# ON THE EDGE

**Edge analytics applications can create real-time alerts, efficiently bringing the attention of human operators to incidents**

**Andrea Sorri** *reveals how edge analytics can be used to enhance safety and security*

**Y**ou'll have no doubt heard the term 'edge computing' (and possibly alongside it, edge analytics) and as processing power in end devices grows, so does the number of applications – especially in large-scale connected environments like smart cities.

As billions of devices become connected – the so-called internet of things (IoT) – and as more of these contain increasingly powerful processing capabilities themselves, edge computing is seeing exponential growth, and the video surveillance sector is also starting to see the benefits.

The latest surveillance cameras are a great example of devices with far greater processing capabilities than we have seen in previous iterations. When Axis created the world's first IP network camera in the mid-Nineties, it was to solve a basic need of remote monitoring. Its sole purpose was to reliably distribute images to a remote operations room, without the need for a server behind the camera.

Over subsequent years, this has been transformed (though the need to reliably return high-quality video footage has obviously been maintained). Advances in semiconductor design, along with innovation in deep learning and machine learning, mean that today's surveillance cameras are truly 'smart' devices.

One specific area where these advances are manifested is in edge analytics. Deep learning and machine learning are used to inform the surveillance camera user of what is being filmed, with the increased processing power of devices allowing them to do this analysis within the cameras themselves, in real-time.

Improved object recognition is one of the fundamental enhancements. Whereas in previous surveillance camera models the most advanced analytics could detect that something was moving in the scene, cameras can now attach far more accurate attributes to those objects. For example, is the vehicle in the scene a motorbike, car or a truck? Is that a human or animal by the building? Are those just shadows or a solid object lying in the road?

The benefits are immediately obvious, and particularly to administrators of our increasingly smart cities using big data platforms to understand more about their cities.

Every city around the world is concerned with improving its 'liveability'. While this is sometimes seen as an intangible concept, it is actually made up of some very measurable factors. Right at the centre sits the safety and security of citizens, which includes: rates of violent crime, vandalism, mobility, air quality, noise pollution and illegal dumping of rubbish. All of these impact wellbeing, safety and security, and all can benefit from edge analytics.

Indeed, more broadly, effectively using technology and data is central to cities meeting their objectives, which are often aligned to the United Nations' Sustainable Development Goals (SDGs). Recent research by ESI ThoughtLab, which surveyed administrators in 167 cities around the world, found that almost 8 out of 10 cities (78 percent) have fully incorporated the UN's SDG framework into their city plans.

The same research highlighted how effective use of technology and data is seen as foundational to achieving the SDGs. The research found that the cities making best progress towards the SDGs were also leaders in using technology, data and partnerships to achieve their social, environmental and economic goals. Today, the largest investments are being made in cloud (87 percent of cities), mobile (85 percent), IoT (81 percent), biometrics (72 percent) and AI (66 percent). These are what we call smart cities, and the link between technology, data and sustainability is clear.

## ADDRESSING PRIORITIES

The challenge for smart city administrators around the globe is applying their limited resources to address all of the city's priorities, and therefore creating efficiencies is essential. The greater accuracy of edge analytics based on deep learning – and the ability to distinguish between multiple classes of object – immediately reduces the rate of false positives and, with them, the false alarms that can quickly become a huge drain on law enforcement, first responders and other city services.

Edge analytics applications – which are being created to address every aspect of managing a city's services, from traffic to law enforcement; from supporting crowd management to monitoring weather – can create real-time alerts, efficiently bringing the attention of human operators to incidents and situations. One Axis partner that focused on traffic management found that the use of edge analytics based on deep learning reduced false alarms by a factor of 10.

Rather than rely purely on manual monitoring, advanced video analytics can monitor multiple video streams, spotting anomalies, unusual patterns, specific objects or suspicious behaviour and quickly bring an operator's attention to the scene. Intervention can then be triggered through emergency services, or via audio speakers on site, either warning criminals that they're being watched or offering assistance, advice and guidance to people at the scene. Such rapid reaction can stop a crime before it is committed, prevent the escalation of an incident, evacuate a specific area or even provide direct assistance before the emergency services arrive on the scene.

