



Homeland
Security

Annual University Network Summit
on Research and Education

Student Abstracts

**L'Enfant Plaza Hotel
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Alexander Gutfraind – Center for Applied Math, Cornell University, A Mathematical Model of Terrorist Organizations

Ashley Howell – The Homeland Security Center for Risk and Economic Analysis of Terrorism Events, Risk Analysis of Biological Agents

Rong Hu – Department of Agricultural Economics, Texas A&M University, National Center for Foreign Animal and Zoonotic Disease Defense, Impact of Animal Disease-related Trade Disruption on the U.S. Beef Market

Sungye Kim - Purdue University, Visual Analytics for Emergency Response Using Mobile Devices

Zhicheng Liu - Georgia Institute of Technology, Southeast Regional Visualization and Analytics Center, Jigsaw: Facilitating Investigative Analysis Through Visualization

Hangzai Luo – Charlotte Visualization Center at UNC-Charlotte, Exploring Large-Scale News Video Databases via Visual Analysis

Huseyin Onur Mete - University of Washington, Optimization with Uncertainties for the Location and Allocation of Medical Supplies in an Emergency Situation

Ashley M. Nellis – American University, Does Watching the News Affect Perceived Risk of Terrorism?

Brian Nussbaum – National Consortium for the Study of Terrorism and Responses to Terrorism (START), Global Cities, Global Threats: The New York Police Department, the London Metropolitan Police Service, and the Internationalization of Municipal Policing for Counterterrorism

Edward Orehek – START Center – University of Maryland, The Quest for Certainty and Social Response to Terrorism

Chi-Chun Pan – The Pennsylvania State University, Automatic Extraction and Geo-spatial Visualization of FEMA National Situation Updates

Jacquelin D. Reed –University of Southern California, A Risk Assessment of Critical Infrastructure Sites in California

Heather Rosoff – Center for Risk and Economic Analysis of Terrorist Events (CREATE), University of Southern California, Estimating the Likelihood of Terrorist Attacks on the Ports of Los Angeles and Long Beach

C. A. Rossetti – Texas A&M University, Dept. of Veterinary Pathobiology, College of Veterinary Medicine and National Center for Foreign Animal and Zoonotic Disease Defense, Host and Brucella Gene Expression Biosignatures in an In Vitro Model of Infection

Randy Rowel – Morgan State University, Low-Income Minorities' Preparedness, Response and Recovery Experiences During Hurricane Isabel and a Tornado: Were They Ready for the Unexpected?

Aylin D. Sayir – Michigan State University in partnership with Wayne State University, Longitudinal Evaluation of Food Safety Discussion Based Exercises

Brian M. Tomaszewski – Dept. of Geography, Northeast Visualization & Analytics Center, Penn State University, Mapping Open-Source Information to Support Crisis Management

M. Douglas Voss – Michigan State University (NCFPD partner under The University of Minnesota), The Role of Security in the Supplier Selection Decision

Scott Walper – The University of Southern Mississippi, Construction of a Single-chain Fv Antibody for a Bacterial Target-specific Biosensor

Douglas S. Watson – Dept. of Veterinary Pathobiology, Texas A&M University and National Center for Foreign Animal and Zoonotic Disease Defense, Multiplex Immunoassays for Detection of Antibodies Against Avian Influenza

Mark H. Weir – Dept. of Civil Architectural and Environmental Engineering, Drexel University, Effect of Host Species on the Dose Response of Inhaled Bacillus Anthracis Spores

Sungyong Won - Dept. of Microbiology and Immunology, University of Texas Medical Branch at Galveston and National Center for Foreign Animal and Zoonotic Disease Defense, Rift Valley Fever Virus NSm Protein Inhibits Virus-induced Apoptotic Cell Death

Weizhong Zhu - Northeast Visualization and Analytics center (NEVAC) and College of Information Science and Technology, Drexel University, Visual Analysis of Terrorists' Networks Extracted from the Public Knowledge Bases

Jun Zhuang – University of Wisconsin-Madison, Game Theory and Homeland Security Resource Allocation

The Softest of Targets

Ian Anderson & Matthew Rozea
University at Albany
Poster Session Location: #27

Abstract

One important area in the analysis of terrorism where there is very little academic research, especially of a quantitative nature, is that of terrorist target selection. More specifically our study investigates what factors may lead a terrorist organization to target civilians. Our project uses the Memorial Institute for the Prevention of Terrorism's (MIPT) Terrorism Knowledge Base to analyze terrorist attacks against civilian targets, both international and domestic, for the years 1998-2005. Our analysis points to group ideology – specifically religion and ethnonationalism – as the decisive factor in turning to target civilians, while organizational factors such as group size and network centrality seem to impact the magnitude of civilian targets attacks.

This article on civilian targets is nearly ready to send out for publication. In the future we would like to explore targeting patterns of not only civilians, but explore the factors involved in terrorist campaigns that target hard targets, such as the military. Examining the relationship between targets and tactics used to execute the attack is another possible related area for future research that I have already begun exploring.

Dose-Response Modeling of Plague Data Reveals High Level of Dispersion

Timothy A. Bartrand

Bishel Kurugatta

Charles N. Haas

Drexel University

Poster Session Location: #11

Yersinia pestis, the bacterial causative agent for the plague, is classified as a Category A bioterror agent. It is also endemic in numerous countries and is responsible for approximately 1700 cases annually. In the United States, *Yersinia pestis* caused 61 infection and 7 human fatalities between 1994 and 2003. In this study, dose response data from the open literature for subcutaneous exposure of mammals to *Yersinia pestis* were fit to dose-response models. The data were more disperse than for other category A bioterror agents. This finding is consistent with widespread environmental distribution of *Yersinia pestis*. In general, data were best fit with exponential dose-response models and the susceptibility of the hosts to plague varied greatly depending upon the geographic region in which the animals were caught and between laboratory-reared and wild-reared hosts. The results of this study will be incorporated into the CAMRA (Center for Advanced Microbial Risk Assessment) effort, whose goals include establishing a critically reviewed reference set of dose-response relationships for Category A agents.

**The Role of Homeland Security
Electronic Information Bulletins within
Emergency Management Organizations: A Case Study**

Hamilton Bean

And

Lisa Keränen (START Lead Investigator)

University of Colorado at Boulder

Poster Session Location: #28

Abstract

Project Scope:

Homeland security information bulletins from governmental, commercial, and non-governmental providers are an important source of threat information within local emergency management organizations. This study explores how the interpretation and use of homeland security information bulletins within one university's emergency management organization influenced preparedness. A one-year field study of the university's emergency management meetings, supplemented by in-depth interviews, survey data, and textual analysis, was used to determine how participants made sense of and communicated about homeland security information bulletins. Assumptions about communication obscure the influence of bureaucratic imperatives in shaping "enactments" of homeland security-related threats. The authors offer recommendations intended to increase the contribution of homeland security information bulletins to preparedness within emergency management organizations.

Recent Progress:

A version of this study recently won an award for "Top Four Paper in Organizational Communication" from the Western States Communication Association (WSCA). The authors anticipate receiving useful disciplinary feedback at the upcoming WSCA annual conference in Seattle, WA.

Future Plans:

The findings from this study serve as the basis for a START-related research project currently underway which investigates the broader relationship between homeland security information sharing and preparedness at the local level.

Publications:

Revision resubmission to the *Journal of Homeland Security and Emergency Management*.

Link-based Classification of Blogs

Smriti Bhagat, Graham Cormode, S. Muthukrishnan,
Irina Rozenbaum, Hongyi Xue
Primary Center of Excellence Researcher:
S. Muthukrishnan
Rutgers University
Poster Session Location: #1

Abstract

Project Scope:

Information networks like blogs, the web, social networks and so on are rich collections of open source data. One of the chief concerns with user generated data such as blogs is that of trustworthiness. We are developing methods to understand and predict the trustworthiness of blogs. We model this as a multigraph labeling problem: each blog is a node which connects in different ways to other blogs, web pages etc., and the labels capture different notions of trustworthiness. Learning involves propagation of the labels based on features such as the link structure, labels of adjacent nodes, and features such as links to the web, in order to infer the reliability of the unlabeled blog nodes. We propose two general classes of methods for propagating these labels in a multigraph namely, local (which rely on neighborhood for inferring the label) and global (based on features occurring across the whole graph). We apply these methods using the blog author's *age* as a label, on large scale collections of blog data.

Recent Progress:

Our work over recent months has included the following results:

- We have collected and cleaned data from several million blogs and many millions of links across multiple blog networks such as LiveJournal, Xanga, and Blogger.
- We have conducted detailed analysis of the structure and features of the blog networks, described feature distributions, identified language and linking patterns, and identified the prevalence of one individual operating across multiple networks via identifier matching.
- We have developed and tested methods based on the local and global paradigms, and shown that these can be highly accurate on the problem of labeling age and similar labels.

Future plans:

Our ongoing work is extending our study to include richer feature information, such as the intricate conversations carried out via commenting, with detailed timestamp information, as well as greater use of textual and language features. We are also looking at analysis of personas across information networks. Specifically, identification of

personas within a particular geographic region, language or a set defined by interests and further exploring the neighborhood around the personas of interest. We are working on understanding the challenges of maintaining privacy in the light of such analysis.

Publications:

No Blog is an Island—Analyzing Connections Across Information Networks (Under Submission)

Link-based classification of blogs, and its applications (In Preparation)

Evaluation in Chickens of a Live Attenuated NS1 Mutant Avian Influenza Virus (AIV) Vaccine

Vinayak R. Brahmakshatriya, Blanca Lupiani
and Sanjay M. Reddy
Texas A&M University

Poster Session Location: #13

Low pathogenic avian influenza (LPAI) virus causes serious economic losses to the poultry industry and has the potential to mutate to highly pathogenic AI (HPAI) strains. In recent years, H5 and H7 subtype viruses have been shown to infect humans during outbreaks of AI virus in commercial poultry. The direct transmission of this virus to humans without an intermediate host and the lack of immunity in the human population to these virus subtypes makes them good candidates for the next pandemic virus. A proper vaccination program in commercial poultry can play a critical role in the prevention and control of AI and therefore safeguard public health. Due to trade implications, differentiation of infected from vaccinated animals (DIVA) is an important issue in the control of AI. In this study we describe the development of a live attenuated vaccine for poultry, with DIVA properties using an NS1 deletion mutant H5N3 virus.

