

Geoinformatics of Hotspot Detection and Prioritization for Monitoring, Etiology, Early Warning and Management Around the World

Two Days Short Course and Case Studies Workshop

1. Siena, Italy (October 13-14, 2005)
2. Hyderabad, India (December 24-25, 2005)
3. Belo Horizonte, Brazil (February 27-28, 2006)
4. Nairobi, Kenya (March 18-19, 2006)
5. San Diego, USA (May 21-24, 2006)

One Day Short Course and Case Studies Workshop

6. Okayama, Japan (November 19, 2005)
7. Bangkok, Thailand (November 30, 2005)
<http://www.j-geoinfo.net/HealthGIS/Symposium.htm>
8. Kuala Lumpur, Malaysia (December 27, 2005)
<http://iscm.math.um.edu.my/>
9. Jakarta, Indonesia (November 25, 2005 and January 9, 2006)

Course Instructor and Workshop Leader

G. P. Patil

Distinguished Professor and Director,

Penn State Center for Statistical Ecology and Environmental Statistics

Principal Investigator,

NSF Digital Government Research Project for Hotspot GeoInformatics

Former Visiting Professor, Harvard School of Public Health

Editor-in-Chief, *Environmental and Ecological Statistics*

Fellow ASA, IMS, AAAS, RSS, ISI, IISA, NIE, DSEA

Administrative Information and Registration

Nominal registration fees, if planned, will be reduced/waived further for graduate research students, interested government scientists and acceptable case studies investigators.

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Technical and Scientific Interaction

Contact

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Motivation, Description, and Timeliness

Geoinformatics for spatial and temporal hotspot detection and prioritization is a critical need for the 21st Century. A declared need is around for statistical geoinformatics and software infrastructure for spatial and spatiotemporal hotspot detection, prioritization, early warning, and sustainable management. A hotspot can mean an unusual phenomenon, anomaly, aberration, outbreak, elevated cluster, critical area. The declared need may be for monitoring, etiology, early warning, or management. The responsible factors may be natural, accidental, or intentional. The five year NSF DGP project has been instrumental to conceptualize hotspot geoinformatics partnership among several interested cross-disciplinary scientists in academia, agencies, and private sector across the nations.

Our efforts are driven by a wide variety of case studies of interest to agencies, academia, and private sector involving critical societal issues, such as public health, ecosystem health, ecohealth, biodiversity and threats to biodiversity, emerging infectious disease, water management and conservation, carbon sources and sinks, persistent poverty, environmental justice, crop pathogens, invasive species management, biosurveillance, biosecurity, disease biogeoinformatics, social networks, sensor networks, hospital networks and syndromic surveillance, video mining, early warning, tsunami inundation, remote sensing, and disaster management. Also space-time disease, poverty, pollution, object identification and tracking, early detection, early warning, hotspot trajectories and trends with examples of West Nile Virus, urban poverty patch dynamics, etc. The project emphasis is on development of geoinformatic hotspot system. The system has two methodological components: hotspot detection and prioritization.

Our methodology involves an innovation of the popular circle-based spatial scan statistic methodology. In particular, it employs the notion of an upper level set and is accordingly called the *upper level set scan statistic system*, pointing to the next generation of a sophisticated analytical and computational system, effective for the detection of arbitrarily shaped hotspots along spatio-temporal dimensions. We also propose a novel prioritization scheme based on multiple indicator and stakeholder criteria without having to integrate indicators into an index, using Hasse diagrams and partially ordered sets. It is accordingly called *poset prioritization and ranking system*.

We propose a cross-disciplinary collaboration to design and build the prototype system for geoinformatic hotspot detection and prioritization. The methodological toolbox and the software toolkit developed will support and leverage core missions of several agencies as well as their interactive counterparts in the society. The research advances in the allied sciences and technologies necessary to make such a system work are the thrust of this five year project.

The project will have a dual disciplinary and cross-disciplinary thrust. Dialogues and discussions will be particularly welcome, leading potentially to well considered synergistic case studies. The collaborative case studies are expected to be conceptual, structural, methodological, computational, applicational, developmental, refinemental, validational, and/or visualizational in their individual thrust.

The proposed short course will provide up-to-date instruction with live examples and illustrations. The proposed workshop will emphasize presentations of case studies from within the region of the workshop, using preferably the methodology and software of the short course. The participants will be encouraged to be in contact with the course instructor before and after the course and the workshop to help formulate and finalize their case studies for presentation and publication.

Best case studies will be invited for presentation at the next annual digital government research conference symposium on geoinformatics of hotspot detection and prioritization to be held in San Diego.

CA, USA during May 21-24, 2006. Publications are planned for special issues of subject area journals and edited monographs.

