



Computer Vision and the Future of Retail

*Better Shopper Experiences, Improved Loss
Prevention and Optimised Operations*

Sensormatic
by Johnson Controls



Computer Vision isn't necessarily new, but its value to retailers is rapidly increasing. The overall value of the Computer Vision market is expected to [reach \\$33 billion by 2025](#), up from just \$2.9 billion in 2018. Meanwhile, nearly 17% of retailers said they planned to deploy new Computer Vision technologies in stores between 2021 and 2023, and a further 10% are already in the process of upgrading their existing solutions.

But what will all of this investment actually deliver for retailers? How can retailers see measurable ROI on Computer Vision solutions, and how can retailers understand which Computer Vision technologies are right for them?

In this white paper, we'll unpack all of this and more – to empower retailers with the knowledge they need to make smart investments in one of retail's most vital and future-forward technologies.

What do Machine Learning and Computer Vision mean in the context of modern retail?

While the applications of Computer Vision and Machine Learning in retail are virtually limitless, some use cases are rapidly becoming common. In almost every case, these solutions – whether used separately or, most often, in tandem – work as a kind of 'staff multiplier', meaning they monitor and perform tasks that traditionally required a human decision-maker. This means stores can operate with fewer associates – and save on labour expenditure in the process.

Consider the example of a large department store: Instead of having a loss prevention officer watching a bank of monitors to detect theft or the kinds of behavioural indicators that come with it, Computer Vision technology can use Machine Learning to learn which behaviour to look for and then monitor for it, alerting loss prevention only when certain behaviour is detected. These alerts range from shelf sweeps, shoplifting single items, or even people loitering in groups to conceal the act of shoplifting. But that's not all – it can help maximise labour resources, provide item recommendations via smart mirrors, inform associates when stock levels are low or depleted entirely, and even monitor the car park for criminal behaviour and safety hazards.

These are just a few of Computer Vision and Machine Learning's potential applications across the retail environment. Others include:

- Creating retail heat maps based on actual consumer traffic to optimise the in-store experience
- Helping retailers understand shoppers' path to purchase in order to optimise merchandise placement
- Measuring shoppers' footfall, pass-by traffic, interactions, dwell times and more
- Detecting weapons, masks and aggressive behaviour
- Serving in-store advertisements
- Managing inventory levels
- Assisting with stocking and auditing planogram compliance

In short, Computer Vision and Machine Learning can play a significant role in automating basic tasks while prioritising important work for the associates, freeing them up to focus on the human interactions that create customer experiences.





What Computer Vision and Machine Learning can do for retailers

Computer Vision can deliver measurable ROI through enhanced loss prevention, a better in-store customer journey, a deeper understanding of the demographics of your shoppers and even help protect the car park. In other words, Computer Vision technology can impact almost every part of the retail ecosystem – but it can't quite do everything.

'There are a lot of misconceptions about the capabilities of technologies like Machine Learning and Computer Vision,' said Gopi Subramanian, global leader, AI centre of excellence, Sensormatic Solutions. 'They can do many great things, but they're not magic. They can't predict the future. But they can detect what we program them to detect – and they can do it very well.'

Why? To understand that, let's break down what Machine Learning and Computer Vision are.

Machine Learning

There are various types of Artificial Intelligence (AI), but the one that matters most here is called 'narrow AI', or ANI. Smart devices like Amazon Echo or Google Home are good examples of ANI. These devices follow specific programs, like listening for key sounds in your speech, and then execute preprogrammed commands upon detecting those sounds. They aren't truly thinking or interpreting the meaning of your words, but reacting to sounds they've been programmed to listen for. Machine Learning is a subset of ANI that, when given access to data – like a video feed – can not only execute preprogrammed commands upon detecting what it's been asked to detect, but also learn to detect them more effectively over time.



Computer Vision

IBM offers a wonderfully succinct definition of Computer Vision:

Computer vision is a field of artificial intelligence (AI) that enables computers and systems to derive meaningful information from digital images, videos and other visual inputs – and take actions or make recommendations based on that information. If AI enables computers to think, computer vision enables them to see, observe and understand.

