Collaborative Project: A Multi-Disciplinary Framework for Modeling Spatial, Temporal and Social Dynamics of Cyber Criminals

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Previous working relationship

• No previous working relationship with Chellappan

• Holt had decade experience working with computer scientists/IT

• My first collaboration with computer scientist
Differences across disciplines

• Terminology/argot

• Methodology
  – Criminal Justice: self-report surveys data sets and online data
  – Computer Science: internet data usage/honeypots
• Little information on individuals

• Disseminating Results:
  – Computer Science: conference proceedings
  – Criminology: publications
Working across disciplines

• Challenging even within single university because of different terminology, priorities, etc., but also because of being housed in different colleges.
  – Many universities may not be equipped to handle one part of this type of collaboration

• Across different universities, some of the same problems but additional problems of physical distance.
Collaborative Project: A Multi-Disciplinary Framework for Modeling Spatial, Temporal and Social Dynamics of Cyber Criminals

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The first steps

• Establishing contacts was a major challenge
  – Identifying social sciences researchers in the discipline of cyber crimes was hard
  – More than 20 contacts attempted before success
  – How to convince researchers from another discipline?
  – Understanding the **foundations** of the other discipline required a lot of time
Institutional Challenges

• Computer Scientists in Institutions focusing on Science and Engineering do not have the necessary training – maybe true in general
• Survey instruments, Metrics Validation, IRB, Exclusion criteria, Subjects protection and more were critical hurdles to understand and then overcome
• Campus specific interdisciplinary forums will be a major help to overcome these issues, but viability is a challenge
• More interdisciplinary conferences will certainly help
Departmental Challenges

• Cross-disciplinary collaborations is not highly encouraged for pre-tenure faculty – chairs are many times not receptive
• Problem is publishing – cross disciplinary forums are seen as lack of discipline specific focus
• Some department chairs actively discourage younger faculty from investing time in inter-disciplinary research
• Students also experience delays in understanding cross-disciplinary terminologies, methodologies and practices
Preparing the proposal

• Formulating the problems and research directions take significantly more time
• Convincing experts in one discipline is hard enough, how about more than one
• Preparing budgets itself have been a challenge – salary, supplies, equipment, data management plans
• Weightage among various disciplines is challenging also
Students

- Students (UG, esp.) these days seem to enjoy interdisciplinary research – not so much international students
- Training in other disciplines seems more challenging than expected
- Publishing creates more hassles than opportunities
- Is the cyber-security industry really hiring students trained in interdisciplinary research
Lessons learnt for future

• Have a firm understanding of the problems faced across disciplines
• Prototypes and preliminary results are awesome assets to break ice and ensure more meaningful discussions
• Encourage student-student interactions across disciplines – even a course or two if time permits
• Spend time identifying the right person(s) to work with

• Finally, in interdisciplinary research – “The whole is truly greater than the sum of its parts”
Thank you
About Us

• Laura Dabbish
  – CMU HCII, Heinz Public Policy
  – Social psychologist by training
  – Tech supported work + communication

• Jason Hong
  – CMU HCII
  – Computer scientist by training
  – Usable privacy and security, mobile
How can we use social influences to help improve cybersecurity?
Social Networks Can Affect Voter Turnout, Study Says

Social scientists presented a message like this one to more than 60 million Facebook users during the 2010 Congressional elections.

By JOHN MARKOFF
Published: September 12, 2012

A study of millions of Facebook users found that online social media can have a significant effect on voter turnout. The study, published online, suggests that a special “get out the vote” message, showing each user pictures of friends who said they had already voted, generated 340,000 additional votes nationwide.

- “showing each user pictures of friends who said they had already voted, generated 340,000 additional votes nationwide”
- “they also discovered that about 4 percent of those who claimed they had voted were not telling the truth”
Project Overview
Social Cybersecurity

• Research to date
  – Interviews about why people changed behaviors and what they talk about with others [SOUPS 2014]
  – Study w/ Facebook evaluating social interventions with 50k people [CCS 2014]
  – Analysis of who does and doesn’t adopt features [CSCW 2015]

• Positive impact
  – NSA Honorable mention for Best Scientific Cybersecurity Paper for 2014
  – Adoption of some ideas by Facebook
We Are an Unusual Case for Collaborative Research