Influenza virus NS1 protein plays a major role in blocking the host antiviral response. Using an eight-plasmid reverse genetics system, we have recovered moderately virulent parental (rH5N3) and NS1 mutant (rH5N3/NS1-143) viruses. rH5N3/NS1-143 expresses only the first 143 amino acids of the NS1 protein compared to the 232 of the parental rH5N3. The growth properties of rH5N3 and rH5N3/NS1-143 were compared in cell culture and in different age embryonated chicken eggs. Our results confirm that NS1 is involved in down regulation of interferon as shown by IFN- β mRNA expression analysis and by the inability of rH5N3/NS1-143 to efficiently grow in older age, interferon competent, chicken embryos. To evaluate the potential use of rH5N3/NS1-143 as a live attenuated vaccine, 6-week old chickens were vaccinated with rH5N3 and rH5N3/NS1-143 viruses. rH5N3/NS1-143 vaccinated chickens showed partial attenuation, when compared to rH5N3 vaccinated chickens, as determined by histological lesions of trachea and lungs. In addition, rH5N3/NS1-143 infected chickens developed a strong antibody response to NP and/or M1 but not to NS1. Interestingly, rH5N3 challenge of rH5N3/NS1-143 vaccinated chickens, indicated that the NS1 mutant virus confers protection to rH5N3. Regardless of the strong immune response to NP and/or M1, the challenge virus was able to replicate in rH5N3/NS1-143 vaccinated group.

The rH5N3/NS1-143 virus can be used as a DIVA vaccine. The vaccine is attenuated in its replication in chickens and yet, protects from pathology caused by rH5N3 and partially against virus replication. Studies are in progress to determine if a killed, inactivated rH5N3/NS1-143 vaccine confers better protection and can be used as a DIVA vaccine.

The use of AI vaccines with DIVA properties will play an important role in the control of AI in commercial poultry in the USA, will protect the industry from trade blocks and will

protect the human population from infection with AI virus by reducing the viral load in commercial poultry.

Understanding Risk and Crisis Messaging and Use of Spokespersons with Native and New American Populations

Tim Sellnow, Robert Littlefield,
Will Hueston and Kimberly Cowden
North Dakota State University
Poster Session Location: #25

Abstract

Summary Content:

The lack of research in the crisis and risk communication literature about cultural groups reveals a weakness in the potential use of the 10 best practices (Seeger, 2006). The purpose of this two-phase project is to better understand how Native and New Americans prefer to receive risk and crisis messaging, and from whom (spokesperson) risk and crisis messaging will be credible, and how this affects the 10 best practices.

We are currently in phase two of this project, working with Native American groups in the upper Midwest to orally survey participants about perceptions of risk and crisis, about preferred learning styles, applicability of the 10 best practices to vulnerable populations, and spokesperson credibility. Phase one, a series of focus groups with Native and New Americans, yielded findings in both how to work with vulnerable populations as researchers, and findings about how to write risk and crisis messaging and from whom the information will be most credible.

Progress has been made from both a research planning and applied research perspectives. When planning research with vulnerable populations, a multicultural research team, a respected cultural agent, and trustworthy, credible methods for recording information are essential.

From a theoretical perspective, initial findings suggest that information that most directly affects an individual or a family is the information that is given the most attention (spheres of ethnocentricity). In addition, contrary to the established risk and crisis literature, initial findings suggest that rather than one designated spokesperson, Native and New Americans tend to believe a credentialed spokesperson from a reputable agency with a preference for a member of their community or ethnocentricity (vicarious credibility). Thus, there is a two-step flow of information with: a) a trusted agent from within the community acquiring information from a primary spokesperson; and b) the community agent serving as spokesperson for the community.

Future plans include replicating this project in other areas and with other vulnerable populations. Plans are currently in place to address the Arab population in Detroit, MI, the African-American community in Little Rock, AK, and the Polynesian-American population in Honolulu, HI.

Findings from phase one have been presented at the International Communication Conference, Central States Communication Conference, and the National

Communication Conference. A guidebook for researchers was published in December 2006. (Available at <http://risk-crisis.ndsu.nodak.edu/>).

Security Management Training of Intercollegiate Athletic Departments

Trey Cunningham, Walter Cooper
and
Kyna Shelley
University of Southern Mississippi
Poster Session Location: #26

On October 5, 2005, an explosion occurred outside a stadium with 84,000 spectators in attendance just before the half-time of a college football game played between the University of Oklahoma and Kansas State University. This incident was not terrorist related, but a suicide by a troubled youth. The young man had explosives strapped to his body, and only a small amount of explosives were detonated. No one besides the young man was injured or killed in this incident, but the possibilities of what could have happened sent alarming waves throughout the security and sporting event communities.

The question facing sport administrators is not if a future incident is going to happen, but when will the incident happen. Who is responsible for taking the security measures to prepare, prevent, deter, or delay a future terrorist attack on a sporting event or stadium? At the majority of colleges and universities, the athletic administration staff is responsible, within the scope of their job, for event management, “game day” operations, and security.

The purpose of this study was to document the level of training and professional development of the persons responsible for sporting events in intercollegiate athletics. The study targeted those that are responsible for event security and game day operations (assistant/associate/senior athletic directors) at Division 1A football schools (N=85).

This documentation of training and professional development will help in discovering the levels of athletic administration training needs for those responsible for “game day” operations and event security. This body of knowledge will also facilitate in finding the gaps in security management professional development of athletic department administration. These gaps, currently not discovered in recent literature, will aid in the future development of education, training, and certification programs that can be tailored to the gaps or needs of athletic departments. Future programs will help with the overall goals set forth by the Department of Homeland Security (DHS), the International Association of Assembly Managers (IAAM), and National Collegiate Athletic Association (NCAA) in ensuring the safeguard of intercollegiate athletics.

Effectiveness of Train-the-Trainer for Foreign and Emerging Animal Disease Curriculum

Shannon H. Degenhart, Angela I. Dement,
Floron C. Faries, and Andy, T. Vestal
Texas A&M University
Poster Session Location: #14

Abstract

Goals/Objectives:

In order to protect the vast U.S. livestock and poultry production sector from catastrophic loss due to Foreign and Emerging Animal Diseases (FEAD), the National Center for Foreign Animal and Zoonotic Disease Defense (FAZD) at Texas A&M University sponsored the creation and implementation of a *Foreign and Emerging Animal Diseases Handbook: Train-the-Trainers Curriculum*. This curriculum was intended for County Extension Agents (CEAs) to educate individual livestock owners in biosecurity and the early detection and reporting of FEAD. The curricula was divided into eleven chapters and covered topics such as: *Epidemiology of Foreign and Emerging Diseases; Foreign Animal Diseases; Emerging and Endemic Animal Diseases; Biosecurity Best Management Practices, and State of Texas Foreign and Emerging Animal Diseases Response Plan*.

Regional Extension Specialists attended an in-depth, one-day workshop to receive curriculum training. Within four weeks, Specialists conducted curriculum training for their regional CEAs. CEAs were then expected to include stakeholder FEAD curriculum training in their yearly plans of work. Pre and post-curricula knowledge tests were administered at both Specialist and Agent trainings. Objectives of these tests were: 1.) determine if curricula increased participants' knowledge of FEAD and 2.) determine if location (i.e. trainers) significantly affected the rate of change in CEA knowledge pre to post- FEAD curriculum.

Results:

Analysis indicated a statistically significant ($\alpha = 0.05$) increase in overall mean knowledge pre to post-FEAD curricula for both Specialists and CEAs. Specialists and CEAs pre-FEAD curricula knowledge was close (1.4 percentage point difference), but Specialists demonstrated a much greater (16.3 percentage points) increase in knowledge than CEAs (6.3 percentage points). This may be due to Specialists' immediate accountability for training CEAs, whereas CEAs were not held immediately accountable to teach the curricula. Repeated Measures analysis indicated that location of training (i.e. difference in trainers) did not have a significant effect on rate of change of CEAs' knowledge.

Interpretation and Application:

Results indicate the Train-the-Trainer approach to FEAD curriculum training increases participants' knowledge of FEAD issues and delivers a consistent educational experience for target audiences, irregardless of differences in trainers. Immediate accountability for trainers to teach the curricula should be incorporated to increase participants' knowledge. The FEAD curriculum training will be delivered to all States to establish a national curriculum for Extension faculty. By adoption of biosecurity measures, this national curriculum will educate and strengthen our producers. These producers serve as the first line of defense against entry of FEAD in American animal operations.

Terrorism's Spatiality and Identity Through Media Content Analysis

Elizabeth Dunn
University of South Carolina
Poster Session Location: #29

Abstract

The impacts of terrorist actions are a function of the spatially defined physical event and the spatially undefined psychological, sociological, and political reactions to the physical event (Hoffman 1998). As the agenda-setting theory in communication research suggests, the mass media have the power to influence public discourse and governmental action with its reaction to terrorist incidents (McCombs and Shaw 1972). This research seeks to answer three broad research questions, including whether terrorism exhibits spatial patterns, whether newspaper coverage of terrorist incidents varies depending on the identity of the responsible party, and whether the discrepancies found in the coverage give rise to any implications when framed under agenda-setting theory of communication.

In order to answer the proposed questions, several methods stemming from the disciplines of geography and communication are used. The geographical methods use a combination of data from the Global Terrorism Database and the MIPT database to geocode domestic and international terrorist incidents during the time period of 1970-2005. A spatial autocorrelation is run on the locations of terrorist incidents to reveal clusters of which the most active organizations are determined. The communications research methods included in the research is a content analysis of three newspapers from the United States: the *New York Times*, the *Los Angeles Times*, and the *Washington Post*. This content analysis, which includes both quantitative and qualitative techniques, focuses on the "watershed" type events from the active organizations. This analysis will reveal any variance in news coverage of terrorist activity based on the perpetrator's identity.

Responding to these questions about terrorism and mass media coverage provides insight into possible spatial patterns of terrorist incidents and into patterns of media coverage. In the field of hazards research, studies using media analysis techniques focus on the reaction of the media after a natural or technological hazard event. In the communication research field, studies involving agenda-setting theory concern mostly political issues such as civil rights or political campaigning. The successful completion of this research will result in an example of the amalgamation of the two fields of study: hazards and communication research.

Currently, this described research is in the data analysis stage. By the end of February 2007, data analysis will be complete and conclusions will be drawn in attempt to address the proposed research questions. The research will be utilized as the master's thesis research of Elizabeth Dunn and the thesis will be defended by April 2007. Future publications are planned but are not currently in press.

References:

Hoffman, B. 1998. *Inside Terrorism*. New York City: Columbia University Press.

Exploring the Situational Determinants of Aerial Hijackings

Susan Fahey, Gary LaFree,
Laura Dugan and Alex Piquero
National Consortium for the Study of Terrorism and
Responses to Terrorism, START
Poster Session Location: #30

Project Scope:

In this project we ask which situational characteristics distinguish terrorist hijackings from other types of aerial hijackings. Studying the situational determinants of aerial hijackings requires us to assume that people choose the situations in which they act and once in these situations, that they adapt their behavior to achieve desired goals. We further assume that certain types of behavior cluster for different types of hijackings because certain types of behavior are more likely to achieve certain ends. In turn, this means that different types of hijackings should be predictable from situational characteristics. The different types of hijackings we study here are those undertaken for the purposes of traveling to a destination determined by the hijacker (transportation), hijackings undertaken to extort money (extortion), and hijackings undertaken to achieve a political or social goal (terrorist).

