

Measuring crime clusters around
criminogenic places:
An enhanced buffer approach

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Outline

- Criminogenic places; facilities and land uses
- Location quotient analysis
- An alternative method: Intensity value analysis
- Case study: Subway stations & robberies
- Analysis software; **free & easy**



Criminogenic places

- Crime is not distributed uniformly across time and space
- It often clusters in areas we call “hotspots”
- Clustering is frequently found at (**and around**) certain land use or facility types
 - Assaults & bars
 - Violent/property crime & high schools
 - Drug markets & liquor outlets
 - subway stations
 - pawn shops
 - check cashing stores
 - Violent/property crime & drug markets



Criminogenic places

- **Why there?**: Clustering result of routine activities, place management, and area socio-economics
- **Why care?**: Accurate identification of criminogenic facilities necessary for effective crime reduction, via:
 - **Police - Place manager cooperation (owners, staff)**
 - **Regulatory enforcement (licensing, code enforcement)**
 - **Place-based crime enforcement efforts**



Identifying criminogenic facilities

- One popular method is location quotient (LQ) analysis
 - Buffers of a selected distance are drawn around facilities in study area (city) using GIS
 - Count of crime incidents falling within buffers are summed as is total buffer area, resulting in crime-incidents-per-area unit
 - Compared to crime-incidents-per-area unit value for entire study area and expressed as a ratio value
 - Ex: $LQ = 2.5$



Issues with location quotients

- LQ values are a ratio and cannot be compared across crime types or other study areas
- No test of statistical significance
- Buffer size is unforgiving
 - Too wide and effects are washed out
 - Too small and count is truncated
- All crime incidents falling within buffer area are given the value of 1. Method is one of **density**, ignoring proximity



An alternative: Intensity value analysis

- Crime events falling within a selected bandwidth (buffer radius) are scored using an inverse-distance weighting scheme
 - Events close to the outer edge of the bandwidth are scored close to zero, while those nearer the facility are assigned a value closer to 1
- Crime scores for each facility are summed
 - Total is descriptive of density and proximity



Intensity value analysis

- Facility scores compared to other facility, or crime types
- Or, to a base standard, such as a random sample of street corners or random points
- Comparison accomplished two ways:
 - T-test of mean values, if assumptions of independence are met (no overlapping bandwidths)
 - Comparison groups plotted in a histogram and visually analyzed (example forthcoming)

