RB.2: Stationary & Aerial Based Radar Detection of Concealed Threats

Soft Target Engineering to Neutralize the Threat Reality

Mahshid Asri, Ann Morgenthaler, Carey Rappaport (NU)
rappaport@coe.northeastern.edu

SENTRY Challenge

Use radar to detect large concealed person-worn metallic objects, including concealed weapons / IEDs in a crowd and provide real time detection of threats on people in STCP. Configure systems so that they are:

- Pervasive
- Massively networked
- Inexpensive
- Low maintenance
- Flexible

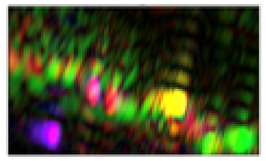
Couple radar with video for continuous tracking of suspicious individuals

Accomplishments

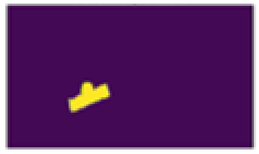
- Developed and applied FDFD computational model for metal objects on body
- Conceived and tested Luneburg Lens with reflectors as cheap multibeam radar antenna
- Developed a Deep Learning Model that can detect metallic objects in radar images:

Ground truth

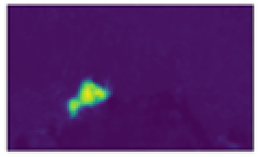
3 radar images combined in RGB format



Ground truth anomaly mask



Predicted anomaly mask



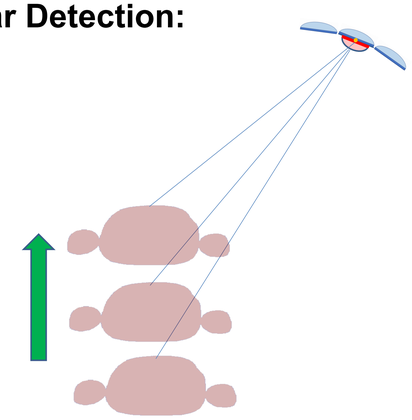
Addressing the Challenge

Fused standoff multibeam radar / video strategy remains fixed, determines the presence – and tracks threats, with no operator needed

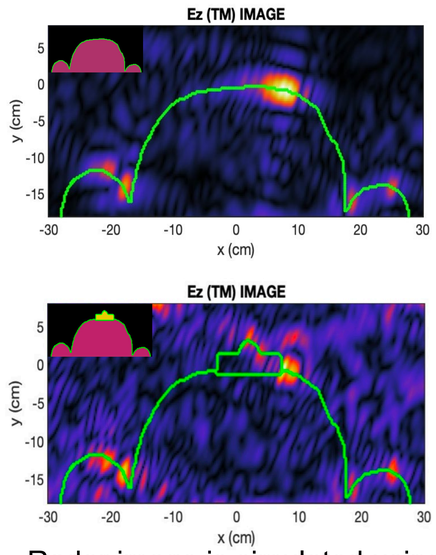
- Detect with mm-wave radar taking advantage of highly reflective anomalous imaging features, identified through modeling
- Use novel inexpensive multibeam antennas to scan full scene, pass suspect off from beam to beam
- Signal to video to track suspects and report to Virtual Sentry
- Use as pro-active rather than a forensic tool
- Aim to be faster than metal detecting portals
- Design so that size, weight, power compatible with drone flight
- STCP stakeholders include city planners and leaders, first responders, and venue administrators who want to ensure the safety of pedestrians

Networked stationary pole-mounted multi-beam radar with coupled video, scans pedestrians on city sidewalk for concealed threats and then follows suspects.

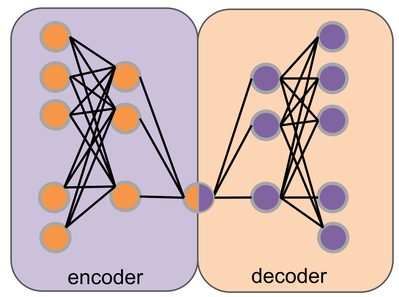
Radar Detection:



- The person walks toward the radar.
- Radar captures multiple snapshots of the subject on the move.



Radar image is simulated using FDFD computational modeling.



- Artificial intelligence is used to predict the location and shape of large metallic guns on the torso.

Next Steps

- Continue work with industry (Leidos, Raytheon, Rogers, Fortify) to develop cost-effective network of radar units
- Develop strategy for venue-specific siting configuration: internal corridors in schools/stations, or approaches to facilities
- Configure sensors for best reporting to Virtual Sentry
- Enlarge and generalize the simulated radar dataset for better results: include more body shapes and various anomaly forms.
- Combine data captured from video recording to radar images to enhance the accuracy of concealed weapon detection.

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