Boston University Statistics Seminar Series

Geoinformatic Surveillance for Hotspot Detection and Prioritization in Public Health and Ecosystem Health.

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NOTE SPECIAL DAY AND TIMES

Friday, March 7, 2003, 2:30-3:30pm and 4:00-5:00pm

Mathematics and Computer Science (MCS) Building, Room 135

111 Cummington Street, Boston

(This is a two-part talk, with a half-hour coffee break 3:30-4pm.)

Abstract: Current methods to organize, represent, and process large bodies of complex information spread over space and time are inadequate for today's decision making needs, especially in a time of crisis. Advances are needed in methods of quickly and accurately recognizing and prioritizing critical changes in important parameters that are masked by fluctuations. We propose research that will address these needs as well as the infrastructure needs of science and technology that are equally important for interpreting high-dimensional multi-attribute spatio-temporal information for policy and research.

The presentation will discuss proposed information science and technology research and its application to geoinformatic surveillance for hotspot detection and prioritization. A hotspot means something unusual an anomaly, aberration, outbreak, elevated cluster, critical area, etc. The declared need may be for monitoring, etiology, management, or early warning. Responsible factors may be natural, accidental, or intentional.

The presentation will discuss first the upper level set scan statistic methodology to recognize arbitrarily-shaped hotspots. Spatio-temporal data are integrated with a new level of accuracy providing more sensitive indicators of changes in critical parameters. The technique applies not only to physical space, but also to connected collections of objects or regions, i.e. networks. Next the presentation will discuss the partially ordered set prioritization methodology to rank hotspots without having to integrate multiple indicators into a single index. The presentation will conclude with new methods of automated knowledge acquisition in the form of behavior recognition technology built on the concept of e-complexity and e-machines from Statistical Physics and a formal language measure from Discrete Event Control Theory, to be used for hotspot detection in relation to an exemplar.

The presentation will motivate the concepts and methods with examples for public health involving disease surveillance with cancer registry data and syndromic surveillance with hospital emergency admissions syndromic data. The presentation will also motivate the concepts and methods with examples from ecosystem health at landscape scales involving biological impairment and water quality in freshwater stream networks and contributing watersheds.