INNOVATIVE APPROACHES TO ELUCIDATE OPTIMAL DEPLOYMENT OF CB SENSING ASSETS

Tactical Awareness Kit Tactical Sensor Placement

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Predictions of chemical and biological (CB) hazards provide first responders with the necessary knowledge of when and where to operate for search, surveillance, and assessment of CB emergencies. Historically, analysts have used time-consuming and computationally expensive physics-based modeling, such as the Hazard Prediction and Analysis Capability (HPAC) or the Lagrangian Operational Dispersion Integrator (LODI) models, to ascertain this knowledge.

The Tactical Awareness Kit Tactical Sensor Placement (TAK-TSP) software plug-in combines artificial intelligence/machine learning (AI/ML) trained on the results of a sizeable physics-based modeling campaign, with efficient algorithms to create planning and decision aids products in tactical time frames. We developed several neural network architectures used as surrogate models to predict the time to detect, time to warn, and probability of hazard presence. We leverage the Common CBRN Modeling Framework (CCMF) to generate data to train the AI/ML models and use in-depth hyperparameter tuning studies to optimize their performance. These neural networks are incorporated in the Tactical Awareness Kit to provide optimal point sensor placement for CB protection, Unmanned Ground Vehicle (UGV) ground sampling locations, optimal light detection and ranging (LIDAR) sensor placement for stand-off detection, and Unnamed Aerial Vehicle (UAV) routes for search and surveillance during a CB emergency.

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