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Title: Multi-Sensor Fusion and 3D Mapping

Abstract:

Recent developments in radiation detection and imaging in combination with the enormous advances in computer vision and data processing enable unprecedented capabilities in the detection, mapping, and visualization of radiological and nuclear materials even in complex environments. We have developed the multi-sensor fusion concept called 3-D Scene Data Fusion (SDF) that allows us to map scenes in three dimensions and to fuse them with nuclear radiation data in near real time while moving freely through these scenes. This concept provides new means to visualize radiation relevant not only for experts and operators but in the communication with the public. We have combined SDF with commercial gamma-ray spectrometers and imagers as well as custom-made instruments providing omni-directional coded-aperture and Compton imaging in compact configurations on drones, ground-robots, and in hand-portable configurations. In addition to imaging and mapping gamma-ray sources in 3D, we have also demonstrated the ability to detect and map neutron sources in 3D from small unmanned aerial systems. SDF has been deployed in source search scenarios and in contamination mapping for example in Fukushima and in Chernobyl. It reflects its utility in proliferation detection and emergency response as well as in the decontamination, decommissioning, and remediation of radiological and nuclear materials and facilities. We will report on the emerging multi-sensor fusion and 3D mapping concept as well as on advances in radiation detection and imaging systems to allow the assessment of gamma-ray, neutron, and electron-emitting radiological materials in-situ.