FUJITSU

Using surveillance cameras for marketing
AI-based image analysis delivers powerful new value

Surveillance cameras have been installed in many urban locations to prevent terrorism and other crimes, and now the scope of their role is expanding significantly. In addition to monitoring to provide advanced security, they are playing a progressively greater part in marketing activities. In the background is the rapid progression of artificial intelligence (AI). The use of AI to perform image analysis is expected to spark a diverse range of new ideas. To develop this concept in a realistic manner, what points should we be looking at? And what kind of usage scenarios are proceeding to practical application? Let's take a look.

The practice of installing surveillance cameras in urban areas for the purpose of preventing terrorism and other crimes is expanding worldwide. In the United Kingdom, sometimes referred to as the "security camera state", approximately six million surveillance cameras operate.

Surveillance cameras may make some people nervous, but their function is not limited to crime prevention. Recent years have seen sharp growth in the use of images captured by surveillance cameras in shops and other areas for marketing purposes. Using such cameras only for surveillance is purely "defensive" in nature. But if used for marketing purposes, a more "offensive" business-like approach can be adopted and investments can be more easily recouped.

The driving force here is the evolution of AI. The use of deep learning makes it possible to distinguish objects within each image with great precision. If we can pinpoint purchasing behavior according to age group and gender, for example, we can address customer needs more accurately. Deep learning enables us to count the number of people in an image and analyze their movements. In a retail context, this can be used to learn about the status and flow of customers, allowing store design to be further optimized.

Even when deploying surveillance cameras for conventional security purposes, there is a growing need for more advanced systems that use AI to detect sudden congestion and intrusions into restricted areas in real time. With the number of cameras increasing so rapidly, it is difficult for the human eye to look at images and detect and deal with abnormalities in real time. It is also not easy to recruit and retain surveillance personnel, particularly in Japan, where the workforce is shrinking as society ages and the birthrate remains low. By using AI to complement this task, it is hoped that high-quality security monitoring can be achieved while managing the workload of security staff.

In this way, using AI to perform image analysis has the potential to dramatically expand the potential for the huge number of cameras already in operation. What kind of obstacles must we overcome to make this successful? And what kind of applications are currently being used?

Two obstacles confronting AI-based image analysis

First, let's briefly explain the process by which AI is used to analyze surveillance camera images (Figure 1).

Images are initially captured by the surveillance camera and the data is stored in the video management system. This data is sent to a computer, equipped with a graphics processing unit (GPU) that is capable of high-speed processing, which then uses AI to perform the analysis. The results are output as analytical data and visualized further. As this process shows, it will soon be possible to use analyzed images captured by surveillance cameras in business applications for the first time.

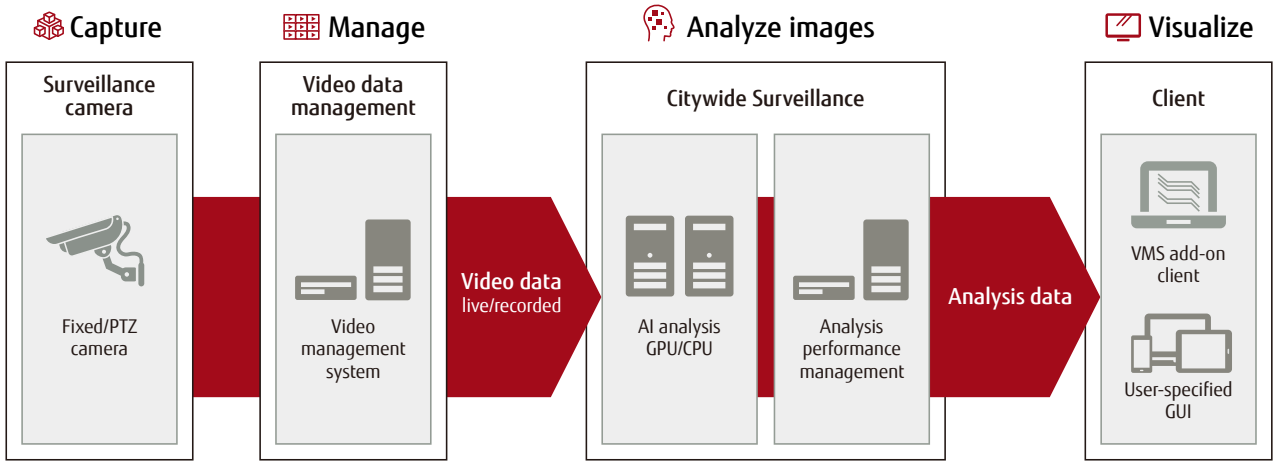

Figure 1. Process of using AI to analyze surveillance camera images

"To perform these processes effectively, we need to solve two major problems," says Seiichi Nakamura, Senior Director, Frontier Computing Center, Technical Computing Solutions Unit, Fujitsu Limited - an expert working at the forefront of Fujitsu's technical computing initiatives, including AI. The first problem is securing a sufficient volume of "training data" required to conduct AI-based learning.

