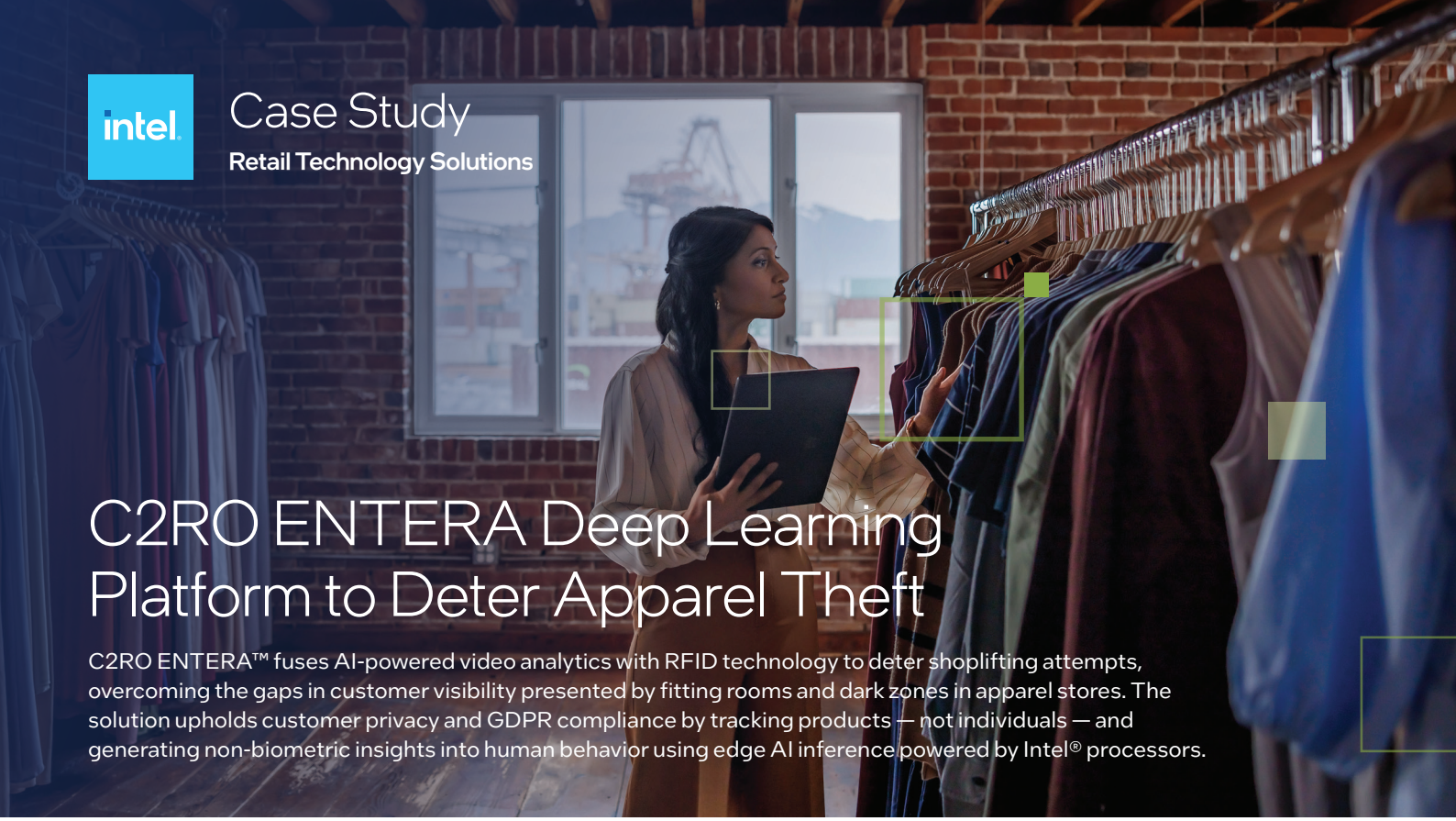


Case Study

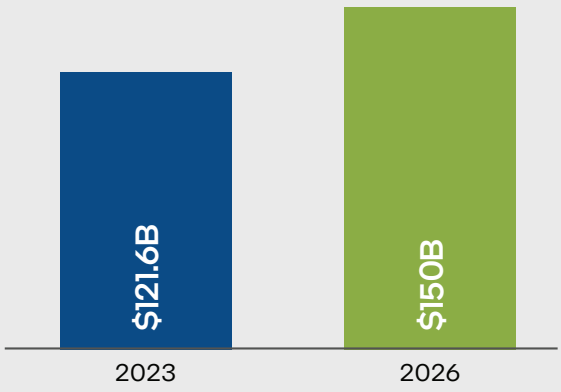
Retail Technology Solutions

C2RO ENTERA Deep Learning Platform to Deter Apparel Theft

C2RO ENTERA™ fuses AI-powered video analytics with RFID technology to deter shoplifting attempts, overcoming the gaps in customer visibility presented by fitting rooms and dark zones in apparel stores. The solution upholds customer privacy and GDPR compliance by tracking products — not individuals — and generating non-biometric insights into human behavior using edge AI inference powered by Intel® processors.

