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Secondary Reachback

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Abstract: Secondary Reachback is a Department of Homeland Security program designed to provide assistance to Customs and Border Protection officials in assessing threats reported by radiation monitors at the United States' border. U.S. ports of entry have radiation portal monitors that detect radiation emissions from vehicles entering the country. The purpose of these monitors, and of Secondary Reachback, is to detect nuclear material and prevent it from being smuggled into the country. To accomplish this goal, Secondary Reachback draws on the expertise of radiation physicists at Los Alamos, Lawrence Livermore, and Sandia National Laboratories. As part of Secondary Reachback, Sandia has developed software to assist in analyzing existing data from radiation monitors in order to develop "signatures" that model threat and non-threat situations. These signatures provide Customs and Border Protection officials with an additional method for determining whether a vehicle with an anomalous radiation profile is in fact a threat.

Courtesy of Pacific Northwest National Laboratories

Sandia specializes in the data analysis aspects of the work. Sandia has developed software tools to access the data, store it, and carry out analyses in an attempt to separate non-threatening anomalies from potential threats.

Detection Process

Radiation portal monitors are passive detectors that measure the amount of radiation emitted from a vehicle. These monitors use two different methods to detect gamma particles and neutrons. Each monitor has multiple panels to detect radiation throughout the vehicle.

Courtesy of Pacific Northwest National Laboratories

One of the goals of this project is to minimize the report of false alarms. However, since many household products emit benign radiation, there have been a number of false alarms. From these, we have been able to better distinguish threats from non-threats, like kitty litter.

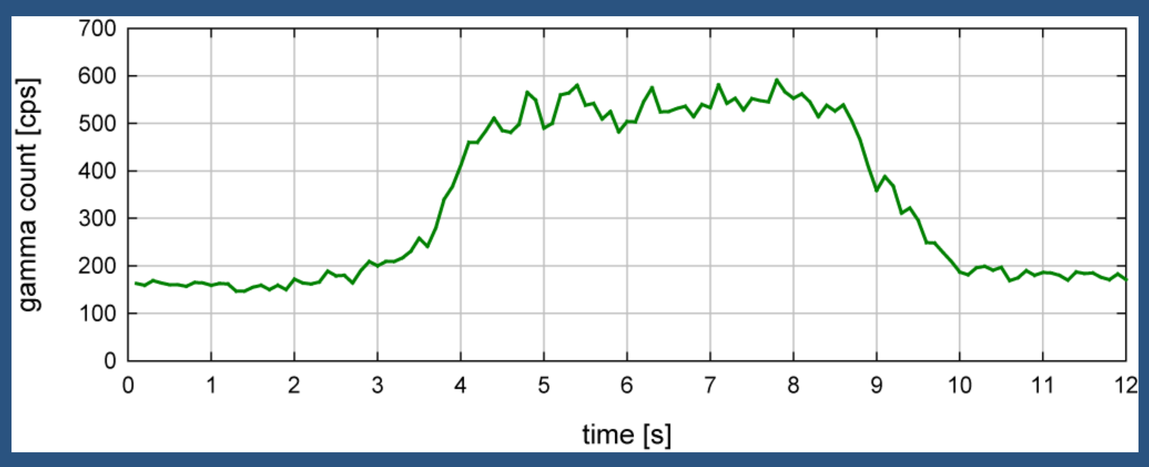
Top 92% of Alarms	Percent of Loads
Kitty Litter	34%
Medical (In, I, Tc, Tl)	16%
Abrasives	8%
Refractory material	8%
Scouring Pads	6%
Mica	5%
Potassium/Potash	5%
Granite slabs	4%
Toilet bowls & tile	4%
Trucks/cars	2%

Courtesy of Pacific Northwest National Laboratories

One of the major ways in which we model non-threats is through spectroscopy. Spectroscopy compares energy levels of different sensors in the portals. From this, we can distinguish Potassium-40, commonly found in bananas and cocoa powder, from Uranium-235, found in nuclear weapons.

Our Part in the Project

One of the major challenges of the Secondary Reachback project was finding an easily accessible data archiving solution. We are currently developing multiple software packages to store and analyze the data. We can then synthesize these tools to find the optimal solution in terms of space, speed, and user-friendliness.



Using a combination of Java, C++, and CERN's ROOT libraries, we create tools used by the investigating physicists. These tools retrieve data from an SQL database, compress it, and perform a series of algorithmic fits to find trends. These trends are not only used to identify threats, but also as quality control for the monitors themselves. If traffic through a certain portal deviates from its previous pattern, the site technicians can inspect the portal for possible malfunctions.

One major aspect of identifying trends is the creation and use of "signatures". Signatures are our attempt to model what a threat looks like and how this differs from a radiating non-threat. After the real data is compared with these signatures, the signatures are revised to better model real world situations.

We are currently developing a comprehensive test plan in order to validate the accuracy of current and future tools, as well as creating a record of known issues or defects with the tools, along with their solutions, in order to aid further code development.

Future Work:

- Optimization of Data Processing
- Increased adaptability of analysis tools
- More Graphical User Interfaces for tools
- Automating the testing process

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