• Same department (CMU HCII)
  – Psychologists, designers, computer scientists
  – Made it easy to advise students and track progress

• Same publication venues
  – CHI, CSCW, SOUPS
  – Conferences vs journals doesn’t matter to us
We Are an Unusual Case for Collaborative Research

• Cross-training over several years
  – I’ve co-taught course on social web
  – Laura hangs around computer scientists
  – We have communication requirement talks by 2\textsuperscript{nd} and 3\textsuperscript{rd} year PhD students on wide range of topics
  – Students also cross-trained in disciplines
We Are an Unusual Case for Collaborative Research

• Methods mostly well-aligned
  – Most CS work focuses on *how to build things better*
  – Most behavioral work focuses on *understanding the world better*
  – Most CS work is atheoretical
  – Most behavioral work is all about theory
  – Most CS work focuses on design, build, and evaluate (often at small scales)
  – Most behavioral work focuses solely on evaluation

  HCI draws on ideas from both perspectives
Recommendations

• Give tutorials on behavioral methods at some top security venues (CCS, Usenix Sec, IEEE S&P)
• Vice versa for the different behavioral sciences
• Invited tutorials for SaTC PI meeting
• Offer funding to travel to these venues to understand methods, values, potential partners
  – Focus on people “closer” to other side
  – Ex. Social scientists already doing text analysis
  – Ex. CS already doing some behavioral work
Recommendations

• Get exemplars of good collaborations and publications to help community’s understanding

• Our CCS 2014 paper on Social Cybersecurity is a really good example of good social science and good cybersecurity
  – Draws heavily on existing social theory
  – Has elements of big data
  – Addresses a core problem in security
EAGER: IC Supply Chain Security and Quality Control in Business

Wei-Ming Lin, PI, EE/CE of U. of Texas at San Antonio (UTSA)
Ravi Sandhu, CO-PI, CS of UTSA
Kefeng Xu, Co-PI, Business of UTSA
Yao Zhao, Co-PI, Business of Rutgers U.
We investigate the types and motivations of Integrated Circuit (IC) supply chain risks, e.g.,
- IC sector lacks effective security enforcement policy and mechanism against counterfeit and Intellectual Property (IP) theft.
- Security threat - a party involved in IC design and manufacturing process may install a hardware Trojan which acts as a information leak back door once activated

We will develop an IC supply chain risk management methodology
- by taking the business and social context into account
- by combining security enhancement techniques and development chain, supply chain and project management techniques
What Works

• Connections in prior background
  - Two business co-PIs have UG training in Eng.
  - Willingness to understand and tackle other side’s problems with different tools

• Informal discussion environment
  - UTSA Faculty Center /Coffee shop

• Multiple interactions throughout project planning stage

• Use of laymen’s language in discussions; avoid jargons from both disciplines to ease communications problems

• Use real world examples to establish the issues to tackle
What Doesn’t Work

• Still to understand what doesn’t work, since we are at the early stage of our project execution.
• One expert in the group tends to be domain-oriented and rarely attends the joint meetings
  – Need both sides to be highly interested in using the other side’s knowledge
• Logistical challenge: Another expert is in a different institution (location) and could not come to the meeting to easily share ideas
Exploring Job Applicant Privacy Concerns

Donald Truxillo (PI), Psychology
Talya Bauer (co-PI), School of Business Administration
Mark Jones (co-PI), Computer Science
Alexa Garcia (GRA), Psychology

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Project Summary

Big Picture Goals:

- To examine privacy concerns of the general population in their interactions with computer systems and to understand resulting impacts on behavior
- To investigate mechanisms by which meaningful privacy expectations can be communicated, understood, and realized in complete systems: humans + machines

Specific Focus and Context:

- Online Human Resource Management (HRM) systems
- Leverage existing data set of applicant reactions
- Develop new experiments for further analysis
Why HRM is a Good Fit

Applicants, especially in our data set, but also in general:

• Are a good sample of a general, nontechnical population

• Are motivated to participate (they want a job!) and likely have experience and perspective from multiple hiring processes

• Have natural concerns for privacy:
  • personal information provided during the online interview and assessments
  • increasing publicity about identity theft, data breaches, inadvertent sharing (e.g., with current or competing employers)
Project & Team History

