



Thursday, December 1, 2016



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The U. S. Department of Homeland Security Center of Excellence, Department of Homeland Security Science and Technology Directorate Center of Excellence through the Borders, Trade, and Immigration Institute, held a Homeland Security Symposium titled: **“Game Theory & Adversarial Reasoning: Potential Law Enforcement Law Enforcement Applications.”** This symposium was a four part conversation reviewing the scope and nature of game theory and adversarial reasoning with law enforcement, with a specific focus on the homeland security enterprise.

Instructors Biography

Dr. Christopher D. Kiekintveld – University of Texas at El Paso

Christopher Kiekintveld is an associate professor at the University of Texas at El Paso (UTEP). His research is in the area of intelligent systems, focusing on multi-agent systems and computational decision making. He is also interested in applications of artificial intelligence to homeland security, cybersecurity, trading agents, and other areas with the potential to benefit society. He received his Ph.D. in 2008 from the University of Michigan for thesis work on strategic reasoning, including applications in designing a champion trading agent for the TAC SCM competition. He has worked on several deployed applications of game theory for security, including systems in use by the Federal Air Marshals Service and Transportation Security Administration. He has authored more than 60 papers in peer-reviewed conferences and journals (e.g., AAMAS, IJCAI, AAAI, JAIR, JAAMAS, ECRA). He has received several best paper awards, the David Rist Prize, and an NSF CAREER award.

Dr. Jun Zhuang – University at Buffalo

Dr. Jun Zhuang is an Associate Professor and Director of Undergraduate Studies, Department of Industrial and Systems Engineering at the University at Buffalo (UB). Dr. Zhuang has a Ph.D. in Industrial Engineering in 2008 from the University of Wisconsin-Madison. Dr. Zhuang's long-term research goal is to integrate operations research, game theory, and decision analysis to improve mitigation, preparedness, response, and recovery for natural and man-made disasters. Other areas of interest include applications to health care, sports, transportation, supply chain management, sustainability, and architecture. Dr. Zhuang's research has been supported by the U.S. National Science Foundation (NSF), by the U.S. Department of Homeland Security (DHS) through the National Center for Risk and Economic Analysis of Terrorism Events (CREATE) and the National Consortium for the Study of Terrorism and Responses to Terrorism (START), by the U.S. Department of Energy (DOE) through the Oak Ridge National Laboratory (ORNL), and by the U.S. Air Force Office of Scientific Research (AFOSR) through the Air Force Research Laboratory (AFRL). Dr. Zhuang is a recipient of the 2014 MOR Journal Award for the best paper published in 2013 in the journal *Military Operations Research*. Dr. Zhuang is a recipient of the UB's Exceptional Scholar--Young Investigator Award for 2013. Dr. Zhuang is also a fellow of the 2011 U.S. Air Force Summer Faculty Fellowship Program (AF SFFP), sponsored by the AFOSR, and a fellow of the 2009-2010 Next Generation of Hazards and Disasters Researchers Program, sponsored by the NSF.

Dr. Arunesh Sinha – University of Michigan

Dr. Arunesh Sinha is an Assistant Research Scientist in the Computer Science and Engineering Department at the University of Michigan. He received his Ph.D. from Carnegie Mellon University (CMU) and obtained his undergraduate degree in Electrical Engineering from IIT Kharagpur in India. He has industry research experience in the form of internships at Microsoft Research, Redmond and Intel Labs, Hillsboro. Dr. Sinha has conducted research at the intersection of security, machine learning and game theory. His interests lie in the theoretical aspects of multi-agent interaction, machine learning, security and privacy, along with an emphasis on the real-world applicability of the theoretical models. He was awarded the Bertucci fellowship at CMU for his innovative research. Dr. Sinha is the chair of two of the leading workshops at the intersection of Artificial Intelligence and computer security: AISec and AICS. Dr. Sinha's work has provided novel approaches to solve the optimization problem used in computing Stackelberg equilibrium in security games. This approach has solved large scale security games, where prior methods such as column generation completely fail to scale up. This innovative approach is being used in an airport screening application by TSA (called the DARMS project). Dr. Sinha has also provided mathematical foundations for the use of learning in security games, revealing the circumstances in which the composition of learning and optimization leads to sub-optimal outputs.

