

White Paper Adapting to a World in Flux with Smart CCTV

How Artificial Intelligence is transforming video networks into the powerful data tools we need



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Introduction

Today, there are two types of companies: those that understand how to harness data, and those that think they do.

The former are able to provide new products and services that are underpinned by empirically verifiable information. Take the example of Google and Amazon using their customers' data to precisely target the right advertising at the right moment. Or the likes of Spotify and Netflix adjusting iterations to enhance the customer experience based on how their users really use their services.

When it comes to those in the second group, they tend to be the more traditional companies. Organizations that may have been around for longer, lumbered with legacy systems, doing their best to adapt to this brave new world – but perhaps struggling to reconcile these new approaches with their existing methods and systems.

But it is a brave new world. We're moving from one with mass consumption to one with mass personalization. We're also in a world where access to technology has innovated new threats: secure buildings infiltrated by YouTubers, drones employed in terror attacks. Global pandemics upend everything we once considered normal.

The essential insights we need to rise to these challenges may be locked in our existing video networks. Artificial Intelligence (AI) is the key. With this knowledge, businesses can reimagine themselves, improving daily operations and customer experiences in the process. They can adapt to this new world.

This may come as a surprise. After all, as a technology, CCTV is a classic case of overpromise and under deliver.

Surveillance cameras helped to solve 4,500 crimes in Chicago over a four-year period, but crimes solved with the help of surveillance cameras comprised a mere 0.05% of all crimes committed.¹ Studies have found that better street lighting has a comparable deterrent effect to CCTV cameras in most cases, at a far lower cost.

This underwhelming performance is not the fault of the cameras themselves. Rather, it is the inherent limitations of the humans charged with monitoring them.

Humans cannot possibly keep up with every frame of video footage for 24 hours a day, 365 days a year – especially when charged with multiple screens. They cannot possibly keep track of suspicious individuals against a teeming mass of people that grows by the minute.

In 2018, 55% of the global population lived in an urban area. By 2050, that number is expected to grow to 65%, and 85% by 2100. Every day, there are more people occupying the same area. Every day, the attention of security staff, managers, and law enforcement is stretched that little bit thinner.

And every day, a treasure trove of invaluable data passes by these cameras. Information that could transform the efforts of city planners, operations managers, and business owners to meet the challenges of this brave new world. Data that can optimize infrastructure, keep communities safer, enhance overall customer experience and support the evolution of new business models. AI is the tool that can help extract invaluable data and insights from cameras, enabling businesses to optimize their operations and address constant changes.

Over the next few pages, you'll see how smart CCTV can revolutionize crowd management, real-time security, and the fight against crime. You'll also see how AI video analytics may hold the answers for businesses struggling to position their physical spaces in a digital economy.



1. <https://journalistsresource.org/studies/government/criminal-justice/surveillance-cameras-and-crime/>

Fulfilling the promise of CCTV

CCTV promised to help prevent crime. Keep people safer. Instead, it has become little more than a mandatory surcharge on insurance premiums. Necessary only for providing evidence for claims made after the fact.

During the 2018-19 financial year, retail crime cost \$35 billion in the U.S., and nearly \$26 billion in Europe. British retailers lost £1.9 billion to retail crime in 2018: £900 million from crime, and £1 billion trying to prevent it.²

The UK College of Policing briefs that although CCTV has been shown to achieve a 41% reduction in thefts in car parks, its impact on other crimes in other contexts is small, and arguable.

CCTV is failing to reduce crime. It is failing to make people safer. And it is of limited use in managing swelling crowds in urban spaces. **The problem is a deficit of attention.**

The attention problem

Humans have limited attention spans. And yet, we expect security staff to maintain a complete and present view of everything that passes through a dozen screens over a 12-hour shift.

How long we are able to maintain concentration depends on the task. But estimates vary from as little as eight seconds to 14 minutes on average. Even when we are focused, we are liable to miss important information on which we aren't directly concentrating.

In the famous Invisible Gorilla study, participants simply did not see a man dressed as a gorilla walk through the frame as they focused on counting the number of times a basketball was passed in the video; a phenomenon known as "inattentive blindness."

“...we at Fujitsu are teaching AI to recognize fraudulent point-of-sale (POS) activity, customers walking into unauthorized areas, and customers underpaying at self-checkout.”

And so, crucial patterns unfurling over hours, days, or weeks are easily overlooked. Patterns that could lead to infrastructural capacity collapse, carefully planned burglaries, or terrorist attacks.

Even if we were physiologically able to trace these patterns, it would be uneconomic. The labor cost of watching one hour of CCTV footage is roughly one hour. In most cases, it is simply not worth the resources to trawl through weeks of footage, despite the benefits doing so might bring.