We use a database of 745 world-wide hijackings drawn from the Federal Aviation Administration, the Global Terrorism Database (GTD), the RAND-MIPT data, and the ITERATE data. First, we hypothesize that the situational characteristics that increase the publicity or symbolic impact of a hijacking will differentiate terrorist from non-terrorist hijackings. Compared to transportation and extortion hijackings, terrorist hijackings will depend more on publicity. Second, because compared to other hijackings, terrorist hijackings are more likely to reflect group based decision making, we expect terrorist hijackings to involve a greater degree of planning than other types of hijackings. We therefore hypothesize that those situational characteristics that indicate a greater degree of planning will differentiate between terrorist and non-terrorist aerial hijackings. We performed logistic regression analysis to determine whether it was possible to differentiate the 106 terrorist hijackings from the 639 non-terrorist hijackings, using the characteristics of the situation.

Recent Progress:

Our first hypothesis was partially supported. First, if a flight originated from a country whose annual level of terrorism was in the top twenty-fifth percentile of countries in the world for that year, it was two and half times more likely to be a terrorist hijacking. In addition, if the flight left from a capital city, it was more than two and a half times more likely to be a terrorist hijacking. Finally, if the flight originated in the United States, it was more than 90% less likely to be a terrorist hijacking. Situational characteristics that did not differentiate between hijacking types include whether the flight occurred on a

weekend, in a particular season, or if there were passenger or crew casualties in the course of the hijacking.

Our second hypothesis was also partially supported. Compared to other hijackings, terrorist hijackings were twice as likely to include a weapon and five and a half times more likely to involve more than one offender. Finally, we found that compared to other hijackings, terrorist hijackings were more than two times more common after 1973, the year in which the United States introduced metal detectors and other important anti-hijacking measures. This last finding may suggest that anti-hijacking measures deterred non-terrorist hijackings more successfully than terrorist hijackings. The only advanced planning variable that did not differentiate terrorist and non-terrorist hijackings was whether the prior three hijackings had successfully achieved their objective. This finding may suggest that terrorist hijackings involve persons that are more committed to their goals and are influenced less by instrumental factors.

We conclude that terrorist-hijackings are in part predictable from their situational characteristics, particularly the country and city from which they originate and whether weapons or multiple hijackers are employed.

Future Plans:

We plan to fully develop the paper for publication in a peer-reviewed journal. This will be accomplished in the next semester.

Publications:

I have not published on this project yet.

Sensing Botulinum Neurotoxin: Microfluidic Platforms Integrating Hydrogel or SAM-based Elements

Megan L. Frisk, Guangyun Lin, William H. Tepp,
Eric A. Johnson and David J. Beebe
University of Wisconsin
Madison
Poster Session Location: #18

Abstract

A dominant homeland security concern is the ongoing development of increasingly sophisticated means of biological warfare – especially those centered on the deployment of a particular microbial toxin, botulinum neurotoxin type A (BoNT/A), which has been released previously as a bioweapon¹ and continues to rank high (next to anthrax) as a likely organism for bioterrorism². BoNT is a protease responsible for blocking the release of neurotransmitters in the synaptic gap between the nerve and the muscle, leading to flaccid paralysis and, in severe cases, death. Deliberate or accidental contamination of food or drink with microbial toxins like BoNT is not only a form of bioterrorism, but also a “global public health problem”³. Existing approved means of BoNT/A detection – the mouse bioassay and ELISA – are impractical with respect to the goal of on-site detection and analysis. As such, adequate preparation for imminent acts of bioterrorism warrants the development of *reliable microdevices that combine biochemical sensing and MEMS technologies* for on-site BoNT detection in, for example, milk supplies⁴. Toward this end, we have developed two separate platforms that rapidly detect BoNT enzymatic activity via (1) visual readout upon degradation (eradicates need for instrumentation) and (2) fluorescence upon cleavage (high sensitivity), whereupon each method boasts unique benefits over existing technologies. These biochemical sensing methods are currently being integrated into microfluidic devices, which offer the functional advantages of minimal sample handling and consumption (less than 1 μ L), increased flow control, and portability for potential on-site testing of contaminated samples.

A *BoNT/A-sensitive hydrogel (1)* was fabricated using a recombinant protein, rSNAP (derived from the BoNT/A SNAP-25 substrate), as the crosslinker. Heterobifunctionalized, linear poly(ethylene glycol) molecules linking an amine-reactive moiety to a photopolymerizable acrylate group were reacted with the rSNAP. Acrylated BoNT substrates were co-photopolymerized with acrylamide as “posts” within microchannels; because rSNAP functioned as the crosslinker within these hydrogels, the entire structure was degraded upon enzymatic cleavage by the toxin. Hydrogel posts have thus far been shown to degrade in response to nanomolar concentrations of BoNT/A. Furthermore, this microfluidic device can be interfaced with electrodes for signal transmission, indicating BoNT/A presence in a contaminated fluid. *BoNT-labile SAMs (2)* have also been constructed for sensing BoNT/A via a synthetic fluorophore-linked peptide (SNAPTide) derived from the minimal number of residues at the SNAP-25

cleavage site required for toxin recognition. The fluorescent SNAPtide was conjugated to gold surfaces using an aminoalkanethiol and a heterobifunctional amine- and thiol-reactive crosslinker. Upon cleavage by the toxin, the N-terminus fluorophore was released into solution for detection, demonstrating feasibility for detecting trace amounts of BoNT/A. Future efforts for the peptide SAMs include optimizing and characterizing sensitivity as well as integration into microfluidic devices.

Animal Carcass Disposal under Trial Event

Qi Gao, Yanhong Jin, Bruce A. McCarl,
Michael P. Ward, Linda Highfield, Raghavan Srinivasan
and Jennifer Jacobs
Poster Session Location: #38

Abstract

This research was supported by the Department of Homeland Security (DHS) funded Foreign Animal and Zoonotic Disease Defense Center headquartered at Texas A&M University and also the Technical Support Work Group (TSWG) of DHS.

Should a major outbreak of foot-and-mouth disease (FMD) occur it is likely to involve mass slaughter and disposal of animal carcasses. A rapid and effective disease eradication response is vital to minimizing livestock losses, economic impacts, and public health hazards. Rapid slaughter and disposal are integral parts of effective disease eradication efforts. However, realization of a rapid response requires emergency management plans that are based on a thorough understanding of disposal alternatives under various circumstances. This paper describes carcass disposal concerns arising in association with simulated animal disease outbreaks in Texas.

A stochastic, state transition simulation is used to develop carcass disposal loads under a disease outbreak under three mitigation strategies. Based on the simulated disease outbreaks, the daily carcass disposal load and available capacities of disposal facilities in events area (eight rendering, two composting and five incinerator facilities), the carcass disposal operation will last from 15 to 60 months if only local facilities are utilized (Table 1). Among alternative disposal techniques, burial is fastest and least direct cost. A geographical information system (GIS) package, which integrates spatial disposal capacity and daily animal carcasses load help to determine disposal locations and the corresponding "best" disposal technique. Using these data a unifying model was developed to minimize transportation cost and risk developing a disposal plan. The GIS model is also limited by regulatory specifications such as the disposal site must be at least 1,000 feet from public water supply wells, 1000 feet from a primary highway, etc. Further, each mitigation strategy will utilize 39, 188, or 160 burial sites with 200 by 400 feet of cell size and require approximately 5000, 25000, or 21000 of labor personnel (Table 1).

Table 1: Estimates of burial sites and the number of labors needs

Mitigation Strategies	Mortality (# of head)	Epidemic Length(days)	Disposal Length(month)	Assume Disposal Length (4 month)	
				# of Burial Sites (200 by 400 foot)	Labor Needs (person)
1	2180000	75	15.6	39	5072
2	8470000	76	60.6	188	24709
3	6860000	76	49.1	160	21013

The Differential Effects of Collective-level vs. Personal-level Humiliating Experiences

Jennifer S. Goldman
Columbia University
Poster Session Location: #31

Abstract

Project Scope:

Humiliation is considered a central factor contributing to the protracted nature of conflict (Coleman, 2003; Crocker, Hampson & Aall, 2004; Friedman, 2003; Lindner, 2002). However, our knowledge is severely limited regarding the precise role humiliation plays in conflict (Hartling and Luchetta, 1999), especially concerning the comparative effects of different types of humiliation. The purpose of this research is to determine whether humiliating experiences that involve collective-level identity characteristics (as opposed to personal-level identity characteristics) cause more negative affective and cognitive reactions and more aggressive behavioral reactions, both immediately after the humiliating experience occurs as well as in the longer term.

Research on relative deprivation suggests that people who experience collective-level relative deprivation show more negative attitudes and intentions to aggress than people who experience personal-level relative deprivation (Koomen & Frankel, 1992; Walker & Mann, 1987). Because the constructs of humiliation and relative deprivation both involve feeling “lower than” a referent party (see Lindner, 2002), I hypothesize that like relative deprivation, humiliation regarding a collective-level characteristic will produce more negative affective and cognitive reactions and aggressive intentions than personal-level humiliation.

Recent Progress:

A pilot study was conducted using an on-line survey in which participants (n = 52) were asked to place themselves “in the shoes” of a main actor who was humiliated by another actor. Immediately after reading the scenario as well as one week later, participants answered a series of Likert-scale and open-ended questions to assess their reactions. The results of the pilot study confirmed a number of aspects of the hypothesis. As compared to participants who were humiliated regarding a personal-level identity characteristic, those who were humiliated regarding a collective-level identity characteristic tended to feel more humiliated, experience more negative affect, think the event would serve as a more formative, guiding force in their lives (both immediately after reading the scenario and one week later), and ruminate more about the event. These results suggest that collective-level humiliating experiences do have more negative effects in the short- and longer-terms than personal-level humiliating experiences. These results, if they are replicable with larger and more

diverse populations, may suggest implications for policymakers regarding the need to prevent collective-level humiliating events from occurring in order to prevent negative reactions over the long-term.

Future Plans:

Based on pilot results, I am in the process of revising the theory and methodology for a second study. I will then run the second experiment with a larger population, collect and analyze data, and since these studies are part of my dissertation, defend my dissertation.

Optimal Detection and Identification of a Sudden Change in an Information Pattern

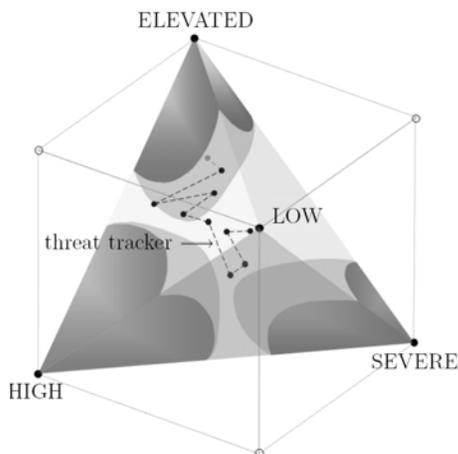
Savas Dayanik, Christian Goulding
and H. Vincent Poor
Princeton University
Poster Session Location: #2

Abstract

Project Description/Scope:

We study the joint problem of detection and identification of a sudden and unseen change in the statistical pattern of an information sequence to one of several alternative patterns. The objective is quick detection of the change and accurate inference of the ensuing pattern. This fundamental problem arises in a variety of applications, such as threat detection and identification in national defense and fault detection and isolation in industrial processes.

