intel.

Tata Consultancy Services Helps Big Retail Eliminate Self-Checkout Machine Losses with Accessible AI

Tata Consultancy Services leverages Intel® Technologies to prevent self-checkout machine theft and error, empowering big retail to offer a modern and efficient shopping experience without incurring product shrinkage and financial losses.

tcs

TCS Authors

Dr. Apurba Das
Global Head, Cognitive AI, IoT & Digital Engineering

Anshuman Gauriar
Solution Architect, Cognitive AI,
IoT & Digital Engineering

Intel Authors

Mohit Agarwal
Solutions Architect at Intel

Suvansh Damaraju
Technical Solutions Architect, IoT & Edge AI for Global Partners

Table of Contents

The Challenge of Self-Checkout: Verifying Transactions

Today's consumers expect to be able to shop and purchase as fast and conveniently as possible and retailers who do not meet these evolving demands can experience increasingly negative consequences. Consumers noted that checkout lines are a top 4 pain point in almost every geo[1] and 77% of consumers are less likely to return to a store due to long checkout wait times.[2]

As a result, retailers are looking for ways to drive brand loyalty and repeat customers by offering frictionless, fast, and ultra-convenient experiences for their shoppers. To do so, they are increasingly leveraging self-checkout machines to enhance the shopping experience for their customers. These automated systems provide convenience and efficiency by allowing shoppers to scan and pay for their items independently, reducing the time spent waiting in queues.

And self-checkout machines are making a difference. "Winning retailers", or those defined by 10% or more in sales growth, invest more in innovative in-store IT such as self-checkout IT, compared to below-average retailers with flat or declining sales.[3] Meanwhile, shoppers are making their preferences clear with 49.4% of respondents of a recent Raydiant survey stating that they are more likely to visit a store with self-checkout offerings than one without.[4]

However, by embracing self-checkout machines, retailers are subjecting their operations to significant risks caused by theft, error, and fraud. The absence of human cashiers overseeing transactions makes it easier for customers to manipulate the system, intentionally or unintentionally. Common issues include failing to scan items, tag switching, misidentifying items, and deliberately underpaying. These challenges represent real costs for retailers with retail losses in 2021 amounting to $94.5 billion, up from $90.8 billion in 2020.[5]

The impact of shrinkage underscores the pressing need for retailers to implement effective solutions, such as video analytics and AI, to mitigate these losses while maintaining the convenience and efficiency that self-checkout machines offer.

However, many retailers who rely on legacy or manual systems hesitate to adopt AI-powered loss-prevention solutions to monitor their self-checkout machines. They fear that the capital expenditure investment of acquiring and integrating the solution into their existing infrastructure will be costly and fail to deliver the required ROI. Retailers may also be reluctant to adopt an AI-based loss prevention solution if they think they must train their staff to operate a new, complex solution, or go through the arduous processes of training the solution's AI models to recognize self-checkout machine errors or theft for their particular retail locations. Tata Consultancy Services (TCS) strives to counter retailers' perception that AI solutions are difficult to implement in-store with a software suite that leverages their existing camera and computing infrastructure to reduce barriers to digital transformation.

The TCS AI-Based Loss Prevention Solution: Enforcing Self-Checkout Transactions and Protecting Inventory

By leveraging a TCS solution, retailers can receive the end-to-end guidance they need in their digital transformation journey as they turn their retail locations into agile smart stores. The TCS Self-Checkout Loss Prevention Solution is an AI-powered video analytics solution that can integrate with the retailer's existing video surveillance to identify self-checkout machine fraud and errors.

How It Works

The system analyzes customer hand gestures at the self-checkout location to detect abnormal behavior, such as when a customer is not scanning all their items or does not pay when completing a transaction using the self-checkout machine. In-store cameras capture customer physical behavior and utilize edge devices to perform highly advanced AI-powered inferencing, including customer activity recognition, action sequencing, and hand gesture analysis. These capabilities can alert the store manager to exception events in real time, giving them the power to intervene and mitigate the financial loss of the shrinkage before the customer steals the item and leaves the store.