In some use cases which might quickly pose a threat to citizen safety and security, the alerts and actions triggered by edge analytics could even negate the need for human intervention entirely. For example, running AI analytics on the edge could identify objects on a road and alert or divert drivers through automated signage.

Further, the ability to distinguish between humans, animals, objects and vehicles can help define the level of severity of warning issued to drivers. If cameras saw that there was someone in danger on the road, they could automatically activate signage to stop traffic and alert emergency services. This real-time control helps to quickly support and maintain wider traffic flow throughout the city.

## ▌INNOVATIONS IN DEEP AND MACHINE LEARNING MEAN CCTV CAMERAS ARE NOW SMART DEVICES

A city's resources don't only include people, of course. Budgets need to be carefully managed, and the level of energy consumed by urban areas is under increased scrutiny, particularly in relation to the UN Sustainable Development Goals. Studies from the UN highlight that while cities only cover 2 percent of the planet's surface, they consume 78 percent of the world's energy and produce 60 percent of greenhouse gas emissions. Anything that can be done to reduce the consumption of energy will be valuable.

Edge analytics can play a part. Analytics taking place with a surveillance camera means that data is only transferred when something of note happens in the scene, rather than constantly. This immediately reduces the amount of bandwidth required (and the associated cost). It also reduces the amount of server capacity needed for storage. Aggregated across thousands of surveillance cameras recording 24/7 across a city, and it's easy to see how this can add up to a significant positive impact.

On a smaller scale, managing the internal environment in a smart building also provides a convincing use case. Edge analytics can be used to understand and control different factors which directly affect energy consumption, such as heating and lighting within the building. These can be adjusted to ensure the most comfortable and energy-efficient conditions for users in different parts of the building.

An additional (and perhaps, even greater) benefit of edge analytics – and one which will help smart cities not only increase efficiencies in safety and security, but also in planning future approaches to meet their goals – is its creation of metadata. Metadata is, essentially, data *about* the data. Taking the example of a mobile phone, when you take a picture not only does the camera capture the image itself, but it also collects

data about the image: the time it was taken, location (if that function has been activated), shutter speed and much more besides.

Using both the data in the image itself and the metadata can significantly improve the ability to search and analyse vast amounts of information. Someone with thousands of photographs on their

## EDGE ANALYTICS BASED ON DEEP LEARNING REDUCED FALSE ALARMS BY A FACTOR OF 10

mobile phone can quickly find those that contain a man with a hat in Greece taken between 12.00 and 14.00, for instance.

The same benefits come through the metadata created by edge analytics in video surveillance cameras, and the combination of data and metadata created by edge analytics can be hugely useful in helping to analyse enormous amounts of information collected over time. This will in turn help city authorities to gain insights into areas of interest, what

we might refer to as what they know they don't know. For instance, how many times have cars blocked bus lanes in the past month or what's the average number of people entering this metro station between 07.00 and 09.00 on a weekday morning? They don't know the answer, but they know what they're looking for, and the results could have a positive impact on improving a city's safety and security.

While this capability moves the benefits of edge analytics forward once more, possibly the greatest value will come through the 'unknown unknowns', when analytics starts delivering insights into what city administrators don't know they don't know.

Devices – and particularly the increasingly intelligent ones using deep learning – are incredibly good at recognising patterns and highlighting anomalies in them. The more data they have to analyse, the more accurate their predictions and insights become, leading to more rapid and accurate treatment of problems.

This is where the true potential of edge analytics in video surveillance lies. The analysis over time of vast amounts of data, leading to the identification of patterns and their anomalies, and enabling as yet unforeseen improvements in safety, security, service delivery and efficiency, and process optimisation ●

**Andrea Sorri** is Segment Development Manager Smart Cities EMEA, at Axis Communications

**Smart cameras and AI now have a far more accurate understanding of specifically what they are filming**