



Center for **S**tatistical **E**cology and **E**nvironmental **S**tatistics

Geographic Surveillance of Hotspot Detection, Prioritization, and Early Warning

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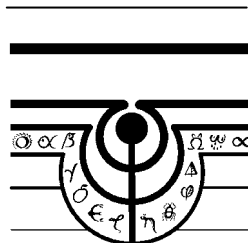
This material is based upon work supported by the National Science Foundation under Grant No. 0307010.

Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.

This project is funded, in part, under a grant with the Pennsylvania Department of Health using Tobacco Settlement Funds. The Department specifically disclaims responsibility for any analyses, interpretations or conclusions.

[Invited paper for The National Conference on Digital Government Research, Atlanta, GA]

Technical Report Number 2005-0201
TECHNICAL REPORTS AND REPRINTS SERIES
February 2005



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Geoinformatic Surveillance of Hotspot Detection, Prioritization, and Early Warning

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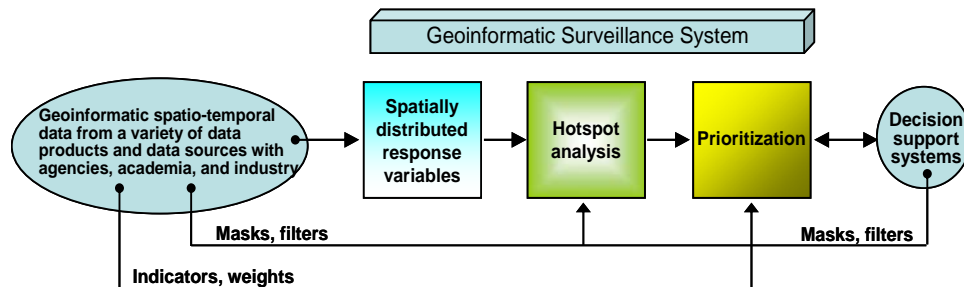
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A Geoinformatic Hotspot Surveillance System (GHS) will be demonstrated. This system is comprised of an upper level set scan statistic system for hotspot delineation, and a poset prioritization and ranking system for hotspot prioritization.

Additional Key Words and Phrases: Upper level set scan statistic, Posets

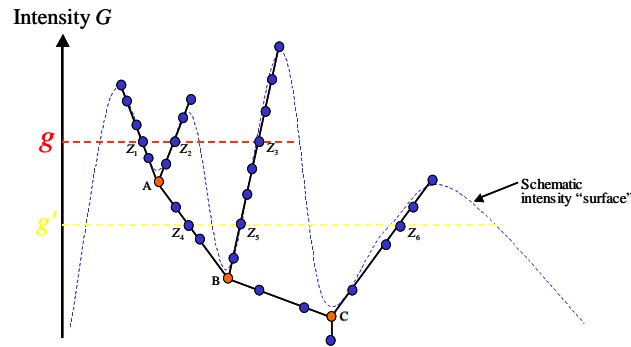
Government agencies often require concise summaries of georeferenced data to support their decisions regarding the geographic allocation of resources. Geoinformatic surveillance for spatial and spatiotemporal hotspot detection and prioritization is a critical need for the 21st century. A hotspot can mean an unusual phenomenon, anomaly, aberration, outbreak, or critical area. Hotspot delineation and prioritization may be required for etiology, management, or early warning.

With support from the NSF/DG program, an interdisciplinary team has developed a prototype Geoinformatic Hotspot Surveillance (GHS) system for hotspot delineation and prioritization. Our efforts are driven by a wide variety of case studies of potential interest to Federal agencies and involving critical society issues, such as public health, ecosystem health, biosecurity, biosurveillance, robotic networks, social networks, sensor networks, video mining, homeland security, and early warning. The prototype system is comprised of modules for (1) hotspot detection and delineation, and (2) hotspot prioritization.

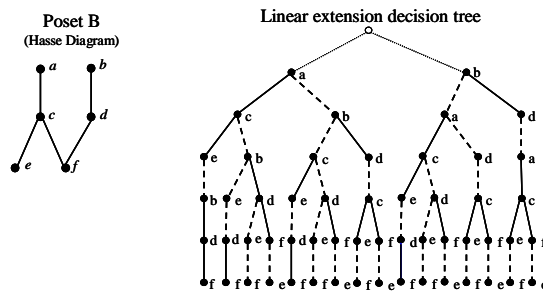


Our approach employs a novel *upper level set scan statistic* to delineate arbitrarily shaped hotspots in both spatial and spatiotemporal dimensions [Patil and Taillie 2004a].

It features maximum likelihood estimation of candidate hotspots, an upper level set tree, and confidence sets for assessing uncertainty in hotspot delineation.



We propose a novel prioritization scheme based on multiple indicators that does not require reduction of the data to a single index. This *poset prioritization and ranking system* features Hasse diagrams describing the partial ordering of the data, linear extension decision trees enumerating admissible rankings among hotspots, and cumulative rank functions for hotspot prioritization [Patil and Taillie 2004b].



For additional information regarding our project, see <http://www.stat.psu.edu/hotspots/> and <http://www.stat.psu.edu/~gpp/>.

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Patil, G.P., and Taillie, C. 2004a. Upper level set scan statistic for detecting arbitrarily shaped hotspots. *Environmental and Ecological Statistics 11*, 183-197.
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