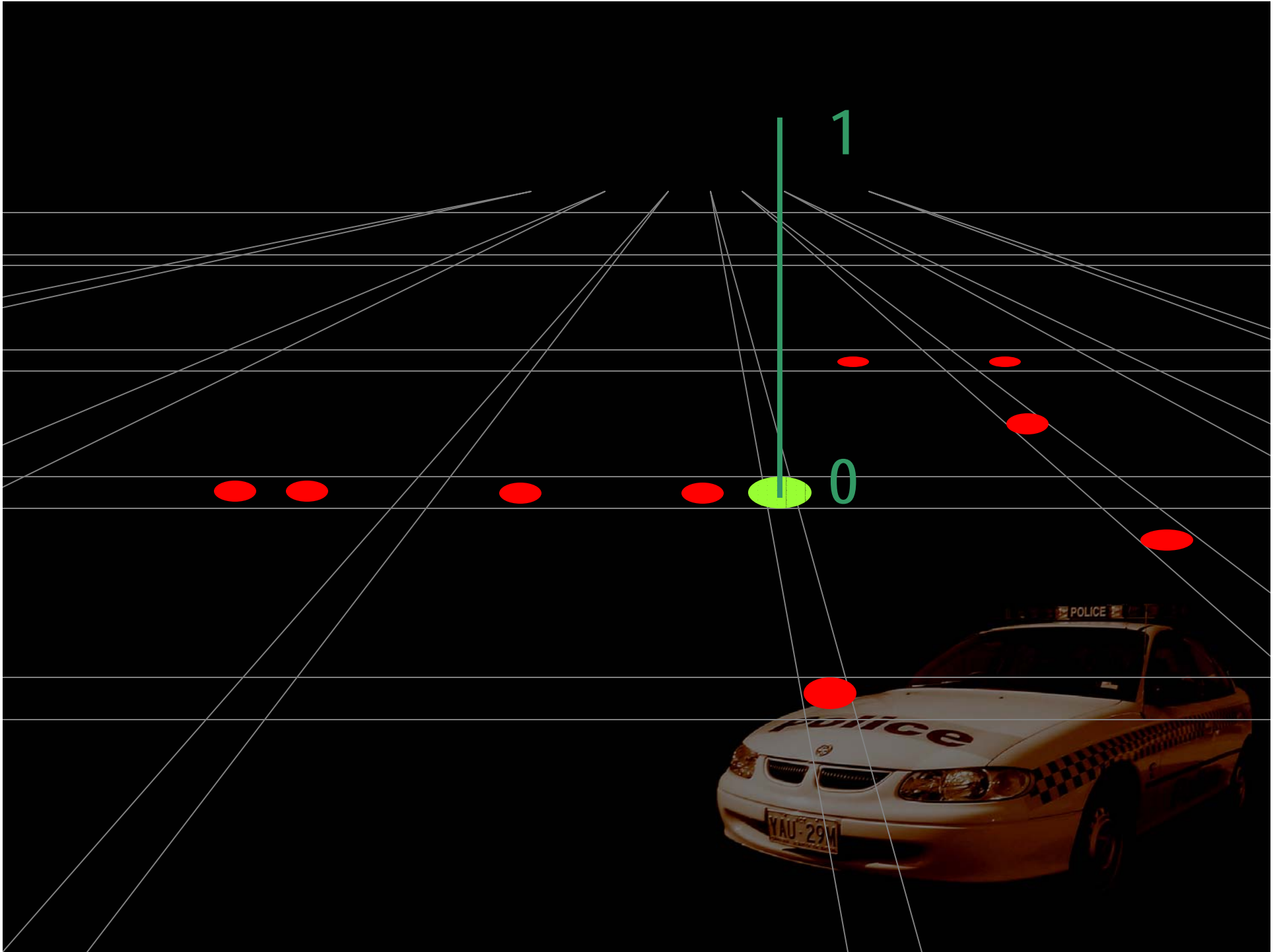


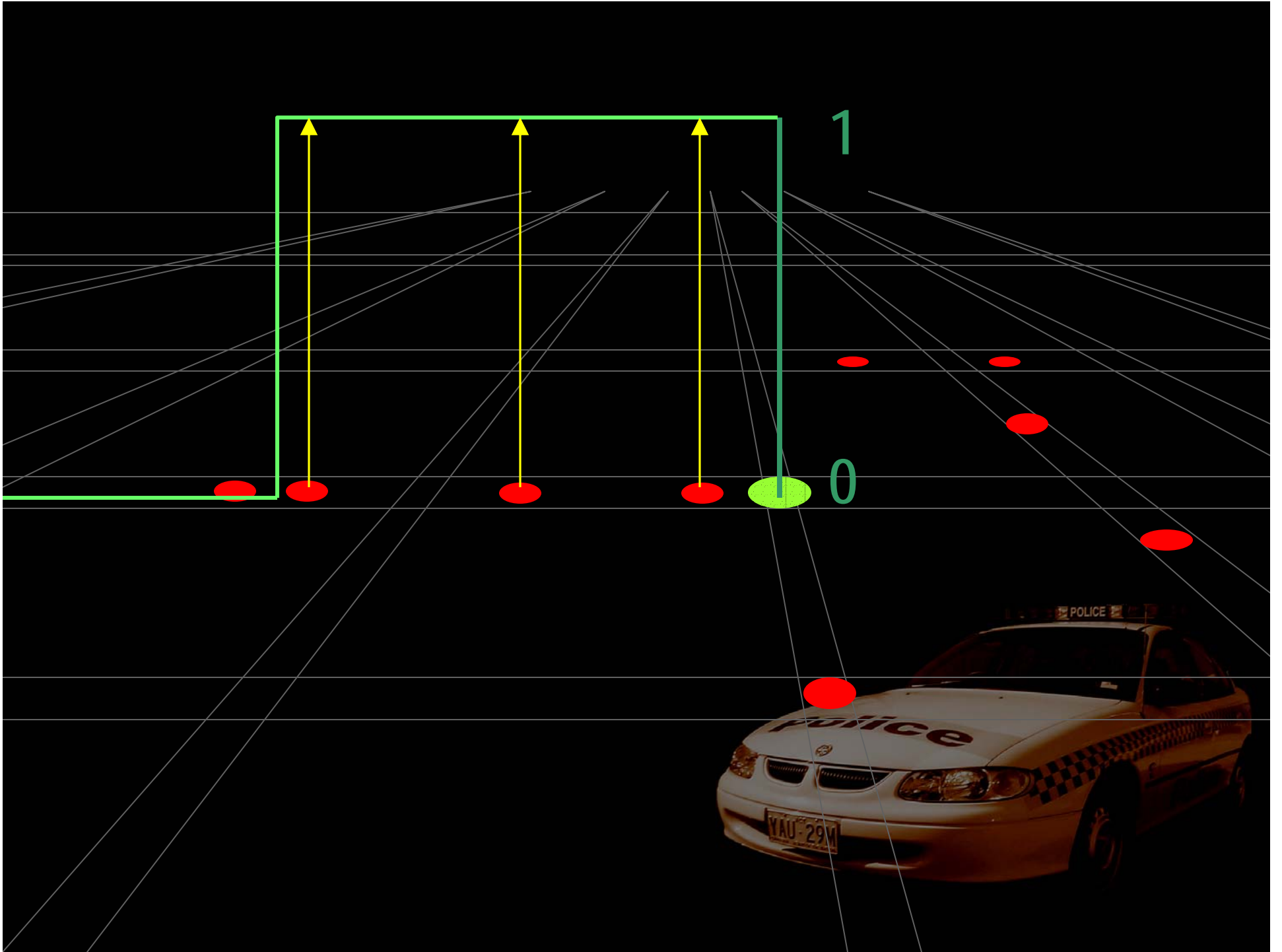
Intensity value strengths

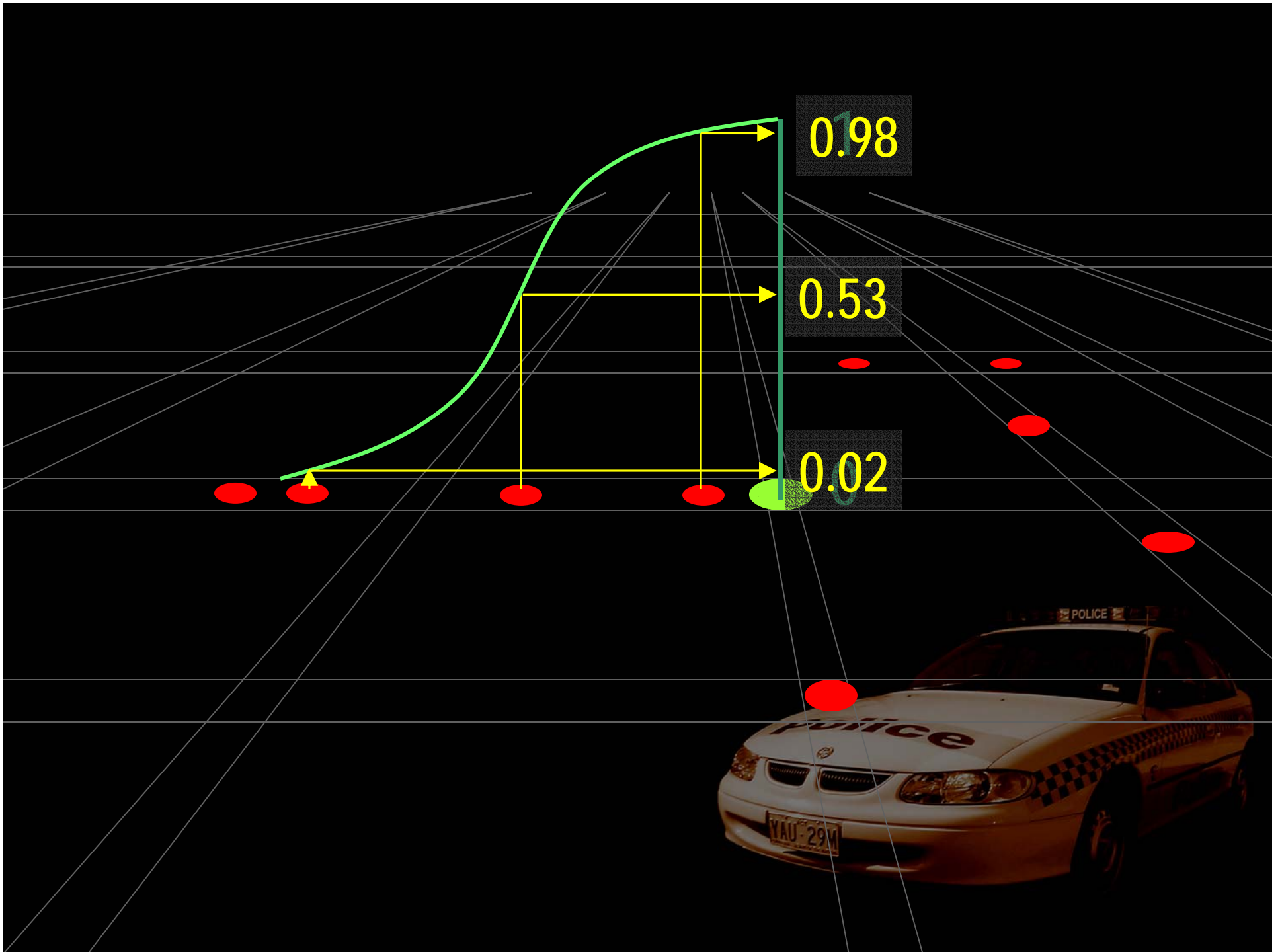
- Minimizes problems associated with too-expansive a bandwidth due to lower value assigned events at outer edge
 - Little literature yet available to define how far from a facility criminogenic effects extend
- Using base standard, e.g., a random number of street corners, results in more robust analysis than LQ
 - In LQ analysis, study area compared to includes areas of low crime opportunity (airport runways, waterways, etc)