In addition to real-time loss prevention, the solution enables the transfer of metadata to the cloud to perform enterprise-level statistical analysis through the TCS business intelligence dashboard. This dashboard empowers retail enterprises to make data-driven decisions with actionable insights into business trends across their stores, including:

Which retail locations are experiencing the most theft	Which self-checkout machine in the store layout is experiencing the most theft	What time of day theft is occurring at

TCS can also store video clips of any theft that occurs as video evidence via the Azure BLOB storage. Video storage length is configurable for customers who would like to save costs. With the case of all video footage, TCS ensures data privacy and utilizes real-time streaming protocol (RTSP) for video analytics. Video footage is not shared with the cloud; only metadata is shared to comply with GDPR regulations. Unless explicitly requested, no video is stored either at the edge or in the cloud. If required, TCS provides a redaction engine that blurs identifiable information such as payment terminals, number plates, and human faces, rendering them unrecognizable. This approach maintains privacy while addressing security concerns.

intel.

TCS Loss Prevention Solution is Designed to Simplify Digital Transformation, From Deployment to AI

In the retail industry, where shopper experience is paramount, TCS offers a comprehensive range of features to enable seamless digital transformation without causing disruptions to the retailer's operations or compromising the customer's shopping experience.

01   A Trusted Partner Who Simplifies Integration

Whether the customer has all the necessary hardware or requires recommendations, TCS is committed to delivering retailers a seamless implementation that maximizes their time-to-market and ROI. In every engagement, the TCS team will assess the customer's current infrastructure to determine what new hardware is needed and what hardware can be repurposed to ensure an efficient and cost-effective deployment. As part of this assessment process, TCS will evaluate if the client's existing camera setup can be utilized and repositioned to capture more information and effectively process the video streams. If the checkout machines are positioned closely together and a single camera can provide an overhead view of all the machines to validate transactions, then one camera can be sufficient for up to three checkout machines. Alternatively, TCS can install one camera per machine if needed.

For retailers that have all the necessary components, integrating the TCS Loss-Prevention Solution into their operating system is a straightforward process, requiring only a simple installation and configuration based on the self-checkout machine layout and camera positioning. The TCS support engineers will manage the installation and configuration to ensure a smooth implementation.

For customers who lack the necessary resources for deploying the Loss Prevention Solution, TCS offers an expansive partner ecosystem to provide all necessary components. TCS has close partnerships with a range of camera and hardware vendors, as well as leading cloud service providers. This comprehensive partner ecosystem allows TCS to deliver an end-to-end solution to customers, managing the entire buying process and ensuring that all required components are seamlessly integrated and optimized. With this unique capability, TCS ensures that customers have access to the right hardware, software, and cloud services, enabling them to deploy the TCS Loss Prevention Solution effectively and efficiently.

02   Flexible Deployment Options

The TCS Loss Prevention Solution stands out for its flexible and easy deployment options, catering to the diverse needs of retailers. The solution typically comprises an edge and a cloud component to enable both real-time video analytics and historical business intelligence reporting. However, TCS offers customers the flexibility to choose between on-premises or hybrid deployment depending on the scale of their engagement. With the option of edge-only deployment, customers can omit a cloud subscription if it is unnecessary for their operations. This cloud-agnostic approach empowers customers to optimize their deployment strategy to align with their operational requirements and budget.

Moreover, the solution's compatibility with existing infrastructure further contributes to a flexible deployment strategy. The solution does not require specialized camera or computing equipment and has low computing requirements. The solution runs on Intel® Core™ i5 or i7 processors, eliminating the need for expensive GPU servers. Consequently, many retailers find that their existing operating systems meet the requirements to successfully run the solution, enabling them to embark on digital transformation without incurring significant technology costs.