Theft is a persistent and growing drain on the bottom line for retailers. The problem's intractability is demonstrated by the fact that only a tiny minority of shoplifting crimes are detected by store personnel as they happen, creating an ongoing cadence of inventory shrinkage. With the average shoplifting incident now costing stores hundreds of dollars, technology solutions are arising to enhance retail loss prevention strategies.

Apparel stores present particular challenges for loss prevention, with high-value items that are easily concealable in private fitting rooms where customers cannot be observed. Surveillance cameras provide some protection, helping detect cases where a thief hides a garment under their jacket out on the sales floor, for example. RFID tags are also in widespread use, tying into inventory systems and alerting store personnel if a customer tries to remove a tagged item from the store.



losses due to retail theft ($US)[1]

~2%

of shoplifters are caught in the act[1]

~$462

average shoplifting incident loss[1]

Both types of measures have limitations. In a common scenario, a shopper gathers several items from the sales floor, in full view of in-store cameras, takes the garments into a fitting room out of camera view and removes or tampers with the RFID tags on some of them. The shopper then takes all of the garments to a self-checkout, where RFID baskets detect and charge for the clothes that still have tags on them, allowing the others to be removed from the store without being paid for.

It appears to the naked eye that this customer has done nothing wrong, and neither camera surveillance nor RFID tracking would detect the theft. While security cameras can track customer movement, they are poorly suited to detecting how many garments a shopper is carrying at any given time, and fitting rooms are a blind spot. Likewise, RFID can detect tags at multiple points in the store, but cannot detect items where tags have been removed, switched or tampered with. The C2RO ENTERA™ loss-prevention platform combines the two modalities, video analytics and RFID, to overcome those limitations.

AI-powered theft deterrence with C2RO ENTERA™

The ENTERA solution builds on existing cameras and other commodity video security infrastructure, adding intelligence based on deep learning to draw conclusions based on the **fusion of video analytics and RFID detection**.[2] Just as humans base their understanding of the world on a combination of senses, ENTERA melds two types of inputs together for novel insights that would not otherwise be possible. In keeping with C2RO's overall privacy commitment, the ENTERA theft-deterrence measures are fully GDPR-compliant.

Elements of ENTERA retail theft deterrence.

Multimodal theft detection

In the shoplifting scenario described above, the customer deception of removing, switching or disabling RFID tags occurs out of sight in the fitting room, making it difficult to detect at checkout. The C2RO theft-deterrence solution overcomes that limitation using multimodal analytics. ENTERA anonymously connects a customer at the RFID Gate entering the fitting room. RFID data collected by an RFID scanner at the fitting room ingress/egress point is fused with video analytics at that point.

Combining insights from the video analytics and RFID modalities, the solution could detect that the shopper left the area with fewer RFID tags than they entered with, a suspicious behavior that could signal a potential theft. Real-time statistical analysis can predict a potential theft, and there are several measures that can be taken at checkout and exits to enable soft deterrence mechanisms to curb losses without any form of confrontation.

The broader context of ENTERA retail transformation

Theft deterrence is just one of ENTERA's many capabilities — all privacy-aware — that help retailers with their loss prevention strategy. The ENTERA platform also analyzes visitor journeys with the aid of anonymous demographic classification to understand customer behavior and optimize their shopping routes. It can benchmark specific displays and store areas in terms of visitor behavior metrics such as dwell time, with visualizations for analysis to help improve efficiencies.

ENTERA offers powerful behavioral analytics, including queue and service counter throughput analysis, planogram compliance monitoring, and supply and demand insights to optimize inventory management. A standout feature is its unique heatmaps, which differentiate between staff and customer movement, providing retailers with one of the most valuable operational insights on the market. Discover the full capabilities of ENTERA at **www.c2ro.com/entera**.

FACELESS AI and GDPR compliance

The ENTERA platform uses video cameras and AI video analytics to produce an anonymous, biometric-free profile of the shopper, preserving privacy by never processing face images or gathering other personal information. GDPR has been a core design requirement since C2RO started delivering video analytics solutions to the market in 2019.

