Geographic Surveillance and Hotspot Detection for Homeland Security: Tasking of Self-Organizing Surveillance Mobile Sensor Networks

Short Description	Many critical applications of surveillance sensor networks involve finding hotspots. The upper level set scan statistic is used to guide the search by estimating the location of hotspots based on the data previously taken by the surveillance network.
Full Description	Many critical applications of surveillance sensor networks involve finding hotspots. The upper level set scan statistic system will be used to guide the search by estimating the location of hotspots based on the data previously taken by the surveillance network (Phoha et al., 2002). As mobile sensor platforms move toward estimated hotspot locations, more data will be taken and used to update estimated hotspot locations. There are many important area surveillance applications for the proposed research including: (i) Finding hotspots for radioactivity and chemical or biological agents to prevent or mitigate the effects of terrorist attacks or to detect nuclear testing; (ii) Mapping elevation or wind, and bathymetry or ocean currents to better understand and protect the environment; (iii) Detecting emerging failures in a complex networked system like the electric grid; and (iv) Mapping the gravitational field to find underground chambers or tunnels for rescue or combat missions. Mobile sensor platforms can measure data fields along their trajectories. We are interested in using feedback from individual sensor platforms, communicated to other platforms in the network (Eberbach, 1999) to guide the search. Once measurements have been taken and communicated, the hotspot locations will be estimated using upper level set scan statistics. This information will be used to modify the search. Additional measurements will then be taken and the feedback process will repeat until the goal is reached. There are two types of hotspots in the applications listed above. The first is caused by point sources such as radioactive material. The second is interesting distributed features, for example an area of variability of the field that is being mapped, e.g. elevation, bathymetry or pressure. By detecting only the significant variations, resources are not wasted on mapping areas of little change.
Strategic Cycle Elements	Preemption Crisis Management Response
Project URL	http://www.stat.psu.edu/~gpp/PDFfiles/Prospectus%2016%20overview.pdf http://www.stat.psu.edu/~gpp/PDFfiles/Prospectus%2016.pdf
Sponsor	NSF Digital Government Program, EPA STAR Grant Program
Keywords	Hotspots, robotic surveillance, upper level set scan statistic.