Seiichi Nakamura adds, "For example, using deep learning to analyze an image of a car makes it possible to not only show that the object is a car but also identify the make and model of the vehicle. Creating a more accurate learning model, however, requires large amounts of training data with differing angles and lighting variations. Millions of images may be required to identify a wide variety of car makes and models."

The second problem is how to handle the huge computing workload. The volume of calculations required to perform analysis will become enormous, in light of the real-time nature of image analysis and the enhanced resolution of cameras. It is also essential to design a system architecture capable of distributing the various computational tasks, such as selection of the optimal analysis method and scheduling.

"Fujitsu is able to offer optimal comprehensive solutions based on the AI image analysis software FUJITSU Technical Computing Solution GREENAGES Citywide Surveillance." explains Seiichi Nakamura. Combining a broad spectrum of Fujitsu technologies makes this objective a reality.

Combining wide-ranging technologies to achieve practical AI applications

"To obtain sufficient training data, we utilize simulation technologies honed over many years." According to Seiichi Nakamura, "Even if only a small number of real images can be obtained, simulation can be used to change shadow forms and other aspects, which increases the amount of training data available."

"By increasing the number of images virtually in this way, we can swiftly expand the scope of deep learning applications." says Yuri Murotani of Fujitsu's Frontier Computing Center, Technical Computing Solutions Unit. Fujitsu Laboratories, which engages in broad-ranging R&D aimed at solving social problems, also plays an important role in this initiative. According to Yuri Murotani, "Fujitsu also has vast experience in the ongoing development of supercomputers, and this knowledge can be applied in developing simulation technologies."

Seiichi Nakamura

Senior Director
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To address the huge computing workload, the company offers FUJITSU Technical Computing Solution TC Cloud, a cloud-based service that uses GPUs for learning. It is claimed that this service realizes world-class speed in terms of learning processing capacity. Meanwhile, Fujitsu is also engaged in edge computing, which divides the processing roles between the surveillance camera and video management system. It is also possible to reduce the workload when necessary by distributing the processing tasks.

According to Seiichi Nakamura, "Adding to Fujitsu's strengths are its technologies for the efficient transmission of video data." Fujitsu has been working on systems for TV broadcasting stations for many years and can utilize the video distribution technologies it has developed during that time.

The Real-time On-site Video Sharing Solution already released by Fujitsu enables video to be transmitted securely, even via unstable mobile lines. In addition to real-time compression and transmission of video, the solution has its own video transmission control technology, enabling seamless transmission of images even during poor reception conditions and when there is reduced throughput.

Using video transmission technologies in this way allows images from in-vehicle cameras to be sent to the cloud for analysis in real time. Fujitsu has also developed an in-vehicle camera capable of 360-degree filming, and has established a system that can provide one-stop video solutions, from capturing to sharing and analysis (Figure 2).

AI-based image analysis already applied in the marketing field

How can these technologies and solutions be applied in the real world? The first example, highlighted by Seiichi Nakamura, is the identification of automobile models and license plates at gas stations.

According to Seiichi Nakamura, "AI-based image analysis enables us to identify car models and license plates. This makes it easy to examine how vehicle models differ according to gas station, and to link image data with license plates and maintenance service histories in order to formulate the most appropriate responses. It also permits a better understanding of behavioral patterns of consumers in gas station shops, which helps station operators bolster non-fuel-related income" (Figure 3).