Topics Covered

1. Introduction to the research
2. Dr. Kiekintveld- Modeling Decision as Games
3. Dr. Zhuang- Gamer Theory and Homeland Security
4. Dr. Sinha- Applications of Security Games
5. Dr. Kiekintveld- Towards Richer Game Models

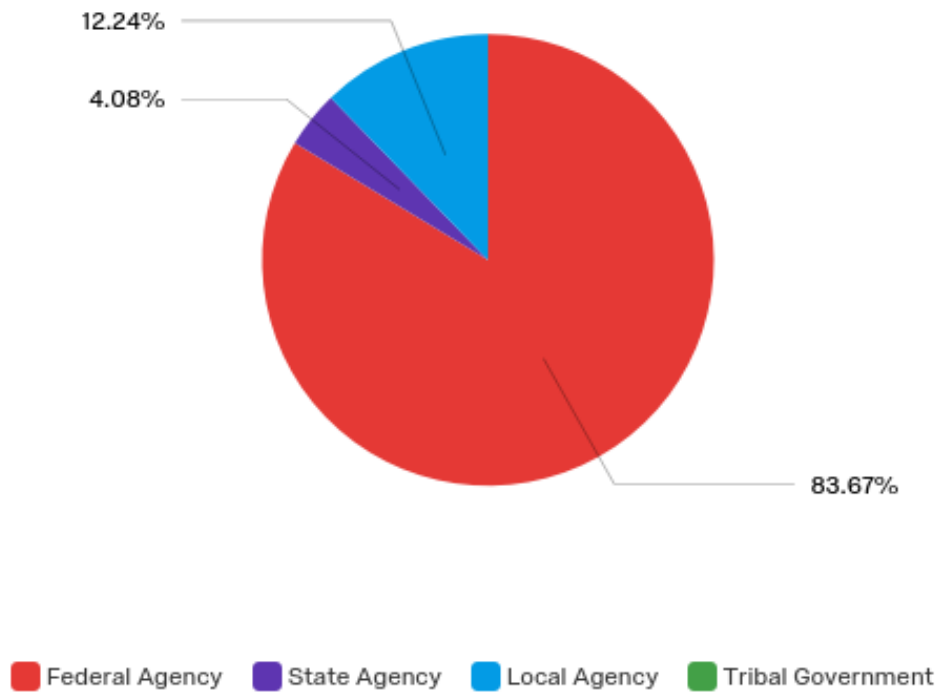
Analysis of Symposium Feedback

The symposium was well-attended with a total of:

- **68 Confirmed RSVPs**
- 56 Attendees (Approximately **82%** of RSVP total)

A total of 10 government agencies organization was represented by the symposium attendees. Attendees from El Paso, TX, U.S. Army Research Laboratory, and White Sands Missile Range, NM, attended this event. The symposium reviewed the scope and nature of game theory and adversarial reasoning within law enforcement, with a specific focus on the homeland security enterprise. The following table displays each of the agencies/organizations with the total number of representatives in attendance.

