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Abstract

Compared to human vision, thermal imaging provides a very narrow field of view and no depth discrimination. Multi-aperture thermal imaging (MA-TIR) has been fused with computational imaging techniques such as stereo vision, integral imaging, and single-photon LIDAR. 360° 3D situational awareness with early threat detection is now possible with applications in battlefield technology.

Project Description

Extreme field-of-views are unavailable in the long-wave infrared. The MA-TIR imaging system provides panoramic 360° imaging using low-cost off-the-shelf components. The scalable system architecture allows for arbitrary pixel resolution with a maximum pixel count proportional to the number of cameras integrated into the imaging architecture [1]. When combined with integral imaging and stereo vision, passive ranging and imaging occluded objects is achieved providing enhanced situational awareness. Furthermore the complementarity of integrating single photon avalanche diode (SPAD) with the MA-TIR imaging system can further interrogate a 3-D scene through TCSPC LIDAR. Recent results have detected breathing in a cluttered scene.



Fig 1. Image of MA-TIR System

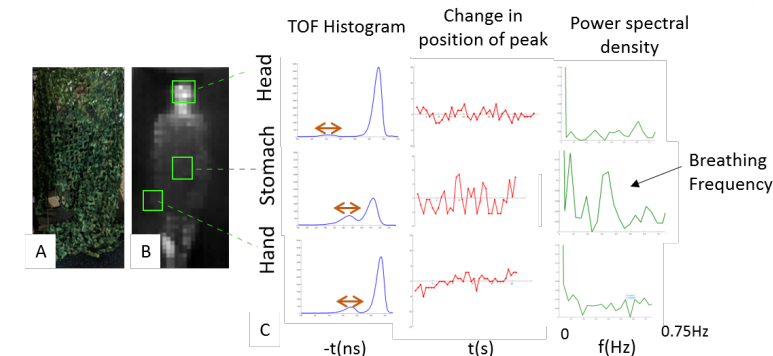


Fig 3. Detection of breathing of occluded person



Fig 2. Panoramic image captured on MA-TIR System (for VR video scan QR Code)

Key Results, Conclusions, Comments

- MA-TIR has a scalable architecture, pixel count is no longer limited by a single detector.
- Curved detector reduces optical aberrations and enables simpler optics
- Versatile Modalities such as passive ranging, imaging and imaging occluded objects have been shown.
- Incorporation of SPAD enables precision ranging and detection of biological micromovements for early threat detection.
- Scan QR code to see 360° MA-TIR virtual Reality video
- Current looking for post-doc opportunities.

[1] Cowan LV, Babington J, Carles G, Perciado MA, Wood A, Harvey AR. 360° snapshot imaging with a convex array of long-wave infrared cameras. In Computational Optical Sensing and Imaging 2019 Jun 24 (pp. JW4B-4). Optical Society of America.



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