

Linking Theory to Practice: Testing Geospatial Predictive Policing in a Medium-Sized Police Agency

Abstract

This project addresses key components of predictive policing and examines what we call the process of predictive policing. This process includes: appropriate theory; valid, reliable and useful data; predictive analytics and algorithms; implementation in the field by police officers; and evaluation by researchers.

Researchers at Justice & Security Strategies, Inc. will work collaboratively with the Columbia (SC) Police Department.

Within the Columbia Police Department we seek to fulfill the following goals:

Goal 1. Link routine activities theory and appropriate measures (data elements) to the practice of predictive policing

Goal 2. Determine the accuracy of various predictive algorithms, including traditional hotspot analyses, regression-based analyses, and data mining algorithms.

Goal 3. Implement the predictive policing process in Columbia (SC) Police Department.

Goal 4. Evaluate the effectiveness of the predictive policing process using a randomized control trial and regression-discontinuity design.

Research and evaluation questions include: What is involved with the entire process? What does it take to implement? What are the underlying theories that guide it? What are the data that we need? What type of software or hardware is necessary? How does predictive policing ‘work’ in the field? What is the practical utility of it? How do we know that it is effective? How do we translate what we know into useful, useable strategies and tactics on the street to prevent and reduce crime?

Routine activities theory is the central theme of this project as it is used to identify both static factors and leading indicators of crime to incorporate into predictive models. These models will then be tested using historical data and the best performing model will be selected for producing forecasts as part of a randomized experiment examining the usefulness of proactive hotspot predictive policing.

JSS will produce written reports and deliverables to NIJ (research bulletins, full technical report, progress reports, peer-reviewed journal articles, and archival data). More importantly, however, JSS will write articles that explain the complexities of predictive policing in simple terms. Translating research into practice, especially in this instance, is extremely important as the findings could have important ramifications for police and policymakers.

Linking Theory to Practice: Testing Geospatial Predictive Policing

Dr. Craig D. Uchida
Shellie Solomon
Sam Ludington

2014

Overview

- Questions to Consider
- Definition of Predictive Policing
- Business Analytics
- Rhetoric and Reality
- Testing and Evaluating Predictive Policing in Columbia



What are people asking?



- What is Predictive Policing?
- What are the elements of predictive policing and how does 'it' work?
- Does predictive policing translate into crime reduction?
- What is the research basis for predictive policing?



Definition

Predictive policing is a multi-disciplinary, law enforcement-based **strategy** that brings together:

- 1) advanced technologies,
- 2) criminological theory,
- 3) predictive analysis, and
- 4) tactical operations that ultimately lead to –
- 5) results and outcomes-- crime reduction, management efficiency, and safer communities.

Roots of Predictive Policing: Business Analytics



WAL★MART®



- Baseball and Sports
 - SABR Metrics (Society for American Baseball Research)
- Walmart – supply chain analytics
- Netflix – predicting customer movie preferences
- Target – for security and supply chain

Based on bottom
lines and outcomes



THE BOTTOM LINE

Policing and Analytics

- Lots of data & police info
- Intuition-based decision making
- Efficiency in bad economic times
- Old school – experience and stereotypes
- New school – use knowledge and analytics more systematically –
but don't disregard experience – in fact, maintain it

