



DoNuTS Technical Meeting

Time: 1600 Wednesday, 04 February 2009

Place: NE Conference Room, 1106 Etcheverry

Speaker: Dorit Hochbaum, UCB Industrial Engineering
and Haas School of Business

Subject: Nuclear Threat Detection with Mobile
Distributed Sensor Networks

The ability to track an illicit radioactive source in an urban environment is critical in national security applications. To this end, two modes of operation are common: positioning individual portal monitors and deploying a network of distributed sensors. We address here the use of multiple detectors, mounted on moving vehicles, for the purpose of detecting nuclear threats. An example scenario is that of multiple taxi cabs each carrying a detector. The detector positions are known in real-time as these are continuously reported from GPS data. The level of detected risk is then reported from each detector at each position. The problem is to delineate the presence of a potentially dangerous source and its approximate location by identifying a small area that has an elevated concentration of reported risk. This problem of using spatially deployed mobile detector networks to identify and locate risks is modeled and formulated here. The problem is shown to be solvable in polynomial time and with a combinatorial network flow algorithm. The efficiency of the algorithm enables its use in real time and in areas containing a large number of deployed detectors. A simulation study that takes into account false-positive and false-negative reports from individual sensors demonstrates the effectiveness of the algorithm in using the sensor network's detection capabilities.