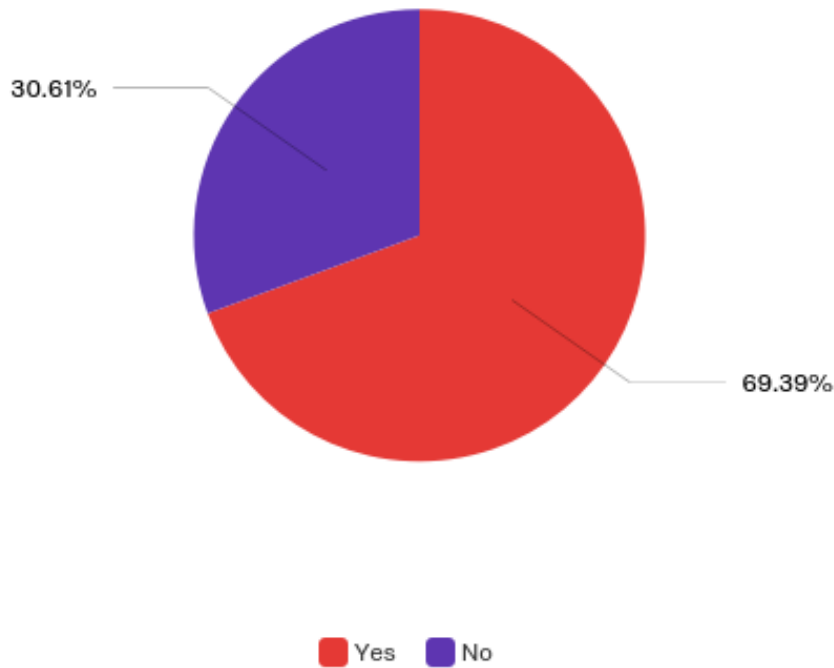
Federal Agencies		State Agencies	
ICE Enforcement & Removal Operations	10	UTEP	1
CBP - Office of Border Patrol	20		
US Army Research Laboratory	5	Total	1
FBI	4	Local Agencies	
DoD	1	El Paso Police Department	4
DEA	2	El Paso County Sheriff's Department	8
Homeland Security Investigations	1	Total	12
Total	43		



Every attendee was asked to fill out a symposium evaluation. A total of 49 surveys (**88% of total attendees**) were submitted. Overall, the assessment feedback was overwhelmingly positive (listed percentages are the sum of both the “agree” and “strongly agree” percentages):

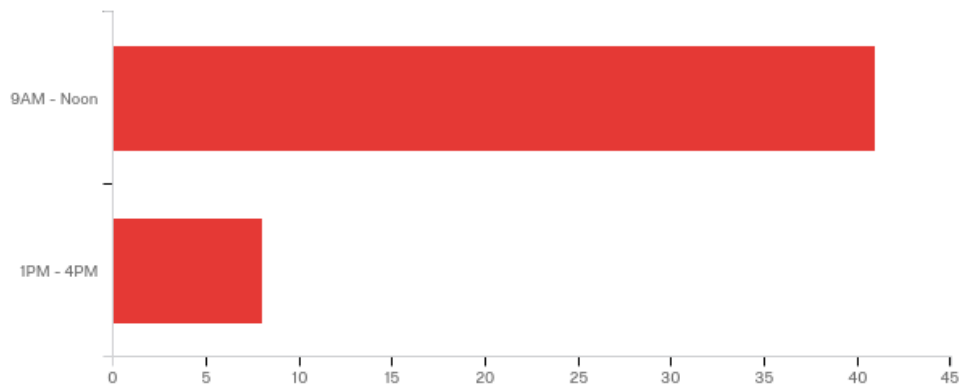
The seminar met my expectations	67.3%
The overall topics covered in this seminar were relevant and useful to my current assignment	59.1%
The seminar description accurately described the seminar content	91.8%
The seminar increased my knowledge of the subject matter	89.7%
The seminar increased my interest of the subject matter	77.5%
The overall quality of this seminar was excellent	83.6%
The instructors’ presentation style was effective	77.5%

The exit survey also contained the following question (Q3): Would you attend a second more in-depth symposium on this topic? The survey revealed that **69.4%** of the symposium participants would attend a second more in-depth symposium.



Open-attended responses indicated a common satisfaction with the course with particularly positive comments regarding the competence of the instructor and the content's utility and pertinence to their field of work. The following questions were asked in the exit survey and no edits have been made to the comments with the exception of spelling.

Q4. What is your preference for the next symposium?



Q5. What other topic/subject matter would you like to see presented in similar seminars, tabletop exercises or practicums?

