shopping experience of customers, and increase the precision of ad placement.

Solving AI Challenges in the Retail Industry and Creating Refined Smart Retail Practices

The partnership between Hanshow, Intel, and Microsoft in the retail sector has successfully driven the application of AI in the industry, stimulated the innovation of retail technologies, and fully unlocked the value of AI in the mining of retail data, optimization of business processes, and enhancement of consumer experiences. This paper focuses on the achievements of Hanshow applications in smart shelf management and self-checkout loss prevention, and outlines how the partnership has solved AI challenges in the retail industry.

- **In terms of AI performance,** the integration of Intel Core processors and the OpenVINO toolkit provide cost-effective and flexible support for AI computing by greatly improving the operational efficiency of AI algorithms such as product recognition, product tracking, pedestrian recognition, pedestrian classification, and other areas without the need for expensive dedicated hardware.
- **In terms of computing power distribution,** Hanshow converges AI algorithms in edge servers based on Intel architecture for processing, and interacts with a cloud management platform to construct a cloud-edge-end integration data processing model. The solution takes full advantage of Intel products and technologies to improve AI computing power while reducing data processing delays through edge processing, thereby saving on investment in key resources such as bandwidth.
- **In terms of the scenario-based implementation of AI technology,** Hanshow has used its long-term expertise and resources in the retail industry and leading advantages in areas such as electronic price tags to realize the optimization of AI technology for smart shelf management, self-checkout loss prevention, and other scenarios to fully meet user demand in all aspects.
- **In terms of the deployment and maintenance of retail AI applications,** Hanshow has realized the one-stop delivery of solutions such as smart shelf management and self-checkout loss prevention. Users are able to rapidly deploy AI capabilities without the need to make significant investments into software and hardware selection, tuning and adaptation, or algorithm development, thereby fully unlocking the value of AI in retail scenarios.

Outlook: From Retail Informatization to Smart Retail

AI and IoT technologies have created a far-reaching revolution in the retail industry. By applying innovative digital technologies to shelf management, precision marketing, supply chain management, safety management, and other areas, retailers are expected to reshape the relationship between people, products, and markets while better tapping into the value of big data. Retailers will be able to accelerate the AIoT transformation of store hardware through the deployment of AIoT devices such as electronic price tags, AI cameras, AI-powered robots, smart shopping carts, self-checkout, and digital shelves. At the same time, SaaS capabilities at the software level will deliver full-link integration, truly realizing the transformation of operational efficiency and the consumer experience.

With the rapid expansion of the scale of retail store data and increasingly refined and intelligent requirements, smart retail systems will be responsible for increasingly complex AI workloads, along with the integration of a variety of different AI algorithms. AI applications covering multiple architectures will become the norm, and more and more retail customers will feel the need to develop, deploy, and run smart retail applications across hardware architectures to realize higher agility and flexibility.

In this context, smart retail service providers will use more heterogeneous development models to develop solutions with out-of-the-box compatibility, while reducing the development threshold of AI applications and shortening their time-to-market. With significant investments in software-defined infrastructure and cloud computing technology, Intel empowers ecosystems, infrastructure, and cloud computing platforms with highly automated management capabilities, along with highly flexible provisioning and expansion of compute, storage, and network resources.

In terms of smart retail solution innovation, Hanshow, Microsoft, and Intel will carry out more in-depth cooperation in AI infrastructure optimization, AI algorithm innovation, smart retail ecosystem construction, and other areas to meet the demanding performance requirements of AI applications, realize precise insights into retail data, and provide excellent levels of reliability, scalability, security, and openness. In the future, the partners will expand their cooperation to smart retail scenarios such as unmanned stores and sensorless payment to accelerate the transformation of the retail industry and deliver unique service experiences to more users.

About Hanshow

Hanshow is a professional digital retail solution provider that primarily serves traditional retail, new retail, department store fashion, culture and entertainment, and other sectors. The company has independent R&D and innovation capabilities, and the ability to integrate both resources and software/hardware solutions across the entire industry chain. Founded in 2012, the company is headquartered in Jiaxing, Zhejiang, with an R&D and management center in Beijing and domestic branches in Shanghai and Shenzhen. The company also has international branches in the Netherlands, Germany, France, the United States, the United Kingdom, and Australia.

About Intel

Intel (NASDAQ: INTC) is an industry leader that focuses on developing technologies that change the world, drive global progress, and enrich human lives. Driven by Moore's Law, Intel is dedicated to the continuous innovation of semiconductor design and manufacturing to provide customers with solutions to major challenges. By integrating intelligence with the cloud, network, edge, and various computing devices, Intel unlocks the potential of data and helps improve both business and society. For more information on Intel innovation, refer to our China News Center at newsroom.intel.com and our official website at intel.com.

About Microsoft

Microsoft (Nasdaq "MSFT" @microsoft) enables digital transformation for the era of an intelligent cloud and an intelligent edge. Its mission is to empower every person and every organization on the planet to achieve more.

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