

My Approach to Research

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Interdicting Nuclear Smugglers (US DOE and DHS)



- Goal: Minimize probability of successful smuggling of nuclear material
- Approach: Install radiation detectors
- Question: How to select detector locations under limited resources?
→ Specific task called *Site Prioritization*: Create a priority list of sites

Project Selection for South Texas Project (Ernie Kee)

- STPNOC manages plant for its owners
- Each year, Risk Mgmt Dept forms priority list of (say) 50 projects from list of 600
- Priority list is presented to owners
- During the year, “blue line” can shift
 1. Project X
 2. Project G
 - ⋮
 20. Project M

 21. Project Z
 22. Project Q
 - ⋮



Conservation Area Network Design (Sahotra Sarkar)



- Given set of species, candidate sites, utilities, and a budget, b , select the “best set of sites”
- Species can move over time. What is the nature of b ?

Priority Lists versus Portfolios

Brown et al., “Defending Critical Infrastructure” (2006)

The military analyst will typically create and deliver a prioritized list to higher-level decision-makers, who make final decisions after balancing costs, effectiveness, and intangibles, and after determining the true budget . . . But a prioritized list has a serious flaw. It insists that the optimal set of $n + 1$ actions simply adds one item to the optimal set of n items. But, we know that the two sets may have nothing in common.

Savage et al., “Probability Management” (2006)

The Risk of Ranking: It is common when choosing a portfolio of capital investment projects to rank them from best to worst, then start at the top of the list and go down until the budget has been exhausted. This flies in the face of modern portfolio theory. (Labeled One of the *Seven Deadly Sins of Averaging*.)

A Principled Approach to Prioritization

- Why do individuals and organizations prioritize?
- Can we form an optimal priority list? For what class of problems?
- What classes of problems lead *naturally* to prioritized solutions?

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