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Optics and Photonics for Counterterrorism, Crime Fighting, and Defence XII

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Yitzhak Yitzhaky, Ben-Gurion University of the Negev (Israel)

Introduction

The conference was arranged around two themes: the detection and identification of dangerous, hidden and suspicious materials, weapons, contraband and counterfeits; and the identification in CCTV and thermal imagery of suspicious activity– vehicles, people and their actions and objects associated with them. An increasing use of unmanned aerial vehicles (UAVs) became apparent during the conference. These are attractive in being able to carry sensors to inspect suspicious objects or activity, but so far their look-down imagery is less amenable to automatic image processing since there is so little top-down data for algorithm training. A second observation was the number of programmes that were collaborative across nations, funded for example by European Union FP7.

The first session began with three presentations on techniques for strengthening anti-counterfeiting features. A United Kingdom/India paper [999501] explained techniques that would strengthen holographic features. A European Union FP7-funded paper [999502] described measurements on automatic passport readers that could lead to operator-free border crossings. The third paper, from France [999503] described how optical image authentication algorithms could help strengthen encryption. The session moved on to searching for hidden dangerous materials and objects at short range with descriptions of improved X-ray techniques for baggage scanning in [999504] from the United Kingdom, [999506] and [99950X] from China and developments of Raman sensing for chemicals and explosives hidden in containers in [999505] and [99950C], both from the United Kingdom. The conference co-chairs recommended this last presenter, Arne Schumann, be awarded the best student paper prize.

At longer ranges, other techniques come into their own. An Italian paper [999508] described a crime scene analyser that used laser induced fluorescence (LIF) to discriminate between different classes of materials. When suspect materials are in aerosol or vapour form, they can be detected and sometimes identified using mid-infrared backscatter [999507] (United Kingdom) or LIF [999509] (Germany), or point and remote sensing can be combined [99950A] (Canada). The automatic detection of fluorescence spectra from biological agents was described in poster [99950W] from Italy. Whilst outdoor sensing techniques continue to be developed, in the laboratory, a researcher from the United States has developed new components [99950B] that will improve point detector performance.

The session concluded with papers concerned with explosives detection. [99950D] from the United Kingdom covered sparse Raman un-mixing for fingerprinting and quantification, [99950E] from the United States described experiments to measure how explosives residues transferred between criminals

and things they touched. From the Russian Federation there were two papers; the first [99950F] on using laser desorption to increase the sensitivity of explosives detection, the second [99950G] on how, at THz frequencies, packaging affected the identification of dangerous materials.

The second day began with a session on detection, tracking and re-identification in imagery from airborne platforms. A German paper [99950H] described how to counter the effects of camera jitter. Netherlands' contributions followed on the subjects of tracking moving targets in airborne imagery [99950I] and of object recognition using deep convolutional neural networks [99950J]. Two German presentations described how best to handle multiple tracker algorithms with different strengths and weaknesses [99950K] and how to use deep learning to improve person re-identification from above [99950L]. The conference co-chairs recommended this last presenter be awarded the best student paper prize.

The session on detection of anomalous events and behaviour was opened by a Netherlands' presentation [99950M] on measuring clues from a person's demeanour that might indicate they were lying (or likely to be telling the truth). The same speaker described a system for image understanding [99950P] based on low-level processing components described as symbols and flexible user-definable and user-understandable combinations of these components, called sentences. A Swedish speaker [99950N] explained his work on the autonomous detection of crowd behaviour and there was a German presentation [99950O] on detecting and alerting operators to possible infrastructure manipulation.

In a concept that was new for this conference, we concluded with six papers all on one topic; a United Kingdom project called SAPIENT (Sensing for Asset Protection with Integrated Electronic Networked Technology). Attendees were given an explanation of how the autonomous sensors could be operated in a plug and play mode [99950Q], the workings of the laser scanner [99950R], the thermal sensor [99950S], the radar scanner [99950T], the legacy CCTV camera [99950U] and finally [99950V] how threat assessment and sensor management could be carried out using the SAPIENT architecture.

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