Donald
Psychology

Talya
School of Business

Alexa
Industrial/Organizational Psychology

Mark
Computer Science

Programming Languages, Trustworthy Systems

Data Set

"Academic Program Prioritization"

EAGER
Institutional Support for Interdisciplinary Research

• Encouraged *in principle*

• But it's unclear if any of us knows how to truly encourage, facilitate, and value it *in practice*
  - No special incentives, support infrastructure, or mechanisms to broker introductions
  - Perceived as risky for junior faculty (beyond logistical challenges, inherent sharing may reduce "credit")

• University level service does provide opportunities to break out of a departmental mindset:
  - Faculty governance
  - Graduate dissertation committees
Pondering Starter Questions

- previous working relationship (or lack thereof)
- similarity of disciplines
- similarity of institutions
- tensions with multiple departments
- tensions with multiple institutions
- deciding what, when, and how to publish where
- internal crediting of the work in an institution
- receptiveness (or lack thereof) of certain venues and institutions
- difficulties or successful strategies in recruiting students
- difficulties or successful strategies in obtaining financial resources
A Smooth Start

We've only just begun

- Yet to hit typical stress points (e.g., publication or reporting deadlines); this meeting may be our first test!
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Different departments, but only one institution
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Senior faculty

- Motivated by interest and personal development rather than the need to build a resume or case for tenure
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Small project, relatively low stakes, low $

- Of course, we still take it seriously and are responsible for the support and academic success of a student
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Established working relationships before the project began

- Shared values and a foundation for trust and respect
Celebrating Differences

As individuals, and as representatives from distinct disciplines, we recognize (and generally enjoy!) the fact that there are differences between us along multiple dimensions:

- Disciplinary interests and expectations
- Language and terminology
- Working practices
- Personal style
Celebrating Differences

Talya Bauer, Portland State University, Management

Talya N. Bauer (PhD, Purdue University) is an award-winning research and teacher who is a recognized leader in understanding the socialization and onboarding of new employees. She specializes in relationships at work and how they influence individual and organizational effectiveness and well-being during the employment life cycle. She has acted as a consultant for dozens of government, Fortune 1,000, and start-up organizations and was a Visiting Scholar at Google. Her work includes individuals around the world in banking, high tech, apprenticeships, court/police settings, job applications, student roles, research science, manufacturing, nursing, government, teaching, in the executive suite, health care, and those doing temporary work. This work has been covered in the New York Times, Harvard Business Review, USA Today, and Business Week as well as appearing on National Public Radio’s All Things Considered, and KGW News. Talya has served in elected positions including Member-at-Large for SIOP and she currently serves as an Associate Editor for the Journal of Applied Psychology (and is the former Editor of Journals Management). She is a Fellow of SIOP, APA, and APS. She has given nearly 200 refereed and invited presentations including keynote addresses and invited talks in Australia, Canada, Costa Rica, France, Greece, Holland, Italy, Norway, Singapore, Spain, Turkey, the UK, and throughout the United States. Her research has resulted over 100 refereed journal publications, book chapters, white papers, and books. Her work has been supported by grants from the National Science Foundation, the SHRM Foundation, the SIOP Foundation, and the Oregon Transportation Research Consortium, and has been published in research outlets such as the Academy of Management Journal, Academy of Learning and Education Journal, Journal of Applied Psychology, Journal of Management, Personnel Psychology, and SIOP's I/O Psychology Perspectives on Science and Practice.

Mark Jones, Portland State University, Computer Science

Mark Jones is a professor in the Department of Computer Science at Portland State University in Portland, Oregon. His primary research focus is on the use of advanced programming language technologies that support the construction and certification of secure and reliable software systems.
Celebrating Differences

Story from the Employing Organization’s Perspective

As an employer, my goals are to get the best applicants to apply so I can have a good applicant pool from which to choose. A large applicant pool will increase the odds of my making a good hiring decision1. I also want to be sure that the selection procedures are valid, that is, that a high score on the selection procedures is associated with better job performance. Thus, using the valid selection procedures can increase my odds of hiring the best applicants in the pool2. And I want the applicants to feel like they’re treated well, although frankly, with pools like this one (entry-level retail), I probably just want people who will take the job if it’s offered, are productive, and who won’t sue me for using an unfair selection procedure3. I have chosen to have online applications because this will increase the size of my applicant pool, and it’s the norm for big retailers these days. I want to go through an organization like K because K uses valid selection procedures and specializes in online assessments within my particular industry (retail).