There are two competing goals associated with addressing this problem effectively. On one hand, we would like to detect the change as soon as it occurs so that we can react quickly. This calls for an on-line approach that can efficiently incorporate the latest information as soon as it is available. On the other hand, we would like to assess the nature of the change so we can react appropriately and use our limited resources effectively. This encourages waiting for more information before reacting. It is important for our decision strategy to balance this inherent trade-off properly. Moreover, although the information sequence bears the signature of the underlying change, typically, the root cause is unseen and we can only *infer* the emergence of an actual threat from the available information with an ever-present risk for getting it wrong. That is, our decision strategy must simultaneously factor in the costs of detection delay, misdiagnosis, and false alarm.



RECENT PROGRESS: Following a Bayesian approach, we reveal a new sequential decision strategy for this problem and provide an optimal mathematical solution. We demonstrate geometrical properties of this strategy via numerical and graphical examples.

For example, suppose that we process an information sequence in order to assess a change in the underlying threat level. Initially the inferred threat is low, but at some unknown and unseen time, the activity changes and the inferred threat changes to one of three prototypical cases, representing an elevated, high, or severe threat.

Left is a depiction of the optimal sequential decision strategy for a sample simulation of

such an instance showing the tracking of the decision statistic (dotted line) in order to trigger an appropriate new warning level (indicated by it entering a shaded corner of the tetrahedron) and to set in motion the proper measures and resources.

Future Work:

We will address a variety of statistical issues, such as dependence between the change time and its cause and multiple serial changes in the information sequence.

A Mathematical Model of Terrorist Organizations

Alexander Gutfraind (sole author)
Cornell University
Poster Session Location: #3

Project Scope:

My research is in developing mathematical models of terrorism, and of individual terrorist organizations. The goal of these models is to inform counter-terrorism policy.

Recent Progress:

In a recently-completed model, I have described the evolution of a terrorist organization like al-Qaeda. The organization is able to grow by publicity-generating attacks, but its growth is checked through counter-terrorism measures. Based on the model, sufficient conditions for the defeat of the organization are proven. Paradoxically, it is shown that under some circumstances, it is necessary to increase the counter-terrorism measures even if the organization is weakening. It is also found that the optimal strategy for destroying a terrorist organization is usually different from the optimal strategy to weaken it.

Future Plans:

In the near future, I will be expanding the core model above to include additional phenomena. In the longer term, I plan to develop mathematical models of a similar kind but looking at different aspects of terrorist activity. For instance, it would be interesting to understand the geo-spatial interactions between branches of a single organization. As well, I will be developing agent-based social network models of terrorism, which would mathematically implement recent insights from terrorism research. An important personal objective is to develop contacts with other researchers in the field, as well as agencies interested in this work. I also need to identify a permanent academic adviser that would be interested in working with me on these projects.

Publications since the beginning of the project:

The basic model is currently undergoing peer-review. A pre-print version is available at: www.cam.cornell.edu/~gfriend/gutfraind_model.of.terrorism.draft.pdf.

Risk Analysis of Biological Agents

Ashley Howell

Terry O'Sullivan

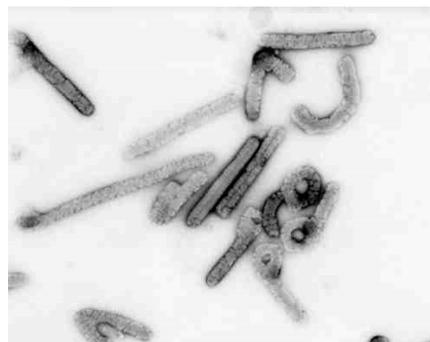
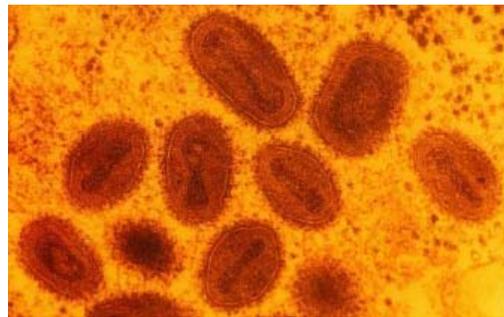
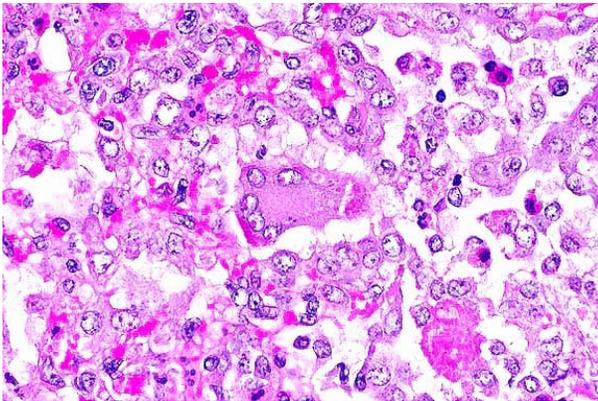
The Homeland Security Center for
Risk and Economic Analysis of Terrorism Events (CREATE)

Poster Session Location: #35

Abstract

My research is bioterrorism: assessing the economic impact and risk analysis of thirty biological agents. One particularly notable accomplishment is that my work will be used in the Bioterrorism Risk Assessment for the Department of Homeland Security produced by the National Biodefense Analysis and Countermeasures Center (NBACC) for the White House. Specifically, I have compiled a database of thirty biological agents detailing their viral composition, disease capabilities, dissemination rate, and countermeasures. This information is used to categorize the agents into a chart based on mortality rate, type of agent, and curability. In addition, the information initiated the most recent phase of examination. These agents are ranked using the specific criteria based on affordability, accessibility and dissemination to imminently cause the gravest impact and threat to society.

I hope to expand on this phase of my research to examine multimedia sources such as terrorist websites and publicans to future accessibility and dissemination. Additionally, I want to explore the risk analysis of agent weaponization by collaborating with members of the defense industry. Knowing the enemy is stopping the enemy. The objective of my bioterrorism research is to make a contribution to our Homeland Security efforts and serve my country. Thank you for your consideration.



Impact of Animal Disease-related Trade Disruption on the U.S. Beef Market

Rong Hu, David Bessler, Bruce McCarl,
and Yanhong Jin
Texas A&M University
Poster Session Location: #39

Abstract

The US cases of BSE (Bovine Spongy Encephalopathy), also called mad cow disease, detected in Canada the U.S., have increased concern relative to the safety of the food supply chain. Animal disease outbreak on large scale brings massive impacts in affected countries. Huge costs can be encountered for disease management, slaughtering of infected animals and subsequent recovery. Outbreaks also cause trade disruptions and shifts in supply and sometimes demand for the affected commodity.

The meat industry is the largest sector in terms of product value within U.S. agriculture. About 10% of U.S. beef production was exported before 2003. However, the export markets to Japan, South Korea, Mexico and Canada were closed after the BSE event. The Canadian BSE cases also resulted in the trade ban on Canadian cattle and beef into the U.S. and the international market. Since Canada was a major source of live cattle imports to the U.S., then the U.S. cattle market was affected.

The objective of the study is to examine the meat market effects and their duration as caused by the BSE events examining effects on prices and market quantities for the U.S. live cattle, U.S. beef exports, and U.S. beef consumption. Results from this study also demonstrate how the U.S. beef market reacts to the shocks in international trade. The results will show the decomposition of the effects from trade disruption and beef demand shifts.

To do this the study employs a time series statistical approach analyzing the data for the U.S. beef market in the neighborhood of the 2003 BSE discoveries in the U.S. and Canada. Empirical results show that changes in trade associated with BSE had impacts on beef prices. The historical decompositions show that the BSE induced ban on live cattle imports from Canada had negative impact on beef prices after the outbreak in Canada. They also show the impact of beef exports is mixed on beef prices. It can be concluded that trade related effects of BSE have impacts on beef prices. Canadian import ban and U.S. export ban had countervailing effects. But the impact of these two outbreaks in North America in 2003 is not as great as we had expected.

Visual Analytics for Emergency Response Using Mobile Devices

Sungye Kim, Yun Jang
and David S. Ebert
Purdue University

Poster Session Location: #4

Project Goal/Scope:

Using mobile devices for visualization provides a ubiquitous environment for accessing information and effective decision making. The motivation for our work is that mobile devices could be indispensable tools for emergency response if various relevant, selected information (e.g., images, 3D models, and sensor data streams) can be effectively visualized together on these devices that have varying capabilities and resolutions. With the advent of high-bandwidth wireless networks and rapidly growing computing capability, the current platform barrier for such visualization is now being removed. The purpose of our work is to develop a mobile visual analytic system for emergency response. In particular, we are interested in processing and displaying sensor network, location, and video data for the first responders to increase situational awareness and enable more effective response.

Recent Progress:

To date, we have focused on visual analytics on client mobile devices basing our system upon server-client architecture. Our tool presents efficient and interactive visual analytic methods for emergency response on mobile devices and provides visualization of various types of data. Our client visualization tool consists of four parts; visualization of 2D/3D environment, visualization of personnel location data, simulated sensor data, visual analytics, and user interfaces. For the scenario of The Station nightclub fire that took place on the February 20, 2003, our tool visualizes a distribution of temperature, smoke, CO₂, and CO from the fire simulation data as well as paths of movement and health conditions of the simulated evacuating agents at interactive rates. In addition, it displays helpful information for analysis, such as the number of evacuated agents at each exit, the rate of evacuation, the current health condition of a selected agent, and the number of agents in each condition (alive, unconscious and dead). For situations requiring rapid decisions, such as emergency response analysis and services, our system can be used as an efficient testbed and prototype. We have tested our application on a Dell Axim™ X51v that has Intel® PXA270 XScale 624MHz processor, the Intel® 2700G graphics accelerator with 16MB video RAM and 64MB RAM and on a Sprint PCS VisionSM Smart device PPC-6700, which uses Intel® PXA270 XScale 416MHz processor and 64MB RAM. However, our tool will be run on any mobile devices using the PocketPC environment with sufficient processing capabilities.

Future Work

As future work, more analytic functions will allow us to understand emergency situations and support rapid decision making. For example, information visualization of specific agents selected by a user can improve analysis. Moreover, an extension using GPS for a client-centered visualization as well as 3D movement of agents for effective user observation through 3D navigation can provide a more meaningful visualization.

Jigsaw: Facilitating Investigative Analysis Through Visualization

Zhicheng Liu (student) and John Stasko (advisor)
Georgia Institute of Technology
Poster Session Location: #5

Abstract

Project Scope:

Investigative analysis often involves discovering clues and gaining insight from large collections of text reports. We present Jigsaw, a visualization tool to deal with this information overload and make the analytical process more effective. Our system provides a collection of useful visualizations that each portray different aspects of the reports. We focus on identifiable important entities mentioned in these reports and create visualizations to reveal the connections between these entities.