Technical, Scientific, Picturesque Reference Material

1. Overview PowerPoint
http://www.stat.psu.edu/%7Egpp/ppts/Atlanta_Overview.pdf
2. Poster PowerPoint
<http://www.stat.psu.edu/%7Egpp/ppts/AtlantaPoster.pdf>
3. Poster Two Pager
http://diggov.org/library/library/dgo2005/demosb/patil_upper.pdf
4. Demo Two Pager
http://diggov.org/library/library/dgo2005/postersb/patil_geoinformatic.pdf
5. Project Highlights Two Pager
http://diggov.org/library/library/dgo2005/alert/geoinformatic_patil.pdf
6. Hotspot Detection Paper
<http://www.stat.psu.edu/%7Egpp/pdfs/TR2002-0601.pdf>
7. Hotspot Prioritization Paper
<http://www.stat.psu.edu/%7Egpp/pdfs/TR2001-1204.pdf>
8. Center for Statistical Ecology and Environmental Statistics
<http://www.stat.psu.edu/~gpp>
9. Hotspots Project Initiatives
<http://www.stat.psu.edu/hotspots>
10. NSF Digital Government Research Program Online News
[DGOnline News](#)
11. Networks and Infrastructure
http://www.stat.psu.edu/%7Egpp/current_events.htm
12. Raster Map Analysis
http://www.stat.psu.edu/%7Egpp/raster_map_analysis.htm

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Lucid Lectures and Picturesque PowerPoint Presentations

Proposed timetable:

<u>Time</u>	<u>One Day Forum</u>	<u>Two Day Forum</u>	
		<u>Day 1</u>	<u>Day 2</u>
9:00 – 10:30 AM	Hotspot Geoinformatics 1: Concepts, Methods, and Tools Upper level set scan statistic system	Hotspot Geoinformatics 1: Concepts, Methods, and Tools Upper level set scan statistic system	Multiple Indicators, Prioritization, and Ranking System 1: Poset concepts, methods, and tools
10:30– 11:00 AM	<i>Break</i>	<i>Break</i>	<i>Break</i>
11:00 – 12:00 PM	Hotspot Geoinformatics 2: Live Case Studies Health, environment, ecohealth, crime and poverty, sensor networks, and cyber-infrastructure	Hotspot Geoinformatics 1: (continued)	Multiple Indicators, Prioritization, and Ranking System 1: (continued)
12:00 – 2:00 PM	<i>Lunch</i>	<i>Lunch</i>	<i>Lunch</i>
2:00 – 3:30 PM	Multiple Indicators, Prioritization, and Ranking System 1: Poset concepts, methods, and tools	Hotspot Geoinformatics 2: Live Case Studies Health, environment, ecohealth, crime and poverty, sensor networks, and cyber-infrastructure	Multiple Indicators, Prioritization, and Ranking System 2: Live case studies, health, environment, general
3:30 – 4:00 PM	<i>Break</i>	<i>Break</i>	<i>Break</i>
4:00 – 5:00 PM	Multiple Indicators, Prioritization, and Ranking System 2: Live case studies, health, environment, general	Hotspot Geoinformatics 2: (continued)	Multiple Indicators, Prioritization, and Ranking System 2: (continued)

Biosketch of the Short Course Instructor and the Workshop Leader:

For everyone Professor Patil is GP. He is Distinguished Professor of Mathematical and Environmental Statistics in the Department of Statistics at the Pennsylvania State University, and is a former Visiting Professor of Biostatistics at Harvard University in the Harvard School of Public Health. He is a former member of the UNEP Science Advisory Board with Nobel Laureate Mario Molina in chair for the UNEP Division of Early Warning and Assessment. He is at present a member of the USEPA Science Advisory Board, Regional Vulnerability Assessment Panel.

He has a Ph.D. in Mathematics, D.Sc. in Statistics, one Honorary Degree in Biological Sciences, and another in Letters. GP is a Fellow of American Statistical Association, Fellow of American Association of Advancement of Science, Fellow of Institute of Mathematical Statistics, Elected Member of the International Statistical Institute, Founder Fellow of the National Institute of Ecology and the Society for Medical Statistics in India and the International Indian Statistical Association.

GP has been a founder of Statistical Ecology Section of International Association for Ecology and Ecological Society of America, a founder of Statistics and Environment Section of American Statistical Association, and a founder of the International Society for Risk Analysis. He is founding editor-in-chief of the international journal, *Environmental and Ecological Statistics* and founding director of the Penn State Center for Statistical Ecology and Environmental Statistics. He has published thirty volumes and three hundred research papers. GP has received several distinguished awards which include: Distinguished Statistical Ecologist Award of the International Association for Ecology, Distinguished Achievement Medal for Statistics and the Environment of the American Statistical Association, Distinguished Twentieth Century Service Award for Statistical Ecology and Environmental Statistics of the Ninth Lukacs Symposium, Best Paper Award of the American Fisheries Society, and lately, the Best Paper Award of the American Water Resources Association, among others.

Currently, GP is principal investigator of a multi-year NSF grant for geoinformatics for hotspot detection and prioritization across geographic regions and networks for digital government in the 21st Century. The project has a dual disciplinary and cross-disciplinary thrust. You are invited.