I want to achieve my goals of a large applicant pool, valid selection procedures, and fair treatment of applicants in the most cost-effective way – I want high “selection utility”. In addition, I also want to accomplish my goals in a way that is quick and that gives good feedback to applicants and hiring managers. I have heard that applicants these days don’t want to spend a lot of time applying for a job4, and they want quick feedback, about whether they are going to be interviewed for the job or get the job5, so that’s really important to me. I don’t want the best applicants to get away.

Given the use of this online application system, this means that applicants will need to provide some personal information online, and so I need to worry a little about the security of their data. I know that there have been cases in the news where companies have had applicants’ personal information stolen, and I don’t need this kind of publicity or legal vulnerability, and so I want to be sure that applicants’ personal information is kept secure. I don’t really know what applicants think about this, though.

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6 This is an issue that have been citing in some conference papers and that is discussed a lot in industry, but to my knowledge, there is little research directly focused on applicants’ expectations of quick hiring procedures.

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Celebrating Differences

I/O?

Make time to learn one another's language ...
Summary

• A new, interdisciplinary project at the intersection of social sciences and computer science

• We're excited to be working together

• We think our project is off to a good start, with no major obstacles so far

• We're hoping that our participation in this meeting will help us to learn about strategies that can help us to:
  - continue with a successful interdisciplinary project
  - make contributions in our individual areas
  - provide a path to academic success for our students
  - have some fun learning new ideas together
Toward Transparency in Public Policy via Privacy Enhanced Social Flow Analysis with Applications to Ecological Networks and Crime

- Assistant professor
- College of Information Sciences and Technology
- Background: Computer Science
- Expertise: Data mining

- Assistant professor
- Department of Sociology and Criminology
- Background: Sociology
- Expertise: Crime, Urban Sociology

- Associate professor
- Department of Computer Science and Engineering
- Background: Computer Science
- Expertise: Privacy
Toward Transparency in Public Policy via Privacy Enhanced Social Flow Analysis with Applications to Ecological Networks and Crime

- LEHD (Longitudinal Employer-Household Dynamics): Census home-work commuting data
- Objective: Privacy-preserving technique that protect (1) privacy and (2) analytic results
Toward Transparency in Public Policy via Privacy Enhanced Social Flow Analysis with Applications to Ecological Networks and Crime -- Jessie Li, Corina Graif, Daniel Kifer (Penn State University)

Collaboration, Venues, and Objective

- Introduce data sets, problems, models used in sociology
- Implement the basic model, scale up the analysis
- Theoretical analysis based on the results
- Improve the statistical model: robust, effective, efficient
- Criminology, Sociology, Social Networks
- KDD, ICDM, SIGMOD, VLDB

EAGER

Design privacy techniques to sanitize data which preserves the analytic results
Toward Transparency in Public Policy via Privacy Enhanced Social Flow Analysis with Applications to Ecological Networks and Crime -- Jessie Li, Corina Graif, Daniel Kifer (Penn State University)

Similarities and Differences of Disciplines

**Similarity**
- Driven by real-world problems
- Using real-world data
- Take quantitative approach

**Difference**
- Evaluation: Theoretic explanations vs. Accuracy
- Skillset: Qualitative interpretation vs. Dealing with large-scale dataset
- Publication emphasis: theory and empirical tests of causal relationships vs. computational innovation
Opportunities and Good Trends

Venues:
• (SOC) National conferences are increasingly making calls for papers that capitalize on big datasets
• (CS) Data mining conferences have the trend to encourage applied data mining, e.g., data science track in KDD’16

Department:
• (SOC) Sociology & Population Research Institute at Penn State
• (CS) College of Information Sciences and Technology at Penn State

Funding:
• This EAGER grant
Challenges and Suggestions

Venues:
• (SOC) more exploratory approach to data analysis in advancing theory development
• (CS) more rigorous evaluations and discussions on simple models, avoid unnecessarily complicated model

Student/faculty training:
• (SOC) Technical skills
• (CS) Qualitative analysis

Faculty/student career:
• (SOC) less emphasis on single-author paper
• (CS) more credits on papers published outside CS

Funding:
• More funding like this EAGER grant