03 Powerful, Pre-Trained AI Models

Large retailers often face significant challenges when it comes to training AI models to effectively detect self-checkout theft. Limited time, resources, and lack of data expertise hinder their ability to achieve highly accurate AI models, ultimately rendering their computer vision solutions ineffective. The TCS Loss Prevention Solution addresses this obstacle by providing a ready-to-use solution that incorporates pre-trained gesture analysis to detect self-checkout machine theft or misuse. Even when deploying the solution to new locations, there is no need for further AI model training. The system's computer vision capabilities are robust, enabling successful operations even in the absence of point-of-sale integration that provides data on scanned items.

Another advantage of the pre-trained gesture analysis feature is its adaptability. Since the AI model is analyzing hand gestures only and not the self-checkout machine environment, the TCS Loss Prevention Solution adapts to different layouts and models of self-checkout machines, requiring only a few minutes for configuration. This efficiency facilitates rapid deployment, allowing the solution to scale up to 10 to 15 stores within a week without requiring additional training.[6]

04 Versatile Integration with Point-of-Sale (POS) Systems

Retailers may hesitate to integrate an AI solution with their self-checkout machines, fearing potential disruptions or downtime caused by the complexity of computer vision. The TCS Self-Checkout Loss Prevention Solution addresses this concern by not requiring POS integration in crucial use cases such as mis-scan, partial scan, and no-scan, which are significant contributors to theft. Once retailers have full confidence that the solution will not impact self-checkout machine functionality, they can introduce more loss-prevention applications with seamless API-based integration with their POS systems. Once fully integrated, the TCS Loss Prevention Solution can further assess product scanning and payment to better inform AI capabilities.

Alternatively, when scaled down to the mentioned use cases of mis-scan, partial-scan, and no-scan, the solution can also be designed to be part of a POS or self-checkout system with few computational requirements. Doing this benefits POS machine vendors looking to package the Loss Prevention Solution with their product as part of their offerings using an Intel® Core-based mini-PC platform which offers cost-effective, compact hardware to run the solution.

Business Outcomes Enabled By Optimizations

By partnering with TCS to gain cognitive AI to manage their self-checkout machines, retailers can realize the following benefits:

Reliable Product Shrinkage Prevention
Retailers leveraging the gesture-based analysis of the TCS Loss Prevention Solution gain a highly accurate methodology for stopping self-checkout machine theft and error in its tracks, no matter the layout or model of the self-checkout machines.

Fast Time-to-Market
The TCS Loss Prevention Solution reduces time-to-market by offering pre-built customizable AI models that bypass the need to train the solution for retail video analytics applications.

Cost-Effective Digital Transformation
With a solution that offers flexible deployment and hardware specifications, retailers can enhance their self-checkout operation with AI-based video analytics at the cost and scale that matches their needs.

A Scalable AI Solution for Big Retail
Retailers can easily scale the TCS Loss Prevention Solution across their retail locations with a modular, scalable, and reusable solution that is compatible across devices and software with seamless API integration.

intel.

Intel and TCS Partner Together to Deliver Superior Digital Transformation at an Accessible Price Point

Intel's hardware and software are optimized for AI to help ensure that the TCS Loss Prevention Solution delivers highly accurate deep learning and traditional video analytics models to detect and flag self-checkout machine theft in real-time, while offering customers the right combination of price, power, and performance.

Intel offers multiple hardware components that TCS leverages to customize the Loss Prevention Solution to retailer budgets and scale of operations. This enables retail operations of all sizes to take advantage of self-checkout technologies to stay competitive in their industry, while mitigating the risk of product shrinkage that arises due to self-checkout machine theft, fraud, and error.

Intel® Core™ Processors
In loss prevention, the crucial distinction between theft and interception lies in real-time AI insights. Intel® Core™ processors offer high-performance CPUs, GPUs, and Neural Processing Units (NPU) in a single package for processing data at the edge to enable near real-time video analytics. The TCS Loss Prevention Solution is optimized to run seamlessly on Intel® Core™ processors, providing a direct advantage to retail locations that already use these processors for their store servers. These store servers are typically not fully utilized due to the enhanced computing power Intel's processors offer and can often be purposed to deploy the TCS Loss Prevention Solution. Intel® Core™ processors are recommended on a case-by-case basis and are optimal for retailers that require:

