



Computer Vision and the Future of Retail

*Better Shopper Experiences, Improved Loss
Prevention, and Optimized 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 labor spend 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 behavioral indicators that come with it, Computer Vision technology can use Machine Learning to learn which behaviors to look for and then monitor for them, alerting loss prevention only when certain behaviors are 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 maximize labor resources, provide item recommendations via smart mirrors, inform associates when stock levels are low or depleted entirely, and even monitor the parking lot for criminal behavior 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 optimize the in-store experience
- Helping retailers understand shoppers’ path to purchase in order to optimize merchandize placement
- Measuring shoppers’ footfall, pass-by traffic, interactions, dwell times, and more
- Detecting weapons, masks, and aggressive behavior
- 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 prioritizing 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 parking lot. 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 center 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 the 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 analyze 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 behavior 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 fulfill – 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 are 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 many startups using open-source solutions boast hundreds of layers of detection – far more than a retailer would ever need.

“There are startups 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 startups 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 most any type of retail environment, large or small, and can be configured in multiple ways. Stores in high-crime areas may prioritize weapon or aggressive behavior 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 kind 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 center around loss prevention, safety and security, inventory optimization, 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 optimization
- Loitering, shelf-sweep detection, and other behavioral 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 analyze 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 startups 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 prioritize 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 customized, 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 behaviors 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 gas stations, convenience stores, and food and beverage retailers,” Ares noted. “We, however, are. We work with global big-box retailers, department stores, specialty apparel retailers, convenience stores, and everything in between.”



Increase efficiency and improve operational outcomes

As the labor 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, like 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 behaviors like loitering. Now, you can retask 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 labor 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 kind retailers are likely already operating. There’s no need to reduce space for inventory to accommodate bulky hardware.”



Learn More

For more information about how Sensormatic Solutions' Computer Vision and Machine Learning improves loss prevention, elevates inventory intelligence, enhances the shopper experience, and elevates your operational effectiveness, visit [Sensormatic.com](https://www.sensormatic.com) today. Or to start a conversation with one of our Computer Vision solutions experts, [just get in touch](#).

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 centers, 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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