The company's concept of FACELESS AI underlies that requirement, implementing models that use all information available to them other than customer faces, actually enabling them to draw on more contextual information than more conventional approaches. The system does not use any facial recognition or uniquely identifying biometric information, and does not require cameras to be within the fitting room area, safeguarding privacy.

Measures to reduce TCO

To help reduce total cost of ownership for budget-conscious retailers, ENTERA is engineered to have very low system requirements. The software is highly optimized to increase efficiency, with small code size that helps minimize the burden on computing resources. Lean processing requirements help reduce in-store hardware costs, including for large retail deployments across many locations.

ENTERA enables further cost efficiencies through optimizations made in collaboration with Intel to run AI inference effectively on the CPU, meeting KPIs without requiring a discrete GPU or other external accelerator. Code portability across Intel platforms enables sizing of the solution at any scale, according to the needs of individual stores within large anti-theft implementations.

Accelerating innovation with the Intel® Partner Alliance

C2RO is a Gold member of the Intel Partner Alliance, as part of its broader commitment to the ecosystem. The program is the site of rich software optimizations for Intel processors built into the ENTERA solution. Co-engineering between the two companies helps ensure that ENTERA deep-learning inference minimizes overhead on in-store computer systems, helping provide business-changing results without the cost of hardware upgrades.

Intel enablement for visual AI inference at the edge

ENTERA performs live monitoring of the store environment, continually updating its anonymous profiles, tracking RFID events and providing insights based on customer journeys. This information must be handled in near real-time to respond to potential thefts while they are still in progress. Processing data at the edge, close to where it is generated, is a vital enabler for low-latency operation in support of that requirement.

Edge technologies based on Intel architecture provide hardware acceleration for ENTERA deep learning workloads to help ensure high performance and efficiency on CPUs at the edge. Data is captured locally near or at the edge, processed at the edge, and updated to dashboards.

Intel Core processors provide the foundations for cost-effective in-store computer systems, with a range of SKU options to scale for the needs of individual store locations. Edge computing powered by Intel delivers business benefits for ENTERA theft-deterrence solutions that include the following:

- **Near-real-time operation**. In-store events can immediately update live dashboards or send alerts to IT Operations tools, without the transfer latency of remote processing.
- **Lower bandwidth expense**. Avoiding the need for long-haul transmission of raw data to a cloud or remote data center eliminates the associated cost.
- **Enhanced reliability**. Local processing simplifies the data path, removing potential points of failure or performance degradation.
- **Security advantages**. The smaller attack surface when data is processed locally at the edge helps harden the solution's security posture and reduce potential vulnerabilities.

In addition to real-time theft deterrence, the C2RO solution provides for cloud-based batch analytics to discover and track trends and KPIs as well as support and inform marketing initiatives. Because the data captured by ENTERA is fully anonymous, these usage models are privacy-aware and GDPR-compliant. This flexibility enables retailers to maximize the future-ready value of ENTERA implementations.

Conclusion

Theft deterrence is one of C2RO ENTERA's transformative capabilities based on GDPR-compliant AI-driven video analytics using anonymous, biometric-free shopper profiles. Combining video analytics and RFID detection, ENTERA uses AI to flag suspicious transactions, helping drive down inventory shrinkage created by shoplifting. As a member of the Intel Partner Alliance, C2RO has optimized its software to deliver high performance on Intel platforms, reducing code size and compute requirements for lower equipment costs.

ENTERA's high compute efficiency delivers near-real-time performance, with AI inference accelerated on the edge system CPU — with no discrete GPU required — using the OpenVINO Toolkit. Intel edge technologies play a vital role in delivering the solution's business value, processing data close to where it is generated. The joint C2RO and Intel value proposition for retailers is compelling, with reduced store losses and optimized TCO.

Streamlined AI for the edge with OpenVINO™

C2RO engineers drew on the OpenVINO toolkit to accelerate visual AI inference for the ENTERA platform. The toolkit simplifies the process of shrinking and optimizing visual AI models, ensuring performance and accuracy while reducing resource requirements on in-store computer systems. Integration with AI Video Analytics enables OpenVINO to deliver low-latency, high-throughput operation.

Learn more

Intel Retail Technology Solutions
C2RO Theft Deterrence and Behavioral Analytics

Solution provided by:

intel + C2RO™

[1] Capital One Shopping Research, April 9, 2024. "Retail Theft (Shoplifting) Statistics." https://capitaloneshopping.com/research/shoplifting-statistics/.

[2] Patent pending.

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