- A limited-scope engagement
- Minimal camera equipment
- An edge-only deployment
- A flexible engagement that considers their financial budget

The Intel® Distribution of OpenVINO™ Toolkit
Meanwhile, the Intel® Distribution of OpenVINO™ toolkit provides continuous performance improvements for deep learning models across a wide range of Intel® architectures, enabling TCS to offer high inferencing performance on the edge without the need for expensive GPUs. With this capability, retailers can minimize hardware costs without sacrificing accuracy or speed. Because the Loss Prevention Solution combines traditional video analytics with its deep learning models, TCS also leverages the Intel® OpenCV™ toolkit to process the video stream in real-time to deliver sophisticated gesture-based analytics.

Intel® Xeon® Processors
Intel® Xeon® Processors offer enhanced computing power to deliver exceptional scalability for retail engagements that require more demanding computing capabilities. TCS recommends upgrading to the Intel® Xeon® Processors if the customer would like to expand the scope of the engagement to:

- Deploy more cameras
- Deploy the solution across a retail chain
- Integrate cloud computing to access historical business intelligence reporting

TCS Image and Video Analytics Toolkit

At the heart of the TCS Self-Checkout Loss Prevention Solution is the TCS Image and Video Analytics Toolkit. Embedded with a library of reusable, highly customizable image and video analytics applications, this toolkit can be used as a modular building block for a wide range of use cases including manufacturing process optimization, workplace safety, security, and in this case, self-checkout loss prevention. All solutions are compatible across devices with seamless API-based integration. The easy deployment offered by the TCS Image and Video Analytics Toolkit empowers retailers to effortlessly adopt the TCS Loss Prevention Solution with fast time-to-market and minimal complexity.

For more information on leveraging the TCS Image and Video Analytics Toolkit to gain competitive multi-media insights, visit the TCS Cognitive AI product page and the TCS Smart Store product page.
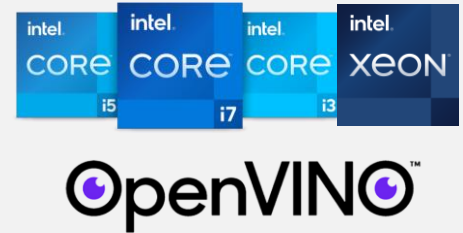
Solution Summary

Although self-checkout machines are deployed by innovative retailers to enhance the experience and efficiency of their checkout process, these machines can be prone to error, theft, and fraud. TCS designed its Self-Checkout Loss Prevention Solution to mitigate the financial losses of self-checkout machines by assessing customer hand gestures to detect when a transaction is not being completed correctly. By integrating the solution with their existing video surveillance to gain automated protection against self-checkout machine theft and misuse, retailers are able to maximize their profitability.

About Tata Consultancy Services

Tata Consultancy Services is an IT services, consulting and business solutions organization that has been partnering with many of the world's largest businesses in their transformation journeys for over 55 years. Its consulting-led, cognitive powered, portfolio of business, technology and engineering services and solutions is delivered through its unique Location Independent Agile™ delivery model, recognized as a benchmark of excellence in software development.

Learn More

- Tata Consultancy Services Website
- Intel® Core™ Processors Product Page
- Intel® Xeon® Scalable Processors Product Page
- Intel® Distribution of OpenVINO™ Toolkit Product Page

- Intel® Optimization for TensorFlow Introduction Webpage
- Intel® Optimization for PyTorch Introduction Webpage

intel.

Sources

1. IHL Group: Intel Worldwide Consumer Study, The New Normal Consumer, January 2022.
2. Soti: Annual Connected Retailer Survey, January 2019.
3. IHL Group: How Winning Retailers Differ on IT Spend, Greg Buzek, December 2021.
4. Raydiant: The State of Self-Service Checkouts, February 2021.
5. National Retail Federation: NR Reports Retail Shrink Nearly a $100B Problem, September 2022.
6. Internal Data of Tata Consultancy Services

Notices & Disclaimers