Case study: Robberies and subway stations

- Subway stations theorized as crime generators
 - Attract many passengers, some of whom are preoccupied, unfamiliar with the area, intoxicated, etc.
 - Ethnographic studies indicate street robbers are selective of victims, preferring those that exhibit inattentiveness, and cues they are likely to possess cash and will not resist



Data

- All 22 stations of the Broad Street subway line that bisects Philadelphia, running north to south
- 500 random street corners used as base comparison
- All reported street robberies during the years 2002 and 2003 (n = 12,814)
- 728 foot buffers equivalent to 2 city block distance



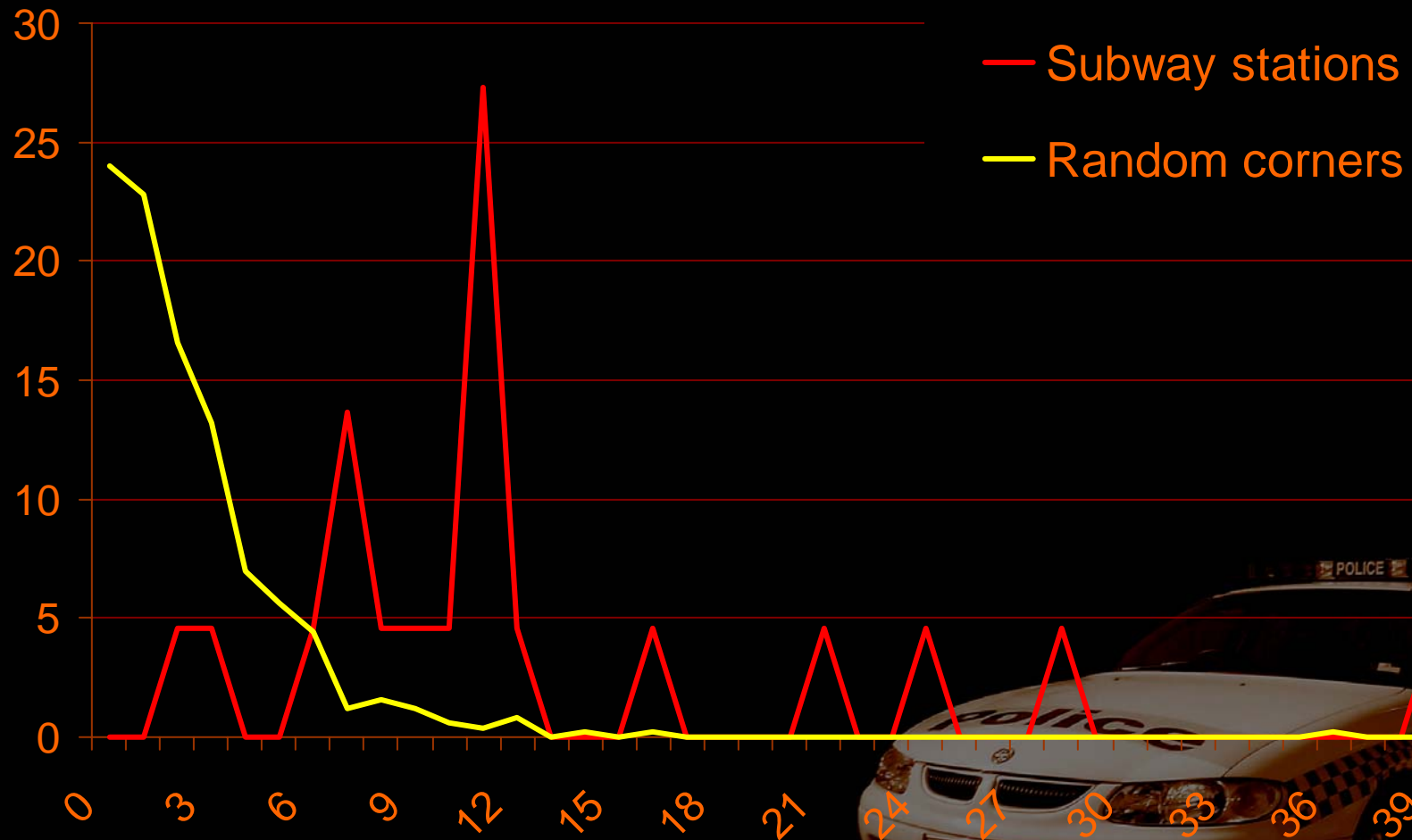


Results

- Mean intensity value for 500 random street corners = 2.1 ($SD = 2.8$)
- Mean intensity value for subway stations = 11.7 ($SD = 8.7$)
- One-sample t-test used (due to unequal group size)
 - Mean difference significant at $p < .001$ ($t = 5.183$, $df = 22$)
- Plotted in histogram...



Robbery intensity values




Intensity value analysis sounds difficult?


- Not at all, we provide free software at www.jratcliffe.net
- Requires X,Y coordinates (feet or meters, not long./lat.) for both crime events and facilities in csv files, easily converted from Excel file
- Pdf help file located on-line with software





Intensity buffer calculator

Intensity buffer calculator

 Click here to load the csv file with the locations.
C:\Attractors.csv

 Click here to load the csv file with the crimes.
C:\location.csv

Bandwidth 

Weighting technique 

Linear

Quartic kernel

Exponential (.10)

Exponential (.25)

