THE HOMELAND SECURITY CENTER FOR DYNAMIC DATA ANALYSIS AT RUTGERS UNIVERSITY

Center for Dynamic Data Analysis

Optimizing Port of Entry Inspection

Benefit: *According to US Customs and Border Protection, 108 million cargo containers are transported among seaports around the world each year. In fiscal year 2004, US seaports handled an average of 26,000 containers per day. Our project is providing strategies for inspecting such containers, balancing costs of inspection with detection rate to achieve the best possible detection rate given practical limitations.*

Mission

Securing our ports and harbors is a major component of protecting our homeland. The possibility that terrorists might introduce catastrophic weapons, such as chemical or biological agents, or nuclear devices requires high vigilance. Even a small event at a major port could be crippling. However, exhaustive examination of each container is prohibitively expensive, both in terms of the cost to effect the examination and the economic costs incurred because of delay of goods through the port. In practice, a range of methods is available for cargo screening. Of these, document screening is the least expensive; physical methods, such as gamma ray detection, are more expensive; and manual unpacking is most expensive.

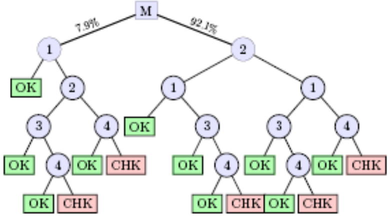
This project is developing decision support algorithms for allocating resources to cargo screening at ports. Such algorithms seek optimal inspection strategies for intercepting illicit materials and weapons entering US ports. The algorithms we seek aim at finding inspection schemes that minimize total "cost", including cost of false positives and false negatives. These algorithms are based on finding optimal binary decision trees representing Boolean decision functions, using a sequential decision making framework. We are finding new algorithms that are more efficient computationally than those that existed previously and we are applying principles of optimization and game theory to decide how to inspect cargo and allocate inspection budgets between screening and definitive unpacking. Remarkably, project researchers have found that the cost-effectiveness of any particular screening test (document inspection, gamma ray testing, unpacking, etc.) may be summarized by a single number, the Screening Power Index (SPI). This index depends on the sensitivity and specificity (or operating characteristics) of the test, on known cost information, and on estimated probabilities. These numbers are, in reality, difficult to find, or closely held. However, once they are determined, it is easy to compute the index. The method can therefore be applied by operators of terminals, and sensitive information need not be shared with researchers.

Collaborator(s):

- *Los Alamos National Lab*
- *US Coast Guard*
- *Maher Terminals*
- *US Customs and Border Protection*

Outreach

Project participants served as chair and co-chair for the IEEE International Conference on Intelligence and Security Informatics, which Rutgers hosted in May 2007. Port security was a main conference theme. The project team also toured the Port of Camden-Philadelphia with the Captain of Port and the Port of Newark-Elizabeth with Customs and Border Protection.



Left: the mobile VACIS truck- mounted gamma ray imaging system is one of the technologies available for inspecting cargo at ports. Right: our project formulates cargo inspection as a sequential decision problem where we seek an optimal binary decision tree.

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Early Development | Lab Prototype | Commercial Product

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