Sensor Management Problems of Nuclear Detection

Benefit: *Our project is developing methods for collecting and interpreting sensor data that are specialized for nuclear detection. Project goals include: (i) reducing false alarms from benign sources and sensor error; (ii) managing large volumes of data in real time; (iii) using data to locate sensors and analyze their performance; and (iv) handling sensor management problems of both long and short response time and with different types of uncertainty.*

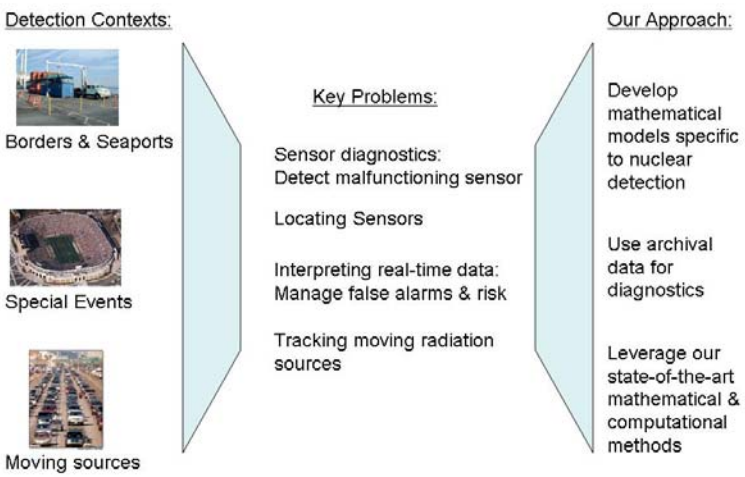
Mission

The effective use of sensors in nuclear detection requires choosing the right type of sensor, putting it in the right place and activating it at the right times. It also involves interpreting the results of sensor alarms and making decisions that balance various types of risk and uncertainty based on those results, sometimes in real time. These are the multiple dimensions of sensor management. Our project is addressing sensor management for nuclear threat detection by formulating the related problems using precise mathematical language and then developing tools of the mathematical sciences to solve them.

Nuclear detection arises in a variety of contexts where the definition of the problem domain leads to overlapping, but sometimes quite different, problems. Our work considers three problem domains: (i) risk assessment for containers and trucks at borders and seaports where we have an intermodal container or truck trailer moving through a port or terminal or at a border crossing; (ii) special events such as a government official's visit to a large city, a major sporting event, the Olympics, etc., where there is need to locate a system of sensors so as to provide maximal protection; and (iii) detection of radiological material carried by moving vehicles or individuals which presents the challenge of detecting devices and material in transit, typically without the ability to choose who is going to be screened in order to precisely identify the source. In such detection settings, we encounter problems of integrating several pieces of inexpensive information and deciding when to make a more expensive measurement or intervene more aggressively.

Collaborator(s):

- *Los Alamos National Lab*
- *Pacific Northwest National Lab*
- *Sandia National Lab*



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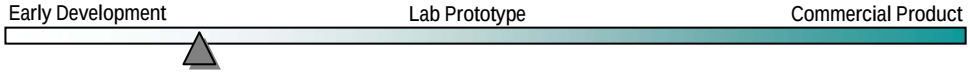
Our project considers several different detection contexts in order to ensure that we have the greatest possible impact and to demonstrate that our research can handle a suitably diverse set of conditions, spanning signals (the nature of the data being collected), economics (efficiently locating sensors), and responses (detaining a stationary source or intercepting a moving one).



For more information, contact:
Fred S. Roberts, froberts@dimacs.rutgers.edu
(dydan.rutgers.edu)