- Command fast operation.
- Treat analysis more specific info on game theory.
- Tabletop on border security resource.
- Intelligence gathering Interviewing/ Debriefing Intel Research.
- Interviews/Interrogations.
- Make it more exclusive depending on the agency to better adapt it.
- Strategic Planning- Military decision making process.
- Gang and violent crime.
- Intelligence Techniques and Collection.
- Apply the Theory to drug routes.
- Machine Learning Artificial Intelligence.
- Cyber security past practices Practical research needs from real issues.
- Table top exercise.
- Utilizing models, such as those discussed, to predict and thwart explorations of ports of entry for commerce.
- How these theories are burnt.
- Interview techniques Terrorism Gangs.
- Can't think of anything at this moment.
- Intelligence data processing- both geospatial analysis and machine learning. Motivational models for leo HR- Management.
- A symposium on current and local crime trends and how police responses has changed because of the anti-police atmosphere.
- Studier in Predictability Analytics with or where social media is being used. Information collected by PC.
- Environmental human detection Technology driven policing criminal intake automation.
- Gender terrorism tactics.
- More intel.
- Transnational threat International Liaison LEOS.
- How to assess threat activities that go undetected Factors that influence threat behavior.
- Human & Contraband movements.
- Social network analysis Criminal network structure Integrating LE Intel Assets w/incident command Strategic Debrief/Interviewing.
- Introduction of intelligence into models. Attacking adversaries' center of gravity.
- Crime analysis.

Q5. If there are any additional comments you have about the seminar topics covered please provide them below.

- Great! Very insightful.
- Thank you!
- Have you used criminals to war game?
- Possibly bring in professors with more job knowledge in law enforcement or prior officers/agents proficient in the symposium topic in order to make the information more relevant to law enforcement professionals.
- Desk Chairs, difficult to write with these chairs.

- Thank you.
- AWESOME PRESENTATIONS.
- Anything regarding border security and counter proliferation.
- Very good symposium.
- Thank you, this was very informational!
- None.
- Very informative and will be useful in deploying resources.
- Very good, Informative.
- Good introduction to Game Theory.
- I believe a bit more hands on examples and have those presenting give their outlook on those examples used.
- EXCELLENT.
- Thanks for invitation.
- None.
- No.

Webcast Analytics

This symposium was the fourth effort to add a webcast feature as part of the value added deliverable of this program. All six symposiums have been filmed and can be viewed by the public on our website and YouTube account to enhance future viewings of the symposium series. The PI will continue with simultaneous webcast broadcasting of the symposium series with efforts to increase viewership through this medium.

Total views: 54

Total shares: 4

Symposium Series Visibility

In an effort to promote the symposium series and the work of the Borders and Trade Institute (BTI) we have actively engaged on Twitter and local news media outlets.

- There were thirteen (13) tweets that were sent prior, during, and just after the symposium event. The tweets received a total of **1,900** impressions.

Learning

Every attendee was asked to take a six (6) question Pretest Questionnaire in order to gauge the level of understanding of the topic. In addition, the participants were asked to take the same six (6) question Posttest Questionnaire at the conclusion of the symposium. The first question asked of the participant was to self-measure their level of knowledge on the topic on a 1 to 10 scale with 1 as *No Knowledgeable* and 10 as *Very Knowledgeable*. A total of 46 pretests/posttests (82% of total attendees) were returned by the participants.

Analysis: Self-evaluation by the participants indicated a **30% increase** in learning. The average Pretest Questionnaire score was **54%** and the average Posttest Questionnaire score was **89%**. The results of the Pretest and Posttest Questionnaires revealed a **35% increase** in learning.

Lessons Learned

As part of the program's self-evaluation process the following areas will be addressed:

- Continue to emphasis to symposium participants the importance of the Exit Surveys and Pretest and Posttest Questionnaires.
- Harvesting more precise information of webcast participation is currently being addressed.

Acknowledgements

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Victor M. Manjarrez, Jr.

December 19, 2016

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Date