Recent Progress:

Important entities mentioned in intelligence reports usually fall into one of these categories: person (in the form of a name), place (in the form of address, city, state or country), date and organization (in the form of a name). Two entities are considered to be connected if they appear in the same report. Preliminary textual processing is used to extract these entities and structure them in an xml file. This data file is used as the input for Jigsaw.

Jigsaw provides four distinctive visualizations, which we call views, to portray the relationships between the entities in different perspectives; hence the ideal setup for Jigsaw would be a multi-monitor computer where the views can be displayed in ample pixel space without cluttering. The views include:

- ◆ a *connections* view containing reorderable lists of entities where connections between entities are shown by highlighting connected entities and drawing links between them
- ◆ a *semantic graph* view showing the connections between entities and reports in a node-link visualization, allowing analysts to dynamically explore the reports by showing and hiding links and nodes
- ◆ a *scatter plot* view giving an overview of the relationship between any two entity categories, a closer investigation over a smaller region is supported by range sliders
- ◆ a *text* view displaying the original reports with entities highlighted

A query interface is also provided in our system to allow users enter entities and the views are updated with the query results. User interaction on one view is translated to an event and communicated to the other views which update themselves appropriately. Through such communication, different aspects of the reports can be examined simultaneously.

Future Plans:

Future evaluation of the system will focus not only on usability, but also on its utility in supporting analytical tasks such as reducing analysis time, increasing productivity, helping hypothesis formation and gaining insights. In addition, we will create authoring views where analysts can describe and document their mental model of the information in the reports.

Exploring Large-Scale News Video Databases via Visual Analysis

Hangzai Luo, Jianping Fan, Jing Yang
and William Ribarsky
University of North Carolina
Charlotte
Poster Session Location: #6

Abstract

Broadcast video news provides not only reports on events but insight into the social and political framework from which the broadcast originates. However, with the rapidly increasing number of broadcasts, the fraction that can be successfully watched in detail or even monitored by any individual or entity is growing ever smaller. This project resolves this problem by integrating achievements in semantic video analysis, knowledge discovery and visualization. By optimizing all sub systems toward a single target, the resulting solution significantly improves overall performance and also provides important new capabilities for large-scale news video exploration, comparative analysis, and discovery.

To achieve semantic video understanding, we have developed a principal shot-based video content representation framework and multi-class EM algorithm for semantic video classification. Based on our semantic video understanding framework and a full multimedia analysis approach that merges video, audio, and closed captions (where available), we have developed novel knowledge modeling via semantics and interesting knowledge extraction via a provider behavior model that can be applied to automatically identify and extract news stories from a video stream in any language. The knowledge extraction algorithm is able to extract interesting knowledge and suppress uninteresting knowledge. Finally, visualization techniques are used to represent the knowledge and visual semantics and provide an interactive exploration approach. An online demo can be found at <http://cs.uncc.edu/~jfan/NewsRelation/demo.htm>. We have more than 20 research publications for this project. Most recent ones are listed at the end of this abstract.

In the future, feature selection will be integrated in the multi-class EM algorithm to improve the performance of semantic video understanding. A better knowledge extraction algorithm will be implemented by integrating the provider behavior model with a user behavior model. A seamless hierarchical browsing visualization interface will be used to enable users to explore the database with different level of details and over any time range.

- H. Luo, J. Fan, S. Satoh, and W. Ribarsky. "Large scale news video database browsing and retrieval via information visualization". (accepted) In *ACM SAC*. Seoul, Korea, 2007.
- J. Fan, H. Luo, Y. Gao, and R. Jain. "Incorporating concept ontology to boost hierarchical classifier training for automatic multi-level video annotation". (accepted) *IEEE Trans. on Multimedia*, 2007.

- H. Luo, J. Fan, Jin Yang, W. Ribarsky, and S. Satoh. “Exploring large-scale video news via interactive visualization”. In *IEEE VAST*. Baltimore, USA, 2006.
- H. Luo and J. Fan. “Large-scale video retrieval via semantic classification”. In *ACM Multimedia Doctoral Symposium*. Santa Barbara, USA, 2006.
- H. Luo, J. Fan, Y. Gao, S. Satoh, and W. Ribarsky. “Large-scale news video retrieval via visualization (demo paper)”. In *ACM Multimedia*. Santa Barbara, USA, 2006.
- J. Fan, H. Luo, Y. Gao, and M. S. Hacid. “Mining images on semantics via statistical learning”. In *ACM KDD Conference*. Chicago, USA, 2005.

Optimization with Uncertainties for the Location and Allocation of Medical Supplies in an Emergency Situation

Huseyin Onur Mete, Zelda Zabinsky
University of Washington
Poster Session Location: #7

Abstract

Project Scope:

Decisions to support preparedness and response activities for disaster management are challenging due to the uncertainties of events and complications on the availability of real time data. Optimization models for the location and allocation problems of medical supplies to be used in emergencies are developed for the Seattle region, which is vulnerable to earthquakes. The location of the warehouses and their inventory levels for medical supplies are critical decisions to be able to respond to an earthquake. The locations must be chosen so they have a low risk of earthquake damage themselves yet provide fast distribution to hazardous areas. Moreover, the transportation roads are at risk of sustaining damage, which has to be considered in the allocation of materials to hospitals. The stochastic programming model is able to balance these risks with timely delivery of medical supplies. These optimization models provide optimal decisions to the players of RimSim, a simulation environment being developed for training of personnel in a command center in a disaster situation. The project is a part of the Pacific Rim Visualization and Analytics Center (PARVAC) with core funding from the Department of Homeland Security.

Recent Progress:

We have been focusing on two major earthquake scenarios for the Seattle area, called Seattle and Cascadia Fault earthquakes. Hospitals in the region share nine warehouses for medical supply storage. In a disaster situation, it is predicted that 22 hospitals will have higher demand than their daily operations. Due to the increase in the demand, they will need immediate transfer of additional medical supplies. The uncertainties of the problem (e.g. demand of hospitals) led us to a scenario-based Stochastic Programming (SP) model.

The problem has a two-stage nature. In the preparedness stage, the warehouses to be active are selected and their inventory levels will be determined by the SP Model. After the disaster occurs, the transportation of each type of material from warehouses to the hospitals, including the loading and routing of vehicles is determined by the Mixed Integer Programming (MIP) model. Considering the possible disaster scenarios for the Seattle area, we provide an optimal solution for the preparation phase. After the onset of the disaster, the players on RimSim can consult with the optimization tool for an updated

optimal solution according to the current conditions. The MIP model takes up-to-date parameters regarding the effect of the disaster and player's preferences to recommend an optimal allocation with routing of vehicles. In addition, we constructed a spreadsheet tool that takes the parameters, formulates the models, calls optimization software to solve, and presents the solutions.

Future Plans:

The first item in our list is achieving seamless connection of RimSim and the optimization models. For this purpose, we have been working on coding of the system in an object-oriented language using the libraries of the OPL-CPLEX software, which is the state-of-the-art MP development and optimization tool. Furthermore, we are planning to get feedback from medical experts about our models and expand the research by incorporating more uncertainties of the medical and emergency management fields.

Does Watching the News Affect Perceived Risk of Terrorism?

Ashley M. Nellis
American University
Poster Session Location: #32

Abstract

Several authors have proposed that the news media elevate perceptions of risk and fear of crime. Research suggests that fear of crime is related to the overall amount of media consumption, “resonance” of news reports, how much attention the individual pays to the news, and how credible he or she believes it to be. The present study examines whether this dynamic applies for terrorism. Telephone survey data (n = 532) of New Yorkers and Washingtonians were obtained through financial support of the University of Maryland’s National Consortium for the Center for the Study of Terrorism and Responses to Terrorism (START), and are used to test whether perceived risk of terrorism is associated with news consumption, and whether this relationship is mediated by resonance, attention, or credibility. Findings are that while exposure to terrorism-related news, and attention paid to it are positively associated with perceived risk of terrorism, the relationship between news consumption and fear of terrorism is more complex. In addition, self-reported victimization (resonance) is significantly related to perceived risk but not fear. Finally, neither attention, victimization experience, nor perceived credibility of news reports mitigates the effects of the overall frequency of terrorism-related television news.

**Global Cities, Global Threats:
The New York Police Department,
The London Metropolitan Police Service and
The Internationalization of Municipal Policing
for Counterterrorism**

Brian Nussbaum, Victor Asal (Faculty Sponsor)
National Consortium for the Study of Terrorism and
Responses to Terrorism (START)
Poster Session Location: #33

Abstract

The London Metropolitan Police Service (Scotland Yard) and the New York Police Department are widely viewed as two of the most effective and ambitious municipal police forces in the world, particularly in the realm of counterterrorism.

These two municipal police forces, from two of the world's most significant cultural, social and economic hubs are at the cutting edge of law enforcement and counterterrorism; and may be offering up an increasingly appealing option to other cities: the internationalization of municipal policing.

I am doing a comparative study of these two police forces, how they've reacted to international terrorism, what new and innovative international tasks they've undertaken, and what the potential is for these approaches to be emulated or mirrored in other cities around the world.

The NYPD is, and has been for sometime, unlike any other police force in the United States. However it has, since September 11th, become unlike any other police force in any country in the world. In the wake of the intelligence failure of 2001, the NYPD's Intelligence Division has undertaken an unprecedented global expansion. New York City officials, feeling they had been left out of the loop regarding terror threats by the FBI and CIA amongst others, has undertaken to provide for their own security in a manner that is considered innovative by many, and threatening by some.

The Intelligence Division has sent officers to capitals in Europe, Asia and the Middle East, developing an intelligence gathering apparatus to rival the scope of those in many moderately sized countries. This internationalization of a municipal police force is unlike anything that has been seen before; with perhaps the possible exception of London's Metropolitan Police.

Scotland Yard on the other hand has a much longer history of dealing with international terrorism dating back to at least the 1870s, particularly terrorism of the Irish Republican variety. My work (interviews being conducted in London between 1/29/07 and 2/8/07) with the Metropolitan police is focused mainly on what used to be "Special Branch" or SO13, but has recently been amalgamated under the new Counterterrorism Command. The MPS also have adopted very unique responsibilities vis a vis Counterterrorism, owing in large part to the particular character of Special Branch and its early history as the main government entity responsible for protecting the UK from terrorism. They have

been doing international counterterrorism as long as there has been such a moniker, and as such have a great deal to offer in terms of insight and best practices.