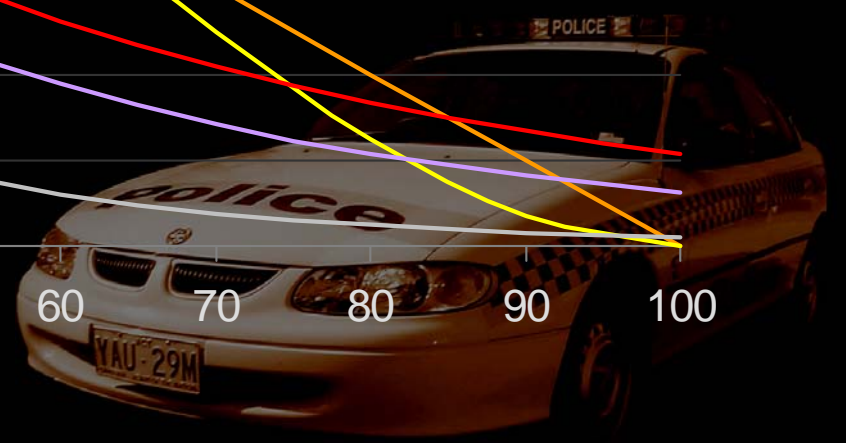
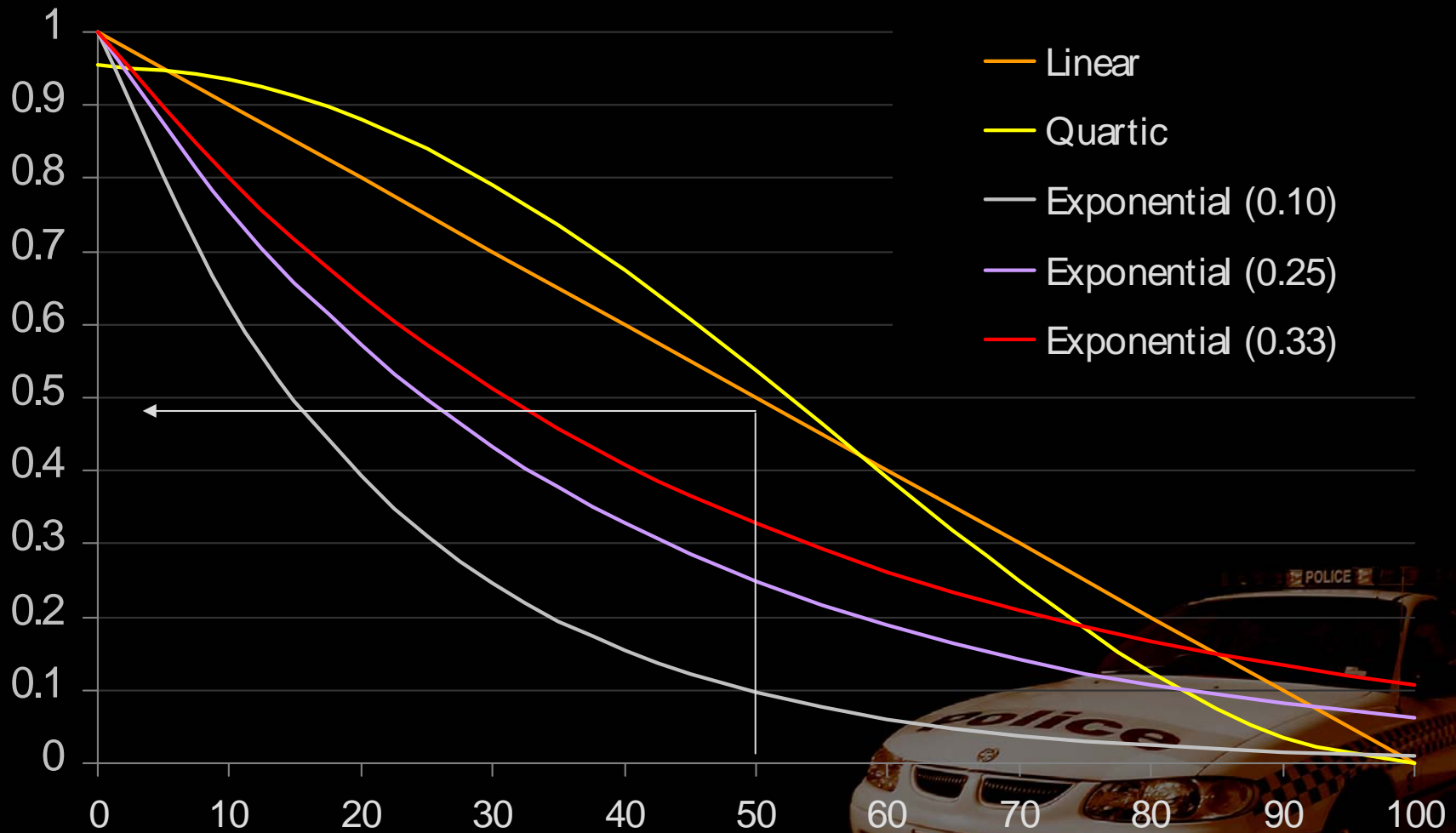
Exponential (.33)

www.jratcliffe.net (2006)

Download for free from www.jratcliffe.net



Inverse distance weighting options



Jerry Ratcliffe's homepage

Welcome! I'm a former police officer turned academic (courtesy of a mountaineering accident), with research interests in the areas of spatial crime analysis and crime mapping, and how these, and other, techniques integrate with law enforcement criminal intelligence and the drive for crime reduction. I've also worked for a number of years in the education area of strategic criminal intelligence. I'm an associate professor at Temple University in Philadelphia.