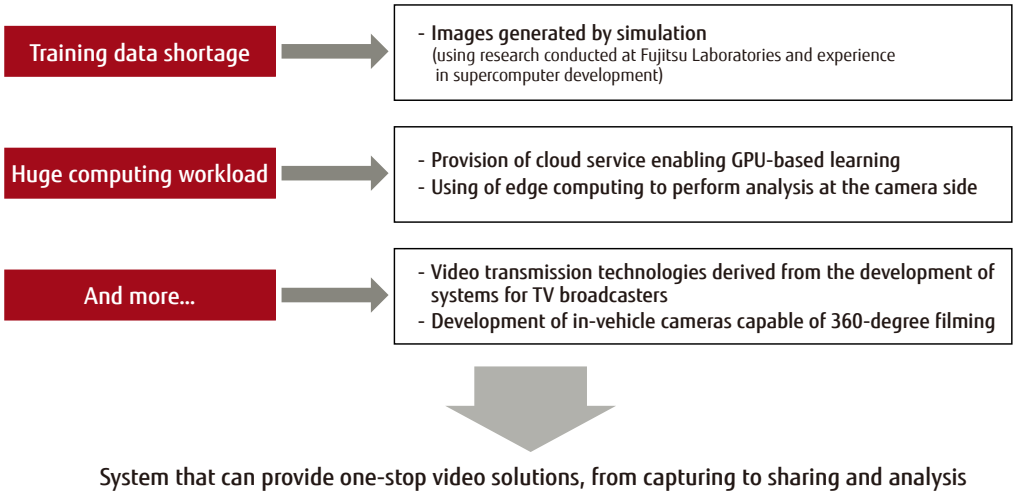

Figure 2. Fujitsu's approach to AI-based video analysis

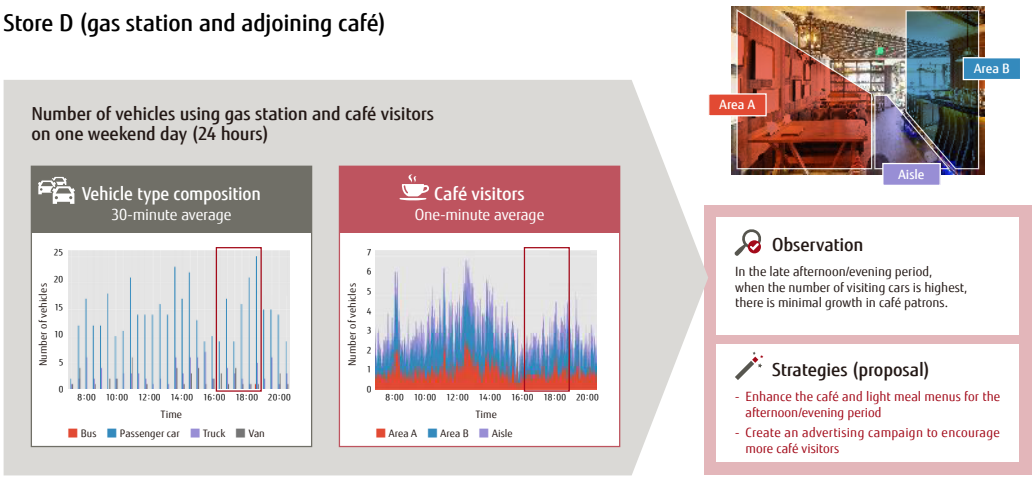

Figure 3. Example of application in a café adjoining a gas station

Meanwhile, Yuri Murotani points out how the technology is used in a shopping mall food court. Based on positional information of people standing and sitting, we can automatically identify where the seats are located, which enables us to understand how long people stay and the status of seating congestion.

Yuri Murotani adds, "Recently, we have seen the arrival of mobile ordering, where people use their smartphones to place orders. However, people who are in the store also encounter problems, such as waiting for mobile orders to be processed and looking for seats, which creates further congestion and makes the situation more complicated. Using AI in this case makes it easier to understand the length of stay of customers and the seating congestion situation. This in turn enables the store operator to provide information to customers in advance and devise appropriate solutions. Even if the store layout is changed, AI automatically recognizes the seating arrangement, so manual resetting of data is not necessary. An understanding of seating congestion patterns enables store operators to consider optimal seating configurations in advance, based on congestion time periods and the number of store visitors."

As we can see, AI-based image analysis has reached the stage of marketing applicability. Surveillance cameras are no longer used just for monitoring people for crime prevention purposes. In the future, AI-based image analysis promises to make major contributions in everyday urban situations, for example by realizing safer and more comfortable lives, improving customer experiences, and transforming corporate management practices.

Yuri Murotani

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In this food court example, AI is used to automatically envisage the seating configuration based on the positional information of people standing and sitting.

This paper is a translation of an article first published in Nikkei xTECH Active in February 2018.

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