The Quest for Certainty and Social Response to Terrorism

Edward Orehek, Shira Fishman, Mark Dechesne,
Bertjan Doosje, Arie Kruglanski, Angela Cole,
Billie Saddler and Tarra Jackson
University of Maryland
Poster Session Location: #34

Abstract

Terrorism is a form of psychological warfare, with the aim to advance political objectives through the spreading of fear. Classic ideologues of terrorism have argued that terrorism destabilizes the state and unmasks its impotence, thereby inviting a political alternative that the terrorists are interested in promoting. The instability and insecurity fostered by terrorism may give rise to a state of psychological uncertainty, the unraveling of expectations, the setting of doubt, and the waning of trust in one's leadership. In psychological terms, the terrorist logic rests on the assumptions that (1) terrorism introduces a state of aversive uncertainty, and that this (2) fosters disappointment in the government entrusted to provide certainty, hence increasing the appeal of anti-government forces. In this vein, Osama bin Laden has proclaimed "neither America nor the people who live in it will dream of security before we live it in Palestine, and not before all the infidel armies leave the land of Muhammad" and that "The Western regimes and the government of the United States of America bear the blame for what might happen. If their people do not wish to be harmed inside their very own countries, they should seek to elect governments that are truly representative of them and that can protect their interests." If terrorism breeds insecurity and uncertainty it should elevate people's need for cognitive closure. However, previous need for closure research suggests that this motivation is likely to engender support for one's group and its leadership rather than undermine it. We conducted 5 studies to test the psychological impact of terrorist attacks regarding the claims of the terrorists about the efficacy of terrorism as a means to achieving a political goal. The present set of studies explored the psychological relation between uncertainty and support for counterterrorism. We found support for the notion that uncertainty arousal, through reminders of the possibility of terrorist attacks, elevates the need for closure and that, the need for closure may enhance group identification, interdependence with others, in group favoritism, support for tough, and decisive policies aimed at restoring certainty, and for leaders assumed likely to carry out such policies. Therefore, it seems that the terrorist ideologues were correct in their assertion that terrorism arouses aversive uncertainty. However, it also seems that this may foster greater group solidarity and rallying around a leader. This only happened in our studies when the leader was perceived to be decisive. As such, the terrorist aims may well be efficacious when leadership fails to provide the certainty individuals are seeking.

Automatic Extraction and Geo-spatial Visualization of FEMA National Situation Updates

Chi-Chun Pan, Prasenjit Mitra
Pennsylvania State University
Poster Session Location: #8

Abstract

Project Scope:

Rapid responsiveness is the key of successful crisis management. However, emergency situations may create an overload of information which are difficult to be processed manually. Hence, automatically extracting useful pieces of information from vast sources of textual data is vital for such scenarios. In this project, we study using information extraction and text mining techniques for Visual Analytics. We create a hybrid information extraction system to extract concept maps and spatial-temporal information from text documents using both rule-based and machine-learning methods.

A prototype system has been implemented to create visualization for FEMA National Situation Updates. Daily reports are fetched from the FEMA website and split into several incidents. Each incident then will be classified into topics based on word frequency and tagged with location names. The extracted information is stored in a repository and can be visualized with GIS applications such as Google Map. The system provides an intuitive way to browse and visualize FEMA situation updates. The applications include emergency situation patterns analysis and real-time emergency updates monitoring.

Recent Progress:

1. We have designed a novel algorithm using stripped dependency tree kernels and Support Vector Machine (SVM) to identify relationships among named entities.
2. The Entity Relation Extractor is implemented as Web Services and can be accessed by Internet.
3. We have created a geo-spatial visualization of FEMA National Situation Updates to demonstrate the usability of the Entity Relation Extractor.

Future Plans:

1. Currently, the accuracy of relationship extraction is about 60%. We will design better algorithms to improve the performance.
2. Resolving ambiguous geo-tags with local/city level accuracy.
3. Aggregate disparate data sources to provide a world-wide real-time emergency monitor.

Publications since the beginning of the project:

1. Chi-Chun Pan, Prasenjit Mitra, Auroop Rattan Ganguly, Relationship Extraction from Text Documents Using Stripped Dependency Tree Kernels, in review.

**A Risk Assessment of
Critical Infrastructure Sites in California**

Jacquelin D. Reed
University of Southern California
Poster Session Location: #22

This research was conducted for the Center of Risk and Economic Analysis of Terrorism Events (CREATE). I investigated potential target sites of terrorist events for the purpose of further protection of California's Chemical/HAZMAT Sites, Commercial Assets, and Water Resources (Dams). This research and on-site investigations found that chemical sites and dams posed the greatest risk. These risk assessments were part of a larger effort to assist the California Office of Homeland Security (CA OHS) in allocating Buffer Zone Protection Plan (BZPP) funds to infrastructure sites. The staff of the CA OHS made their allocations of 2006 BZPP funds following our assessments and asked CREATE to also support their allocations of the 2007 BZPP funds.

Estimating the Likelihood of Terrorist Attacks on the Ports of Los Angeles and Long Beach

Heather Rosoff and Detlof von Winterfeldt
Center for Risk and Economic Analysis of Terrorist Events (CREATE)
University of Southern California
Poster Session Location: #36

Abstract

Since September 11, border security measures have proliferated. In particular, the Department of Homeland Security publicly has recognized the vulnerability of ports nationwide to terrorist attacks. Researchers from the Center for Risk and Economic Analysis of Terrorist Events (CREATE) conducted an analysis that focuses on the susceptibility of the Los Angeles and Long Beach ports. Together these ports are the third busiest in the world. Thirty-six percent of all United States imports travel through their entranceways and have a value of about \$212 billion per year. An attack upon the ports has the potential for serious economic and health - both physical and psychological - damages. This project provides an example of how risk analysis can be used to assess the susceptibility of these ports to a dirty bomb attack. Our analysis examines thirty-six scenarios of possible dirty bomb attacks in the Los Angeles and Long Beach harbors. Using project risk analysis tools, we estimate the success probability of such an attack. Plume models are used to estimate both short term health effects and long term cancer deaths. An input-output model provides estimates of the economic consequences of a short term and prolonged port shutdown. We suggest using this methodology to assist in setting counter terrorism policy measures against a dirty bomb attack, including the protection of the radiological sources and intercepting an ongoing dirty bomb attack. A paper entitled "A Risk and Economic Analysis of Dirty Bomb Attacks on the Ports of Los Angeles and Long Beach" has been accepted by *Risk Analysis*. A second, more technical paper is currently under development. Future plans involve expanding upon the model so that our analyses can extend to other areas of terrorist threat, such as biological attacks and bombings.

Low-Income Minorities' Preparedness, Response and Recovery Experiences During Hurricane Isabel and a Tornado: Were They Ready for the Unexpected?

Randy Rowel, Bazle Hossain, Myrtle Evans-Holland, Angela Cross,
Morgan State University; Thomas Kirsch, Johns Hopkins University

Center for the Study of Preparedness and Catastrophic Event Response

Project Scope:

The goal of the project is to identify cultural-specific disaster needs and to develop educational materials. An initial survey was conducted using a convenience sample of

292 low-income ethnic/racial minorities in 3 areas of the Maryland that had experienced a tornado (Spring 2002) or Hurricane Isabel (Fall 2003). The quantitative survey explored the participants' experiences with these events during preparedness, response, and recovery phases of the natural disaster by various demographic variables (i.e., income, race/ethnicity, age, gender, etc.). Of those surveyed, 67% were African Americans, 22% Spanish speaking Hispanics, and 11% other. The majority of respondents were females (68%) and between 18 and 44 years of age (70%). Nearly half (40%) had less than a high school degree or were high school/GED graduates (34%). Key findings resulting from this study were: 1) Risk Perception (66% felt completely or somewhat safe from natural disasters and 51% felt completely or somewhat safe from a terrorist attack); 2) Preparedness Behavior (43% indicated they were somewhat prepared and 27% were not all prepared when Hurricane Isabel or the tornado hit their community; 50% were not too or not at all confident that the system would do a good job protecting the public's health while 32% were very confident); 3) Warning Communication Response (47% indicated they would change their daily routine if the alert level were high or severe while 39% reported they were likely or not at all likely to change); 4) Recovery (48% indicated the government was not too or not at all supportive in helping them get things back together after Hurricane Isabel or the tornado hit their community. In addition to the survey, 20 focus groups were conducted involving 140 low-income African Americans and Spanish speaking Hispanics; one set of 10 focus group sessions provided an in-depth understanding of the quantitative data and a second set of 10 focus group sessions solicited input needed to validate and develop cultural appropriate educational materials for the target audience.

Recent Progress:

A follow-up study was conducted this past summer with a subset of low-income African American populations to further assess disaster service needs, perceptions about pandemic and avian flu, and the impact Hurricane Katrina had on their perceptions about disaster preparedness, response, and recover.

Future Plans:

Working with other PACER researchers, we plan to publish papers to: 1) examine the role of faith-based organizations in disasters; and 2) explore how vulnerable and underserved populations are defined within the context of disasters.

Publications since Beginning of Project: None

Host and *Brucella* Gene Expression Biosignatures in an *In Vitro* Model of Infection

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¹Dept. of Veterinary Pathobiology, College of Veterinary Medicine, Texas A&M University, College Station, TX, 77843-4467; ²Seralogix, Inc., Austin, TX; ³University of Texas-Southwestern Medical Center, Dallas, TX; ⁴Arizona State University, Tempe, AZ; ⁵Department of Homeland Security, National Center for Foreign Animal & Zoonotic Disease Defense, College Station, TX

Poster Session Location: #15

Abstract

Brucella natural infections occur primarily through mucosal membranes. HeLa cells, as non-professional phagocytic cells, have been used to investigate adhesion, internalization, intracellular trafficking and survival and replication of brucellae. Post-infection global gene expression profiles of *both* agent and host have yet to be analyzed. The goals of this study were to characterize the transcriptome of *Brucella* and *Brucella*-infected host cells during the initial infectious process for understanding the initial strategies employed for the pathogen to survive and replicate intracellularly and to identify perturbations of major gene(s) modulating critical cellular pathways during initial infection. Our initial results revealed that the intracellular replication of *B. melitensis* in HeLa cells begins after an initial adaptation period of 4h post-infection. Analysis of microarray results using classical statistical methods revealed 161 (35 up- and 126 down-regulated) and 115 (86 up- and 29 down-regulated) genes differentially expressed in intracellular *B. melitensis*, and 152 (45 up- and 107 down-regulated) and 957 (733 up- and 224 down-) altered genes in infected cells compared to non-infected ones at 4 and 12 h post-infection, respectively. *Brucella* genes related with transcription/translation (transcriptional regulators, ribosomal proteins) and metabolic processes (carbohydrate, lipid and amino acid transporters, kinases, dehydrogenases) were down-regulated at 4 but were up-regulated at 12 h post-infection. Among others, host genes related to apoptosis (caspase 1 & 3), cell cycle (cyclin, histone deacetylase) and MAPK signaling (MAPK1, 6 & 8) pathways were differentially expressed at both time points. Dynamic Bayesian modeling analysis identifies host and *B. melitensis* candidate mechanistic genes. To verify this *in silico* predictions, knocked down HeLa cells and *B. melitensis* mutants on candidate mechanistic genes were interacted with *B. melitensis* WT and non-transfected HeLa cells respectively, and their interaction followed up to 12 h post-infection. Our preliminary results characterized candidate genes important in *B. melitensis* infection to non-professional phagocytic cells as a preliminary approach to characterize and understand the *B.abortus*: host initial interactions as diagnostic biosignatures.

Low-Income Minorities' Preparedness, Response and Recovery Experiences During Hurricane Isabel and a Tornado: Were They Ready for the Unexpected?

