SIGMA+ Tiered Algorithm Architecture

Algorithms for CBRN Threat Detection, ID and Characterization

SIGMA+ uses an advanced tiered algorithm architecture to improve detection sensitivity, identification accuracy, as well as clutter and false alarm rejection associated with CBRN sensor platforms deployed in both static and mobile configurations. Sensor-level algorithms improve detection sensitivity by > 10x while operating at a false alarm rate at least two orders of magnitude lower than existing, state-of-the-art capabilities. A network of sensor assets transmit raw data and sensor-level alarms to the DTECT Common Operating Picture (COP). DTECT enables the execution of a data fusion approach that provides near-real time characterization of threat plumes and accurate network-level decisions of threat likelihoods.

Real-time CBRN threat detection and identification in complex urban environments with ability to predict the spatio-temporal extent of the threat plumes

R/N Tier 0 (sensor-level execution)

- *Employs PSI's award-winning Poisson Clutter Split (PCS) algorithm*
- *Exceptionally low false alarm rate and stability in complex and variable radiological backgrounds using NORM rejection and clutter suppression*
- *Highly sensitive, 1 Hz detection, identification, left / right directionality with contextual information*
- *Exceeds ANSI N42.43 and DNDO TCS sensitivity requirements while operating at a false alarm rate of less than 1 in 340 hrs of continuous 1 Hz acquisition in complex urban environments*

Chem Tier 0 (sensor-level execution)

- *Optimized for Ion Mobility Spectrometers (IMS) to generate detection and identification against 31 chemical targets, including CWAs*
- *Spectral data is analyzed using a 1D Convolutional Neural Network architecture that has been designed to improve sensitivity, specificity and clutter alarm rejection in low SNR conditions.*
- *$P_{d,ID}$ > 85% at 5 ppb, 40 mph, and CWA false alarm rates < 1 in 4 days with 1 sec sampling*

CORAL (Chem Tier 1, sensor-level execution)

- *Incorporates contextual data and information on businesses of interest for chemical alarm categorization by distinguishing background variations from threat emissions*
- *Provides exculpatory information for >75% of benign chemical alerts to reduce operational burden*
- *Annotated contextual video significantly increases human understanding of the potential source of alerts and enables more efficient response*

CB-SIGMA (Tier 2, network-level execution)

- *Uses a network of mobile and/or static CB-sensors to estimate the likelihood of an attack, the source, and the affected area*
- *Incorporates advanced, near-real time plume propagation modeling to predict release dynamics and estimate the release location to within better than 50 meters*
- *Tracks threat likelihood and yields reliable network-level threat alarms with an urban operational false alarm rate of < 1 in 1 month for a 4-sensor network*

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