AI is immune to these shortfalls. Able to maintain the constant vigil we can't, directing our limited attention exactly to where it is needed. So we can leverage AI capabilities to detect issues humans may miss, enabling humans to focus on other tasks.

As one security services company identified, the combination of AI, CCTV, and analytics enables “the transformation of physical guarding to a remote and automated security service.” More efficient security practices, yielding greater value from CCTV investment, at a time when maximizing return on existing assets has never been more important.

Identify, triage, act

The key to AI's applicability in a security context is machine learning. Machine learning algorithms learn in much the same way we do: recognizing patterns. Once the algorithm has seen enough examples of pixels arranged into what we would call a 'car', it can recognize them independently.

The principle applies to more complex patterns as well. In retail, for example, we at Fujitsu are teaching AI to recognize fraudulent point-of-sale (POS) activity, customers walking into unauthorized areas, and customers underpaying at self-checkouts.³

Having identified a potential incident, an alert can be triggered for security staff to triage the situation and take appropriate action.

This method can be applied to support ATMs as part of an EU Horizon 2020 project. AI monitors CCTV covering cash machines and flags any unusual or suspicious activity: transactions where a human isn't present, card skimming, the presence of known suspects or accomplices, and tampering with the camera itself.⁴

It also immediately alerts security to muggings or potentially coercive activity to aid in responding as rapidly as possible. Customers are safer. Banks are better protected from fraud.

2. <https://www.city.ac.uk/news/2019/march/annual-retail-crime-survey-reveals-the-1.9-billion-cost-of-crime-to-the-sector>

3. Examples taken from Tractica Video Analytics Research Report 2020 (2.8.1.2)

4. Ibid (2.8.6.1)



Preventing unwanted incidents

Having learned to recognize incidents in real-time, AI can establish commonalities that may precede them, granting predictive capabilities.

By learning environmental patterns often displayed before a terrorist act, AI can alert security to a potential attack before it happens – affording the opportunity to prevent it, or at least mitigate its impact.

Patterns can be as complex as emotional states or erratic behavior. Or they can be as simple as deviations from take-off and landing schedules, repeated intrusions into unauthorized areas, or leaving luggage unattended on public transport.

In many European countries, train stations must be shut down if unattended luggage cannot be reunited with its owner within five minutes. The station can only be reopened when the bomb squad has attended, satisfied it is safe.

We tested Computer Vision – our smart CCTV solution, that applies AI to camera footage – at one of Europe’s busiest stations to detect unattended luggage and find its owner. The AI identifies the last person seen with the bag and traces their movements to find their current location.

Security staff can be dispatched immediately, with a clear destination, dramatically improving their chances of resolving the incident within those crucial first few minutes – preventing transport disruption, and a potential act of terror.

Post-pandemic crowd control

These capabilities can extend to crowd control; a growing priority amidst increasing population density, its importance amplified by the COVID-19 pandemic. The real-time data of smart CCTV enables better, faster decisions – and feeds predictive modelling for contingency planning, and optimization.

Automated counts can maintain caps on customer numbers, perhaps using tablets to inform when it is safe to enter. Real-time alerts can flag significant violations of social distancing. Temperatures can be measured with the addition of infra-red sensors.

Hard passenger numbers can inform the redirection of crowds from crushed metro exits. Contingency plans for disruption – vehicle breakdown, terror attacks – can be predictively modelled for instant implementation; closely monitored for deviations necessitating adjustment.

Systemic issues can be uncovered, their optimal solutions identified by modelling. Smart city planners are already using a combination of Internet of Things (IoT) and Computer Vision data to optimize everything from crowd flow at major events to traffic re-routes to minimize accidents and disruption.

In all these ways, smart CCTV data enables better management of crowds, ensuring the most efficient use of resources. Achieving more with the same or less.

Unlocking the value in video networks

With only text and images at its disposal, ecommerce should be at an experiential disadvantage to bricks and mortar shopping. But the expert use of data to optimize and personalize has enabled e-tailers to overcome the medium's inherent handicap.

In the UK, for instance, retail footfall had fallen 10% in the seven years preceding COVID-19, as shoppers moved online. The pandemic has only served to amplify and entrench this shift.

Even before the pandemic, physical retailers were battling against convenience. Not only from home delivery, but from the act of shopping online itself. 90% of e-shoppers in 2018 abandoned their cart. 41% came back to complete their purchase. Online browsing can simply hum in the background.

It's also easier to compare prices online. Many shoppers use their smartphones to bargain hunt when in a physical store as well.