Randy Rowel, Bazle Hossain, Myrtle Evans-Holland, Angela Cross,
Morgan State University
Thomas Kirsch, Johns Hopkins University
Center for the Study of Preparedness and Catastrophic Event Response
Poster Session Location: #24

Project Scope:

The goal of the project is to identify cultural-specific disaster needs and to develop educational materials. An initial survey was conducted using a convenience sample of 292 low-income ethnic/racial minorities in 3 areas of the Maryland that had experienced a tornado (Spring 2002) or Hurricane Isabel (Fall 2003). The quantitative survey explored the participants' experiences with these events during preparedness, response, and recovery phases of the natural disaster by various demographic variables (i.e., income, race/ethnicity, age, gender, etc.). Of those surveyed, 67% were African Americans, 22% Spanish speaking Hispanics, and 11% other. The majority of respondents were females (68%) and between 18 and 44 years of age (70%). Nearly half (40%) had less than a high school degree or were high school/GED graduates (34%). Key findings resulting from this study were: 1) Risk Perception (66% felt completely or somewhat safe from natural disasters and 51% felt completely or somewhat safe from a terrorist attack); 2) Preparedness Behavior (43% indicated they were somewhat prepared and 27% were not all prepared when Hurricane Isabel or the tornado hit their community; 50% were not too or not at all confident that the system would do a good job protecting the public's health while 32% were very confident); 3) Warning Communication Response (47% indicated they would change their daily routine if the alert level were high or severe while 39% reported they were likely or not at all likely to change); 4) Recovery (48% indicated the government was not too or not at all supportive in helping them get things back together after Hurricane Isabel or the tornado hit their community. In addition to the survey, 20 focus groups were conducted involving 140 low-income African Americans and Spanish speaking Hispanics; one set of 10 focus group sessions provided an in-depth understanding of the quantitative data and a second set of 10 focus group sessions solicited input needed to validate and develop cultural appropriate educational materials for the target audience.

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Publications Since Beginning of Project: None

Longitudinal Evaluation of Food Safety Discussion Based Exercises

Aylin D. Sayir, Elizabeth A. Prebles,
Dale C. Brandenburg, and Edward C. Mather
Michigan State University in partnership with
Wayne State University
Poster Session Location: #19

Abstract

A literature review of evaluation materials reveals that, to date, limited research has been published specifically examining the long-term effects or outcomes of discussion based exercises for emergency and disaster response. Reality based exercises (RBX) are a subset of these discussion based exercises. The RBX simulates real world chaos in a structured format, promotes discussion among the key stakeholders regarding a hypothetical incident and stresses the management and creation of policies and procedures for such an incident. Michigan State University has partnered with Wayne State University to evaluate the longitudinal outcomes of coordination and collaboration of four RBXs. It is also a goal of this project to better understand the lessons learned process. These RBXs took place at different times and in different locations for somewhat different groups. By evaluating participants from these exercises at various points in time after their participation, the impact of the exercise on the individual participant as well as their organization can be evaluated.

This project has three phases. First telephone interviews were conducted on a small sub-sample of the participants from the exercises. These participants were randomly selected. The interviews are near completion and will be reported in summary form. The second phase of the project is an online survey. This survey seeks to determine the outcomes of the exercise based on five major factors. These factors were borne out of previous research. These are management strategies, coordination strategies, organizational acceptance, exercise design features and response criteria (or measurement). The online survey will be administered to randomly selected participants from these exercises. A control group will also be measured.

Currently there are few prior publications related to this effort. The overall goal of this project is to determine the long-term effectiveness of discussion based Exercises. Because the literature on these exercises is lacking this project hopes to add to the literature and promote further studies on this important topic. The lessons learned process is not well understood and this type of project seeks to further the knowledge and literature regarding the lessons learned process. Based upon the disaster and emergency response literature, it seeks to understand and improve discussion-based exercises. This project also seeks to better understand the impact of these exercises on individuals and organizations.

Mapping Open-Source Information to Support Crisis Management

Brian M. Tomaszewski (in collaboration with Dr. Alan M. MacEachren)
Dept. of Geography, Northeast Visualization & Analytics Center
Pennsylvania State University
Poster Session Location: #9

Abstract

Crisis management activities inherently rely on geographical information. Geographical information abounds in open-source channels such as news stories. These channels implicitly contain numerous references to place (e.g., cities, countries) that are not readily accessible or viewable on maps. This information can support crisis management activity by helping, in part, to understand varied geographic reactions to a disaster event, develop post-event intelligence about what happened during a crisis and why, and aid in collection of information about hazard mitigation discussions underway in various locals.

The goal of the research reported is to develop a map-centric, visual analytic environment that can support crisis management activities through mapping of open-source information. A working web-portal version of this environment has been implemented and will be presented. Functionality developed to date centers around the automated retrieval of news stories based on a user-specified crisis context. Data retrieved is then computationally processed by extracting and visualizing geographic place names and possible relationships between places across user-defined geographic scales over time. Formal ontology's related to crisis concepts are used to find potentially relevant non-spatial dimensions within data retrieved. Concepts found are geographically contextualized by being anchored to the map locations of their corresponding news stories. Tightly coupled map displays allow the user to simultaneously view geographical locations found in 3D-realistic terrain and standard 2D cartographic perspectives. The unique advantage of this research is that the power of Google™ News, Maps, and Earth is harnessed in an integrated visualization system that can combine heterogeneous data sources to develop geographical knowledge. The public availability and ease of use these technologies afford makes the system available to a wide range of crisis management practitioners.

With our initial goal of extracting relevant content from news stories to visualize geographical and other forms of information now completed, it is possible to extend our research from a web-portal targeted to individual use to a portal that supports collaborative information retrieval and interpretation. Our goal with this research direction is to improve the effectiveness of teams to collaborate in crisis-oriented information synthesis activities by applying combined expertise to finding relevant information and to interpreting results of searches. A goal for the methods and tools presented is to contribute towards group awareness of the geospatial and temporal dimensions of situations within which people act and make decisions before, during, and after a crisis.

Publication related to this research:

Tomaszewski, Brian (2006), "Concept Discovery: Spatiotemporal Analytics, Visualization, and Knowledge Integration", <
http://www.geovista.psu.edu/resources/flyers/NEVAC_flyer_CDA.pdf >, (last accessed 24 January 2007).

The Role of Security in the Supplier Selection Decision

M. Douglas Voss and David J. Closs
Michigan State University
(NCFPD partner under The University of Minnesota)
Poster Session Location: #23

Abstract

This research investigates the trade-offs food manufacturers are willing to accept in order to receive increased security from their suppliers, as well as the conditions that might make food manufacturers more willing to make these trade-offs. Evidence exists that firms who increase their security capability will increase their cost of doing business. These costs will most likely be passed down to that firm's customers. It has also been shown that firms who increase their security capability add variance to their order cycle time, which stands to decrease their capability to deliver product to their customers in a reliable manner.

This research elucidates the amount of price increase and delivery reliability decrease purchasing firms are willing to accept in order to receive secure product from their suppliers. It is hypothesized that firms are not willing to accept higher prices or decreased delivery reliability in order to utilize secure suppliers unless certain conditions apply. These moderating conditions are hypothesized to be: (1) the purchasing firm is concerned about security related incidents that have occurred at their firm or (2) the purchasing firm sources goods internationally.

Conjoint analysis was used to test the proposed hypotheses. A sample of 107 purchasing managers employed by domestic food manufacturers was obtained. Results indicate food purchasing managers are not willing to sacrifice price or delivery reliability for security. However, if respondents were concerned over security related incidents or source goods internationally they are willing to pay a 1-2% price premium for advanced security. Respondents were not willing to sacrifice delivery reliability. Other supplier selection criteria are examined as well and results related to these criteria would be presented.

This research stands to be of interest to academics, practitioners, makers of public policy and parties interested in risk management. There has been little empirical work related to supply chain security, and this research therefore stands to be of interest to academics interested in the topic. The research is also of interest to academics in that it delineates the importance of security as it relates to other supplier selection criteria. The research provides practitioners evidence supporting the value of security to their customers, which could assist them in moving security related change management initiatives forward. Public policy makers can utilize the results to determine if government regulation of security is required, or if free market demands for security can substitute for burdensome regulation. The results are of interest to those interested in risk management in that they indicate if security, a means to mitigate the risks of terrorism, is important enough to managers that they are willing to sacrifice in order to receive secure product from their suppliers. Academic publications related to this research are in progress and targeted toward operations and supply chain related journals.

Construction of a Single-chain Fv Antibody for a Bacterial Target-specific Biosensor

Scott Walper, Gordon C. Cannon and Sabine Heinhorst
University of Southern Mississippi
Poster Session Location: #20

Abstract

The highly specific interaction between antibodies and their target antigen can be manipulated to construct an antibody-based biosensor that will allow for rapid identification of specific contaminants in a liquid sample. To avoid potential complications with the expression of a full length antibody molecule in bacterial cultures such as protein folding and glycosylation, a single-chain antibody gene is being constructed that is based on the antigen-recognizing domain only. This molecule will be significantly smaller and less complex than the full-length immunoglobulin and will facilitate manipulations of the gene itself that will directly affect the specificity of the antibody for its target antigen.

For detection of bacterial targets, a displacement biosensor is under development. The biosensor will consist of a single-chain Fv antibody (scFv) conjugated to a magnetic bead and bound to a solid support through a minimal antibody-antigen affinity for a substance on the support surface. The scFv will be engineered to demonstrate a high degree of affinity for a bacterial target antigen allowing it to dissociate from the solid support in the presence of this antigen. The biosensor displacement from the solid support will be detectable using a separate device which measures miniscule changes in mass. Since the scFv-bead conjugate is significantly larger than a single bacterium, displacement of even a few of the biosensors should be immediately detectable, compared to changes in mass that would occur with the binding of the target bacterium alone.

Our work is currently in a proof-of-concept stage. The target of our biosensor is a *Pseudomonas* species which serves as a pathogen stimulant. We have isolated immunoglobulin genes for the heavy and light antibody chains that demonstrate an acceptable level of affinity for the target bacterial antigens, and combined them into an scFv. Conjugation to a high mass bead has been performed with full-length antibodies and should be easily accomplished using the abbreviated scFv molecule. Mutational studies of the scFv gene will be conducted to improve specificity for the target antigens and to diminish specificity for the antigen bound to the solid support of the detector. Improvements in the scFv for its target antigens will be determined through surface plasmon resonance and phage display.

These preliminary studies will lead to future improvements that will allow for rapid detection of potential bio-terrorism threats such as *Bacillus anthracis* or *Clostridium botulinum* based on isolation of highly specific single-chain Fv antibodies. Although initial work focuses on a single target antigen, we are hoping to improve the capabilities

of the biosensor by combining several scFv that will identify a number of target antigens into a single biosensor unit that can readily be used in the field.

