EO/IR solutions harness the power of artificial intelligence

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Advanced data-rich capabilities are driving more agile perimeter and airfield surface surveillance. *Hugh Griffith* **reports**

Operational military requirements have driven the development of advanced electro-optical/infrared (EO/IR) solutions for force protection, situational awareness, all-weather imaging, wide area monitoring, and target tracking.

Many of these capabilities for advanced security and surveillance can also be applied to protect airports and other critical aviation infrastructure, particularly given the ever-evolving threat landscape. Dangers include hostile activity on the approaches to an airport, breaches of the perimeter defences by individuals and vehicles, and airspace incursions by unmanned aerial vehicles (UAVs).

EO/IR sensors play a significant role in airport security surveillance and monitoring systems, either as stand-alone systems or integrated as part of a wider solution for secure and efficient airport operations. For perimeter intrusion detection, EO/IR delivers day/night, all-weather surveillance and monitoring, enabling persistent surveillance of an airport and its environs. As well as intrusion detection on the perimeter fence line, these systems can find and manage the identities of personnel moving through an airport, including passengers and workers.

The SPEED-BIRD multisensor surveillance system is in service at Ben Gurion International Airport, Israel. (CONTROP Precision Technologies Limited)

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In the past decade the threat to critical infrastructure from UAVs has increased. Commercial and consumer UAVs feature advanced technologies and high-performance capabilities including autonomous flight operation. The misuse of UAVs presents increasing airport security concerns as systems become more widely available. Small non-metallic UAVs are difficult to detect with radar

as they generally have small electromagnetic (EM) signatures, whereas thermal imagers capture the IR radiation of a scene (detecting small differences in IR signature). This capability that helps to improve UAV detection performance compared with other systems.

The need for speed

Capturing images with high-resolution EO/IR cameras is one deliverable for airport security, but it is equally important to analyse those data quickly for accurate decision making. High-resolution, high-frame-rate video and image capture results in the need for wideband networks for data sharing. Data processing requirements are now very heavy, meaning that high-performance computer systems are required to process image data and to run complex image analysis algorithms. Airport EO/IR image-capture solutions also have large data storage requirements, as imagery is archived for forensic analysis or post-event investigations.

Manufacturers supply software tools that manage the function and output of their EO/IR sensors, to yield as much information as possible from the captured images. Software tools also reduce the training overhead and burden on the system operator, and enable faster decision making, by taking advantage of automated data analysis to detect, find, and classify threats.

Artificial intelligence (AI), powered by faster computers and the parallel computing performance of graphics processing units (GPUs), allows advanced image analysis of large image datasets, bringing new capabilities for surveillance applications. The GPU – originally developed for parallel processing to accelerate graphically intensive functions – also enables advanced processing power for general computing tasks including data analysis, taking these tasks from the central processing unit (CPU).

A GPU uses a parallel architecture consisting of thousands of smaller cores that process multiple tasks simultaneously (in contrast, a typical CPU includes eight or 12 cores). Harnessing the power of GPUs has enabled new capabilities that enhance general-purpose computing, and GPU acceleration is a significant feature in AI, UAVs, and robotic systems.

Versatile TWISTER

One system that uses GPU acceleration and AI is TWISTER from CONTROP Precision Technologies Limited. CONTROP manufactures EO/IR sensors, systems, and advanced software solutions for the defence and homeland security markets and applies that proven EO/IR expertise to other markets including aviation safety.

TWISTER is a passive high-speed scanning and observation system that gives a panoramic 360^0 image of a target area and provides automatic moving target detection. The system creates a virtual fence and detects maritime, land, and air targets.

TWISTER has a multitarget tracking capability, and uses a cooled medium-wave infrared (MWIR) thermal imaging camera that features a continuous optical zoom lens. The system has a 360° horizontal, 18° vertical field-of-view and a panoramic scan frequency of 1 Hz. It is capable of tracking and detecting a human-sized target at a range of 4 km. When the system detects a target it automatically saves a track file, and continues to run and scan the designated area. The operator can refer to the recorded track and has the choice to investigate it in real time.

Designed for use as a stand-alone system or integrated into a network architecture, TWISTER can be mounted on a mast or fixed to a tower or building. The system features H.264 video encoding

and displays the captured 360° panoramic picture on a single screen for ease of viewing and monitoring. A laptop gives local system control, and the system also includes a remote operation functionality via integrated RF and Ethernet network connections. TWISTER integrates into wider system architectures, including command-and-control (C2) solutions. The system includes proprietary control software from CONTROP that features advanced algorithms to improve target detection rates and to differentiate targets from noise and background clutter.

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