In short, Computer Vision is a Machine Learning system's 'eyes', enabling it to analyse data via video, rather than, say, massive spreadsheets. That's a huge advantage for industries like retail, but as Subramanian said, they can't do the impossible.

As an illustration, he pointed to anomaly detection.

'We implemented an anomaly detection algorithm, and we combined that with aggressive behaviour detection,' Ares said. 'The solution could identify if someone's agitated and has produced a weapon, and then it can issue a real-time alert, which is exactly what the customer wanted. But we occasionally field questions about things like concealed weapon detection, which the solution can't fulfil – because no system can. If the camera can't see it, then it can't detect it. It's that simple.'

Purpose-built versus repurposed solutions:

What to know about differing approaches to Computer Vision solutions

While many retail technologies like point-of-sale (POS) systems offer value to one aspect of the enterprise, Computer Vision delivers value across the entire ecosystem. But to get maximum value from their investments, retailers need to identify the right Computer Vision solution for their unique needs. The first step is to identify what you want a Computer Vision solution to do for your enterprise. The second is understanding the pros and cons of solutions that are purpose-built for retail versus those that are adapted from existing, off-the-shelf technologies.

'There is no shortage of Computer Vision solutions that repurpose existing technologies for retail applications,' said Dustin Ares, product general manager, video analytics AI and incubation at Sensormatic Solutions. 'The primary upside of these solutions is typically cost. The downsides, however, are far more significant. They're cumbersome to implement, they often require significant new hardware – like entirely new camera systems – and they're limited in the value they can truly deliver because they're not built specifically for the retail environment. And since they're often capable of doing many things beyond what a retailer would need or want them to do, they typically require massive amounts of computing power, meaning retailers have to make room for server racks in stores where space is already at a premium.'

Speaking of computing power, Subramanian pointed out that many start-ups using open-source solutions boast hundreds of layers of detection – far more than a retailer would ever need.

'There are start-ups that claim to have hundreds of layers of detection – but what does that give the retailer?' he said. 'Does it make a solution any more accurate than a solution that has, say, three layers of detection? No – all those additional layers just add up to a need for more hardware that the retailer has to then find a place for. They're not actually getting better detection with those additional layers.'

On the other hand, there are a select number of solutions that are built expressly for use in retail environments.

'Solutions that are purpose-built for retail have a long list of advantages,' Ares said. 'Solutions like ours deliver accuracy that's head and shoulders above the basic open-source, object-detection models that start-ups typically leverage. They're designed to operate in a busy retail environment, and are built by taking data directly from in-store video footage. Purpose-built solutions can accommodate almost any type of retail environment, large or small, and can be configured in multiple ways. Stores in high-crime areas may prioritise weapon or aggressive behaviour detection, while others may want to map the in-store shopper experience or measure dwell time in front of a given set of displays.'

'Likewise, there's no "too big" or "too small" for purpose-built solutions,' he added. 'They can be deployed with greater effectiveness than off-the-shelf solutions in big-box stores, department stores or even convenience stores – and everywhere in between. In short, purpose-built solutions can be configured to any number of a retailer's priorities, no matter what type of store or stores that retailer operates – and they consistently deliver better results.'

Common applications of Computer Vision in retail

The uses for Computer Vision technologies in retail are varied, but there are some common use cases. Most centre around loss prevention, safety and security, inventory optimisation, and improving the customer experience, but that's hardly the extent of how Computer Vision delivers value to retailers. For example, some common applications include:

- Cashier-less points of sale
- Customer demography
- 'Person of interest' recognition for repeat offenders
- Heat maps
- Inventory management and optimisation
- Loitering, shelf-sweep detection and other behavioural analytics
- Mask and weapon detection
- Shopper journey and pathing analysis
- Traffic counters
- Theft detection and stolen item recognition
- Vehicle alerts
- Virtual mirrors

The list goes on, but these are the applications we see most often in today's retailers. In short, if a camera can detect it, it's likely that a Computer Vision solution exists to track and analyse it.

The Sensormatic Solutions advantage

With so many options to choose from, what makes Sensormatic Solutions' Computer Vision offerings different from the rest? Here are four reasons to consider before starting your own Computer Vision journey.