Multiplex Immunoassays for Detection of Antibodies Against Avian Influenza

Douglas S. Watson, Sanjay M. Reddy and Blanca Lupiani
Department of Veterinary Pathobiology, Texas A&M University and
National Center for Foreign Animal and Zoonotic Disease Defense
Poster Session Location: #16

Abstract

Avian influenza (AI) is considered an exotic disease in commercial poultry in the United States. However, AI outbreaks in poultry occur occasionally having dramatic economic and health implications. Thus, significant need exists for rapid and sensitive assays for AI detection. Multiplex bead immunoassays hold potential as platform for diagnostic assay development. Whereas traditional immunoassays, such as ELISA, can detect a single analyte per sample, bead immunoassays can potentially detect up to 100 analytes per sample. This could dramatically increase the efficiency of disease surveillance, raising the possibility of a single test capable of detecting influenza-specific antibodies and identifying virus subtype. Other advantages specific to AI include facile profiling of exposure to all influenza subtypes, evaluation of vaccination programs, and differentiation of vaccinated from infected animals (DIVA). The objective of this study was to develop a triplex assay for the detection of antibodies to three AI virus proteins in commercial poultry.

As a preliminary assessment of feasibility, a triplex assay for detection of three AI proteins, NP, M1 and NS1, was developed. Recombinant AI proteins were cloned into baculovirus expression vectors and expressed in insect cells. Immunoassay bead reagents were prepared by covalent coupling of recombinant proteins to fluorescent polystyrene beads. Bead immunoassays were developed using the Luminex platform. Bead couplings were confirmed using chicken polyclonal serum to AI and mouse monoclonal antibodies to NP and NS1 proteins. Reagent preparations were consistent and reproducible, and results were consistent in monoplex and triplex assay formats. A two-dimensional serological optimization was performed to determine ideal assay conditions. The antibody response of chickens infected with AI virus under laboratory conditions was also evaluated. Anti-NP responses were strong and consistent, both over time and between individual birds. On the other hand, anti-NS1 and M1 responses were weaker, highly variable between individual birds, and decreased significantly over time. To assess the specificity of the assay for AI virus, a series of samples known to be positive for other unrelated avian viruses were tested. A high degree of specificity in anti-NP and anti-M1 detection was observed. The multiplex assay was then compared to a commercially available ELISA for detection of anti-NP antibodies in commercial chicken flock samples. The multiplex assay was found to be superior for detection of anti-NP antibodies, with reduction of both false positive and negative samples in a small sample set. The assay was also capable of detecting anti-NP antibodies in commercial turkey flock samples.

This work demonstrates the potential for success of multiplex diagnostic assays for AI and other infectious agents of interest to DHS. These experiments will contribute toward advancing development of antibody detection diagnostics for AI and other infectious agents. They have also laid a clear path for future improvements toward the final goal of a functional end-user assay.

Effect of Host Species on the Dose Response of Inhaled *Bacillus anthracis* Spores

Mark H. Weir and Charles N. Haas
Drexel University
Poster Session Location: #12

Abstract

The objective of this study was to determine the quantitative differences between inhalation dose response of *Bacillus anthracis* spores. The inhalation of *B. anthracis* spores, once passing into the infection phase, is difficult to diagnose and nearly always fatal. Therefore the proper quantification of the dose response relationship is necessary for determination of the risk associated with inhalation of *B. anthracis* spores. *B. anthracis* was also chosen due to its significance and the existence of data for multiple hosts.

Data using primates, guinea pigs and rabbits were obtained which had sufficient data for a dose response analysis. The fit to exponential and beta Poisson models was obtained using maximum likelihood implemented in the open source platform R.

Overall guinea pigs exposed to the ATCC-6605 strain of *B. anthracis* and the data of primate exposure, showing a good fit to the exponential model, while all the other data for the other hosts and strains showing a good fit to the beta Poisson model. Despite this difference that was found both between strain used in one study and host animal, our analysis found that overall the data from these studies (with two different hosts) can be pooled. Hence, between monkeys and guinea pigs, inhaled dose can be used as a single metric, without interspecies correction. This suggests that such data could also be used to extrapolation to humans without interspecies correction.

Rift Valley fever Virus NSm Protein Inhibits Virus-induced Apoptotic Cell Death

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University of Texas Medical Branch at Galveston,
National Center for Foreign Animal and Zoonotic Disease Defense
Poster Session Location: #17

Abstract

Rift Valley fever virus (RVFV) (genus *Phlebovirus*, family *Bunyaviridae*) causes severe epidemics among ruminants and causes fever, myalgia, a hemorrhagic syndrome, ocular disease, and encephalitis in humans. Most recently, in 2006-2007 an outbreak of RVFV occurred in Kenya with a high case-fatality ratio. RVFV M segment encodes two major structural envelope proteins Gn and Gc, a minor structural protein 78-kDa protein, and a nonstructural protein NSm. The viral M segment-derived mRNA has five in-frame translational initiation codons upstream of the region encoding Gn and Gc proteins (the pre-Gn region). NSm protein and 78-kDa protein were translated from the first AUG and second AUG, respectively. The biological functions of the NSm and 78-kDa proteins are unknown, while both proteins are dispensable for viral replication in cell culture. To find biological functions of NSm and 78-kDa proteins, we generated a mutant RVFV (arMP-12-del21/384) carrying a large deletion in the pre-Gn region by using a reverse genetics system of an attenuated vaccine candidate of RVFV, MP-12. Neither NSm nor 78-kDa proteins were synthesized in arMP-12-del21/384-infected cells. arMP-12-del21/384 and its parental arMP-12 showed similar virus growth kinetics, viral RNA synthesis and viral protein accumulation in infected Vero E6 and 293 cells, yet the former produced larger plaques than the latter in Vero E6 cells. MTT based cell-viability assay showed that arMP-12-del21/384 replication in Vero E6 cells and 293 cells induced rapid and more extensive cell death than the parental arMP-12. Annexin V binding and flow cytometry analysis further revealed that RVFV infection induced apoptosis and arMP-12-del21/384 replication triggered apoptosis early in infection as compared with arMP-12 replication. Consistent with the annexin V binding assay, the activation of caspase-3, which is a hallmark of apoptosis, and the cleavage of its downstream substrate, poly-ADP-ribose polymerase, occurred much earlier in arMP-12-del21/384-infected cells than in arMP-12-infected cells. We further demonstrated that the kinetics and severity of caspase-3 activation was suppressed by expression of NSm protein in arMP-12-del21/384-infected 293 cells. These results demonstrated that the NSm protein delayed or inhibited virus-induced apoptotic cell death, suggesting that NSm protein may be involved in viral survival and pathogenesis in infected hosts.

Visual Analysis of Terrorists' Networks Extracted from the Public Knowledge Bases

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Drexel University

Poster Session Location: #10

Abstract

Understanding the conceptual, temporal and social properties of terrorism is essential to unlock terrorists' minds, track terrorists and make policies for emergency responses to terrorists' attacks. The primary goal of this article is to introduce an integrative approach to study the ideology of terrorism, social structures of terrorists' organizations and consistent patterns of terrorism events hidden in the public knowledge bases. Specifically, our approach aims to solve the tasks with the questions like:

1. What are the major terrorists' organizations at the Middle East? And what is the ideology for the organization?
2. Who are the key leaders of a terrorists' group?
3. When are the peak periods of terrorism attacks? And Why?
4. Are there emergent patterns connecting attacks with certain groups?
5. What is the lesson learned from an emergency case, such as Cuba Crisis?

Our system, Storylines [1], provides a novel storytelling framework to examine our approach and to help user visually and interactively explore textual information from multiple resources with diverse perspectives. The system enables user study a body of unstructured text without prior knowledge of its thematic structure and automatically find Who, When, What and Where in a salient story. It integrates natural language processing, latent semantic indexing and social network analysis. Natural language processing extracts data signatures, such as single key words, n-grams and named entities (People, Location, Organization and Time). Latent semantic analysis supports visually systematic exploration of the data signatures with reference to quantitative measures of importance and their associations. Measuring the data signatures by their contributions to the global latent concept space or a local latent concept dimension provides a unique way to understand the context and nature of the terrorism ideology. Social network analysis combines co-occurrence analysis of named entities and importance measures such as degree centrality and betweenness centrality. Named entity inter and intro relationships networks aware user the social structure and key players of terrorists' organizations. The temporal distribution variation of terrorism events, the ideology concepts and social structures with time, location and organization accelerate user sense making processes involving high-complexity and high-dimensionality problems. Our system has been applied to the 2006 VAST contest data that is a synthesized dataset. Our next step is to extend the work to large scale real-world datasets such as news archives, live news feeds, email archives, citation records and web blogs. The data sets of test cases we may use for

this poster include a concentrated terrorism news resource ICT (<http://www.ict.org.il/>), Google news and a web resource related to Cuba Crisis.

Publication:

[1] **Zhu, W.**, Chen, C. (2007) Storylines: Visual exploration and analysis in latent semantic spaces. *International Journal of Computers and Graphics*. Special Issue on Visual Analytics. In Press.

[2] Chen, C., **Zhu, W.**, Tomaszewski, B., MacEachren, A. (2007) Tracing conceptual and geospatial diffusion of knowledge. [HCI International 2007](#). Beijing, China. July 22-27, 2007.

Game Theory and Homeland Security Resource Allocation

Jun Zhuang and Vicki M. Bier
University of Wisconsin-Madison
Poster Session Location: #37

Abstract

In this work, we identify equilibrium strategies for both attacker and defender in a general model of whether and how the defender should disclose her resource allocation in the homeland security context. The key novel feature of our model is studying the defender options of whether to disclose arbitrary types of defensive information, including correct information (transparency), incorrect information (deception), or null information (secrecy). For simplicity, and to help ensure that we are focusing on the most fundamental reasons for secrecy or deception, we begin by examining this question in a single-target, single-period game.

In the case of complete information, our results show that secrecy is preferred to disclosure only under special circumstances (e.g., when the cost of disclosure is much larger than the cost of secrecy). In the case of incomplete information, however, our analysis shows that there some equilibria in which secrecy and/or deception can be strictly preferred by some types of defenders in order to mimic other types of defenders that are of less interest to attackers.

We propose to extend the model introduced to address situations in which the defender types (i.e., asset valuations) can be either discrete (binary) or continuous. Moreover, we plan to then model multiple-stage games in order to address more general phenomena, such as defender reputation effects and attacker learning over time. We hope that the results of this work will provide guidelines to defenders on the conditions under which secrecy and/or deception are appropriate in defending against terrorism, and when publicly known defenses can be expected to provide better deterrence.

Previous Publication:

- Zhuang, J and V.M. Bier. "Balancing Terrorism and Natural Disasters---Defensive Strategy with Endogenous Attacker Effort," *Operations Research*, in press.
- Zhuang, J, V.M. Bier and A. Gupta. "Subsidies in Interdependent Security with Heterogeneous Discount Rates," *The Engineering Economist* 52(1):1-20, 2007, in press.
- Zhuang, J and V.M. Bier. "Katrina vs. 9/11--How Should We Optimally Protect Against Both?" in Richardson, H., Gordon, P., Moore II, J. eds., *Post-Katrina: Economics, Social Aspects, and Risk*, Aldershot, England, Edward Elgar, in press.