But under normal circumstances, even digital natives prefer to shop offline. In a 2019 survey by A.T. Kearney, 81% of Generation Z respondents said they prefer to shop in a physical store. Indeed, while conversion rates in physical stores average 20%, 5% is considered a success online – ample incentive to tempt shoppers back to brick and mortar stores.

The trick is repositioning these spaces in the context of a post-pandemic digital economy. The primary appeal of offline shopping is the experience. The chance to touch and examine products. To get the opinion of a knowledgeable sales assistant.

And yet, while 85% of US shoppers and 81% of European shoppers were satisfied with online shopping experiences, those numbers drop to 65% and 66% for offline shopping. Now more than ever, physical stores need to close the experiential gap if they are to remain relevant.

Smart CCTV offers retailers the opportunity to use the same kind of data, to make the same kind of improvements to offline shopping experiences, and capitalize on the tactile experience.

“ The primary appeal of offline shopping is the experience. The chance to touch and examine products. To get the opinion of a knowledgeable sales assistant. ”

Online abilities. Offline spaces

In recent research into AI, carried out by independent research firm Forrester Consulting on a commission from Fujitsu, 85% of business leaders agreed that “the success of my company's insights practices are linked to business outcomes.” 84% agreed that “insights are continually acted upon to optimize business outcomes.”⁵

Until now, offline retailers have struggled to gather the data necessary for these insights. Previous attempts at digital analytics for physical spaces have fallen short. Most utilize public wi-fi sign-ins, delivering incomplete, noisy datasets that dwindle as privacy tightens and mobile data cheapens.

Smart CCTV can harvest the same kind of data available online, without violating privacy, but reliably including every customer across three main data categories: quantification, qualification, and flow.

AI can *count* people. Recognize types defined by common characteristics. And track the movement of individuals or groups – within the bounds of privacy legislation. Bricks and mortar retailers are therefore able to know their customers in much the same way e-tailers do, following when they arrived, how long they stayed, what products they looked at, and so on.

This data, analyzed with the same kind of dashboards and natural language queries used online, can be used to enhance the offline shopping experience – principally by optimizing service, and in-store marketing.

5. *Starting Today, AI Will Power Businesses Into The Future*, a commissioned study conducted by Forrester Consulting on behalf of Fujitsu, May 2020



Optimizing service

In the A.T. Kearney survey, 22% of Gen Z shoppers had halted an online purchase because of a poor experience three to five times in the preceding year. That number rose to 24% in-store. For millennials, 15% had halted an online purchase, and 21% in-store. 73% of Gen Z preferred to discover new products in-store.⁶

There is comparatively more to gain in ensuring a frictionless service from door to till than there is from landing page to checkout. Smart CCTV offers the opportunity to achieve this.

Customers can be tracked to discover, for example, the optimal wait times for queues, how many staff are needed in each area to achieve these times, and how long sales assistants should allow a customer to browse before approaching.⁷

These insights can all be broken down into granular demographics. Couples may prefer to browse longer than families. Professionals on their lunch breaks may prefer assistance sooner – keen to get in and out with what they need as quickly as they can.

Retailers may discover operational issues they weren't aware existed. The same analytics can then be used to evaluate the success of interventions, beginning a process of continual refinement.

Optimizing in-store marketing

Through AI, there are even greater opportunities in optimizing in-store marketing. Retailers may discover, for example, that young professionals tend to spend more when playlist x is playing vs. y. When the store is filled with 70% young professionals, staff could be prompted to switch to playlist x.

Retailers can engage in online-style A/B testing. Sales campaigns can be evaluated by tracking whether customers look at a display wall, how long for, and breaking down the demographics. Product placement can be measured in much the same way. The results can inform future campaigns and changes in store layout.

And as customers grow to expect ever greater levels of personalization online, retailers can implement similar initiatives in their physical spaces. Customer segmentation, in-store behavior, and even facial expressions can trigger personalized offers, recommendations, or service actions.

In this manner, retailers can begin to craft a personalized customer journey that crosses channels between online and off, capitalizing on their respective strengths.

6. <https://www.cnbc.com/2019/09/17/gen-z-shopping-habits-can-fuel-a-brick-and-mortar-resurgence-report-says.html>
7. Examples taken from Tractica Video Analytics Research Report 2020 (2.8.1.4).

Uncovering opportunities

Online analytics often uncovers unexpected opportunities and ancillary revenue streams. Applying similar techniques can do the same for offline businesses.

Gas stations face obsolescence in the face of a looming shift toward electric vehicles and decentralized charging points. For them, it is an existential challenge to find supportive revenue streams that will ease the transition to alternative business models.