By retail, for retail

'As with all Sensormatic Solutions' products, our Computer Vision solutions are built with retailers, for retailers,' said Milton Rock Navarro, video solutions manager at Sensormatic Solutions. 'We have a team of fantastic engineers, data scientists and former retailers who have worked closely with our clients to build solutions that are tailored for today's changing retail environment. They're using real data from our customers' own stores to build these solutions, rather than the generic object-detection data used by many of the start-ups that are trying to penetrate the market with open-source technologies.'

As with all of our products and solutions, Sensormatic Solutions combines our vast retail knowledge from industry practitioners with the best of technology offerings to create real, tangible value for our customers. We've also developed our computer-based analytics to align with the most critical issues and needs of retailers, and we prioritise their current and emerging needs in ongoing our development process.



Keep your existing infrastructure

'Retailers have sunk hundreds of thousands or even millions into the legacy hardware in their stores,' Navarro added. 'From cameras to computers to anything in between, we know how expensive those technologies were to procure and difficult they were to implement. That's why we build our Computer Vision solutions around customers' existing technologies. No need to buy new cameras or new computing hardware. We'll craft a customised, leading-edge solution that works with what you currently have.'

What's more, our Computer Vision solutions are easy to deploy and painless to implement. Once the camera infrastructure is in place – and it usually already is – and the cameras are positioned to capture the desired behaviour or activities, retailers simply need to add one or more small Smart Hub devices that allows them to subscribe to all of our developed analytics. Retailers can add or delete these analytics as needed to keep pace with their changing business needs.



Any store, any segment – anywhere

'Many Computer Vision solution providers today are targeting retail giants – and only retail giants. They're not particularly interested in working with mid-market retailers or segments like petrol stations, convenience stores and food and drink retailers,' Ares noted. 'We, however, are. We work with global big-box retailers, department stores, speciality clothing retailers, convenience stores and everything in between.'



Increase efficiency and improve operational outcomes

As the labour shortage continues, most of today's retailers are asking their stores to do more with fewer associates. Computer Vision technologies can ease this pain by freeing your associates up to do more valuable tasks, such as engaging with customers.

'With computer vision, you no longer need an associate watching monitors or keeping watch at self-checkout, for example,' Ares said. 'Computer Vision performs many of the same tasks you were asking an associate to do, like watching for theft or suspicious behaviour like loitering. Now, you can re-task that associate to do higher-value tasks like engaging with customers. This can lead to more sales and a better overall customer experience – and it can make the labour shortage less painful.'



Easy to implement and maintain

'Some off-the-shelf solutions require so much computing power that retailers essentially have to build server rooms on site,' Subramanian said. 'But ours can run easily on very simple systems, the type that retailers are likely already operating. There's no need to reduce space for inventory to accommodate bulky hardware.'



About POSDATA

POSDATA is an authorized distributor of Sensormatic products and provides Sensormatic's full solution suite of technologies to improve operations and effectiveness. This includes sales and support for loss prevention, shopper experience, computer vision/video solutions, and inventory intelligence technologies. Contact POSDATA at sales@posdata.com.

About Johnson Controls

At Johnson Controls (NYSE:JCI) we transform the environments where people live, work, learn and play. As the global leader in smart, healthy and sustainable buildings, our mission is to reimagine the performance of buildings to serve people, places and the planet. With a history of more than 135 years of innovation, Johnson Controls delivers the blueprint of the future for industries such as healthcare, schools, data centres, airports, stadiums, manufacturing and beyond through its comprehensive digital offering OpenBlue. With a global team of 100,000 experts in more than 150 countries, Johnson Controls offers the world's largest portfolio of building technology, software and service solutions with some of the most trusted names in the industry.

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About Sensormatic Solutions

Sensormatic Solutions is the leading global retail solutions portfolio of Johnson Controls powering operational excellence at scale and enabling smart and connected shopper engagement. Our intelligent digital operating platform – Sensormatic IQ – combines the full Sensormatic Solutions portfolio, including third-party data to deliver unmatched insights into shopper experience, inventory intelligence, loss prevention and operational effectiveness with advanced technologies, like AI and Machine Learning. This enables retailers to act on prescriptive and predictive data-driven outcomes to confidently move into the future.

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