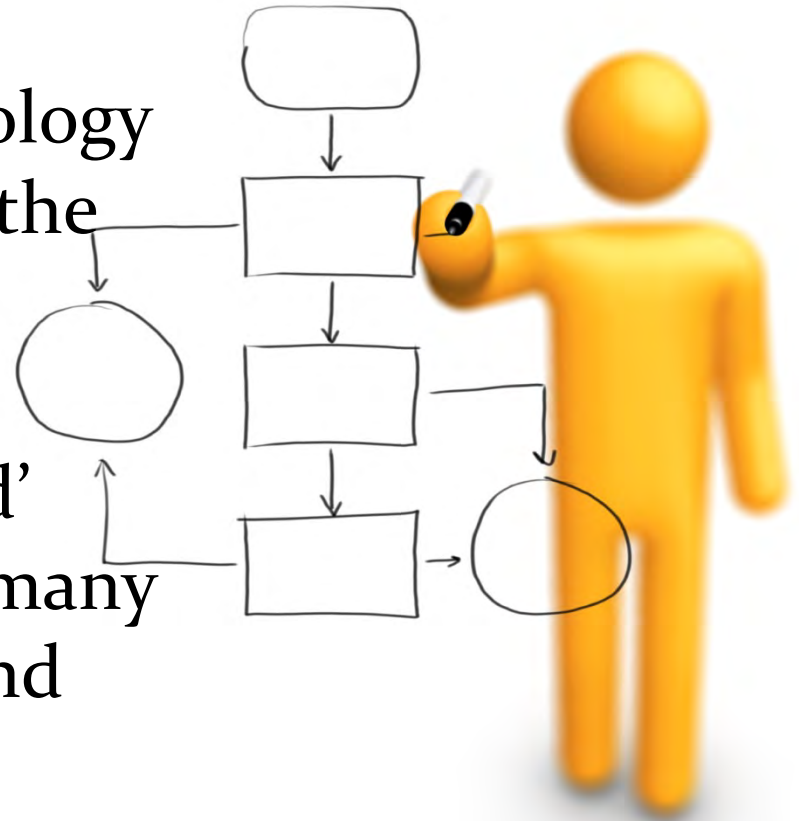


Rhetoric

- A lot of talk about predictive policing
- A lot of tools and techniques, including mapping
- A lot of vendors – Bair, IBI, SPSS, ESRI, PredPol
- A lot of unknowns
 - Some tout the ability to reduce crime
 - Others tout the ease of use

Predictive Analytics

- LAPD and Santa Cruz use an algorithm derived from seismology -- ‘earthquake’ algorithm or the ‘self-exciting point process methodology’
- As of yet, there is no one ‘good’ model or software program – many models are being developed and tested – some are free!





Predictive Policing Needs

- Data – what do you have?
- Technology – RMS? Software? Hardware?
- Analytic capacity?
 - Who?
 - What are the skills that are needed?

Data

It's *still* all about the data:

- Accumulate data from multiple sources
- Assure data integrity
- How are data 'pulled' in?
- How are they analyzed?



What are the Technology needs of Predictive Policing?

- Functional and easy-to-access records management system
- Ability to re-program RMS to accommodate algorithms or software
- Software for predictive and spatial analytics – tools to analyze complex data
- GIS-based systems to visually show areas

Analytic Capacity

- Crime and/or intelligence analysts?
- Knowledgeable police officers, detectives?
- Research partner?
- Contractors?





Analytic Capacity

- Skill levels –
 - Intermediate to advanced knowledge of GIS
 - Comfortable using data
 - Interest in innovation and willingness to test new tools



Reality

- We don't know much about the predictive ability of these models and algorithms
- No standardized metrics about predictive accuracy
- No *independent* evaluations have been conducted of these
- Limited knowledge about predictive techniques and their applicability to specific crime types
- We do know something about GIS and spatial analytics



Evaluating Predictive Policing

- JSS received an NIJ grant to examine the process of predictive policing
- Columbia, SC is the test site
 - 130,000 residents; diverse community
 - Nearly 400 police officers; 85 non-sworn
 - Similar to almost 200 police agencies
 - Home of the University of South Carolina



Evaluating Predictive Policing

Data:

- Crime, demography, land use, weather, probation/parole, medical calls, business, foreclosures, and traffic accidents

Technology:

- PredPol, predictive algorithms, hotspot analyses, Bair Analytics, IBM Modeler, and data mining models

People:

- Police Execs, Officers, and Crime Analysts – how does it affect them?



Evaluating Predictive Policing

- Evaluate the effectiveness of predictive policing
- Answer the following questions:
 - How accurate are the various predictive algorithms?
 - What does it take to implement predictive policing?
 - What is the practical utility of the software packages?
 - How do we know its effective?
 - How do we translate predictive policing into useful strategies and tactics?



Report Cards

- Create report cards to measure the ‘value’ of datasets and predictive software
- Summarize the quality and usefulness of available datasets
- Provide a snapshot of the capabilities of predictive software
- Create a scoring rubric for data and software



Report Card: Datasets

- Dimensions:
 - Importance in theory and research
 - Data Format, Availability, and Documentation
 - Data Completeness, ‘Cleanliness’, and Need for pre-processing
 - Informational Content
- Examples: Census data, American Community Survey, Weather and event-related data, business licenses, etc.



Report Cards: Predictive Software

- Dimensions:
 - Theoretical Relevance
 - Empirical Support
 - Ease of Use; Ease of Integration
 - User Support
 - Cost Factor

- Examples: Hot spot analytics, Data mining models, PredPol, Bair, IBM, RTM



Evaluation

- Process Evaluation – Select the ‘best-performing algorithm’
- Establish procedures for incorporation into predictive policing strategy
- Columbia PD develops a strategy for use by analysts, supervisors, and in the field
- JSS observes implementation and measure interventions (e.g., high visibility patrol? Foot patrol? Specialized unit?)



Evaluation

- Impact Evaluation:
- Randomized Control Trial (hot spots, but TBD)
- Measure:
 - Crime reduction by month
 - Diffusion of benefits or displacement
 - Predictive ability of software

QUESTIONS?