In a Computer Vision trial at a European gas station, an unusually high proportion of Audi and BMW vehicles were discovered – perhaps because of proximity to the city’s financial district.

The gas station capitalized on this insight by carrying more Audi and BMW-specific accessories, in the hope to increase customer sales. Further opportunities lie in offering access to this audience to the manufacturers themselves, perhaps through co-brands, discounts, and service plans.

Smart CCTV enables more direct revenue possibilities in renting access to this audience as well. Just as online advertising is bought on a pay-per-click basis, smart CCTV can track how many times a billboard or poster has been viewed, how long for, and by which customer segments.

These examples are just the beginning. We cannot predict the insights that could be discovered over time. Insights with the potential to guide gas station owners into new business models that will serve them in a net-zero economy.

Taking the first step

CCTV is made ‘smart’ with software. Existing cameras can achieve everything described in this paper. The insights come from the application of machine learning and other AI to video footage.

Organizations with advanced AI capabilities have deeper knowledge of their data, and use a variety of AI capabilities. Alongside video analytics (66%), they use machine learning platforms (59%), AI-enhanced business intelligence (63%), speech analytics (56%), and deep learning frameworks (56%) to an advanced level, among other technologies.⁸

The challenge is identifying which metrics to measure. Which AI technologies to adopt. Which patterns to teach the algorithm. Whether it’s customer segmentation, passenger flows, or suspicious behavior.

Over time, and as the algorithm learns, the data becomes more valuable. Sample sizes are increased. Month-on-month comparisons can be made. Baselines are established against which optimization trials can be measured. The information that will be most valuable depends on the challenges faced by the organization.

The final barrier is embracing this data. Using it to concretely shape organizational strategy. CCTV technology is impotent without the accompanying strategy to enable business transformation and organizational improvements, that in turn address and serve end customer needs.

44% of firms with advanced AI capabilities – and 54% with intermediate – recognize the importance of developing a workforce plan to identify AI supportive skills and roles, embedding data scientists in every area of the business.



8. Starting Today, AI Will Power Businesses Into The Future, a commissioned study conducted by Forrester Consulting on behalf of Fujitsu, May 2020.

Zinrai: Fujitsu's human centric approach to AI

That's where our human centric AI approach comes in. Zinrai is a framework for configuring best of breed technologies into co-created solutions.

All of us are touched by the historic challenges discussed in this paper, as individuals and organizations both. Zinrai AI is designed to help our clients to rise to new challenges, by augmenting their existing, human abilities. But also to play their part in steering us all through these complex, chaotic times.

We work closely with our clients to identify their goals and priorities, and shape the solution around them. The use cases in this paper rely on a custom configuration of Computer Vision and supporting AI technologies – but these are far from the limits of possibility.

And with our rare ability to deliver comprehensive, end-to-end solutions – including all hardware, software, engineering, and consulting – we ensure the necessary infrastructure, processes, skills, and talent are in place to harness the full potential of artificial intelligence.

Crucially, every Zinrai solution adheres to our [AI Commitment](#) to transparency, trustworthiness, and ethical use. Fujitsu's trusted human centric AI solutions, powered by Zinrai are benchmarks for responsible, ethical AI.

Protecting people's privacy

We are committed to ensuring all data collection, and real-time monitoring, is consistent with privacy legislation like the EU General Data Protection Regulation (GDPR) and the California Consumer Privacy Act (CCPA).

Real-time monitoring is designed solely to inform action as close to the camera as possible. All analytical data is appropriately anonymized, untraceable to the individuals it originated from.

We believe this approach strikes the perfect, necessary balance between protecting people's personal information and enabling our clients to solve the historic challenges we all face together.

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“ Fujitsu's trusted human centric AI solutions, powered by Zinrai are benchmarks for responsible, ethical AI. ”

Securing the future

By imbuing your existing video network with Artificial Intelligence, CCTV can finally deliver recognition capabilities, with the additional value of data analytics and insights organizations need to support business operations today, and in the future. One that can help to solve the biggest challenges we face as humans. One that can help to solve the biggest challenges we face as organizations.

71% of business leaders surveyed by Forrester agreed that [companies that fail to master AI in the next 24 months risk irrelevance](#). 79% reported already having moderate to advanced AI image and video analysis capabilities.

We have already seen how the data revolution has transformed our online spaces. Computer Vision has the power to do the same for our offline spaces.

Discover the intelligence you need to adapt to a world in flux and find out how Fujitsu – through Computer Vision – can transform your CCTV into your most valuable resource. [Contact us today.](#)