Jerry's top ten tips

PowerPoint advice, presentation tips, essay writing guide, how to reference, how to study, Jerry's top ten mapping tips!

Research publications

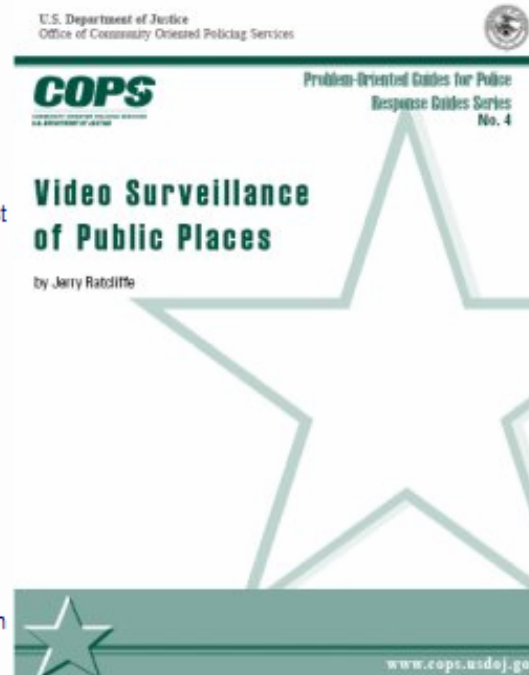
A selection of recent publications written or co-written by the author. Most available to download in pdf format.

Research and spatial questions

Current research being undertaken by the author in the field of crime mapping/spatial and temporal analysis. Information about the Aoristic analysis, the Modifiable Areal Unit Problem and other current issues.

Published books

Recently published books exploring thinking in criminal intelligence, crime mapping, and illegal drug markets are now available. Details of these texts can be found here.



Download software

A few MapInfo routines that you might find useful, and SPAM (the predecessor of HotSpot Detective®), the better program.

HotSpot Detective

Generate crime density maps from within MapInfo with minimum effort. Designed for police officers who may not have a GIS/spatial analysis background. Includes a geocoding address scrubber and temporal analysis graphers. HotSpot Detective® is a registered trade mark.

Contact details and cv

Snail mail contact details, and an on-line cv. If you want an alternative resume from the stuffy professional one, [try looking here...](#)

Student links

Specific documents and data for my students

Conference notes

Handouts, web sites referenced and general notes from selected conference presentations.

Top ten links

OK, so it might be difficult picking ten good links, but these are my favourites...

About crime mapping

A brief background to the theory and application of crime mapping. Be advised that this section is pretty

Jerry H Ratcliffe Editor

**STRATEGIC
THINKING**

Then the details for this conference...

Conference notes

[Index](#) > conference notes



For links to the papers and presentations, click on the underlined words in the title of the conference presentation in which you are interested.

Crime Mapping Conference #9: Presentations from the 2007 conference held in Pittsburgh, PA.

A number of our fine graduate students from Temple University presented papers at this conference, and we also unveiled a spreadsheet to calculate weighted displacement quotient and a software tool that calculates inverse distance weighted buffer calculations. These software tools are available on our web site as a free download. Details through [this page](#).

ECCA 12: The effectiveness of police intelligence management: A New Zealand case study

Paper from the 12th International Symposium on Environmental Criminology and Crime Analysis, 3rd July 2004, held in Wellington, New Zealand. This is the final draft of the paper that will be published in a forthcoming issue of *Police Practice and Research*.

IALEIA, Sacramento 2004: Intelligence-led policing

Slides from the presentation given at the Annual conference of the International Association of Law Enforcement Intelligence Analysts, Sacramento, CA, April 2004.

NIJ (MAPS), Boston 2004: Location quotients and force-field analysis

Paper of the techniques explained in the presentation to the 7th International Crime Mapping Research conference run by the Mapping and Analysis for Public Safety program (formerly the CMRC) of the National Institute of Justice. Boston, MA, March 2004.

ISPAC (UN), Courmayeur, Italy, 2003: Intelligence applications of crime mapping

Invited general session address to the International conference on Crime and Technology: New frontiers for legislation, law enforcement and research. Organized by the International Scientific and Professional Advisory Council of the United Nations, Courmayeur Mont Blanc, Italy, November 2003.

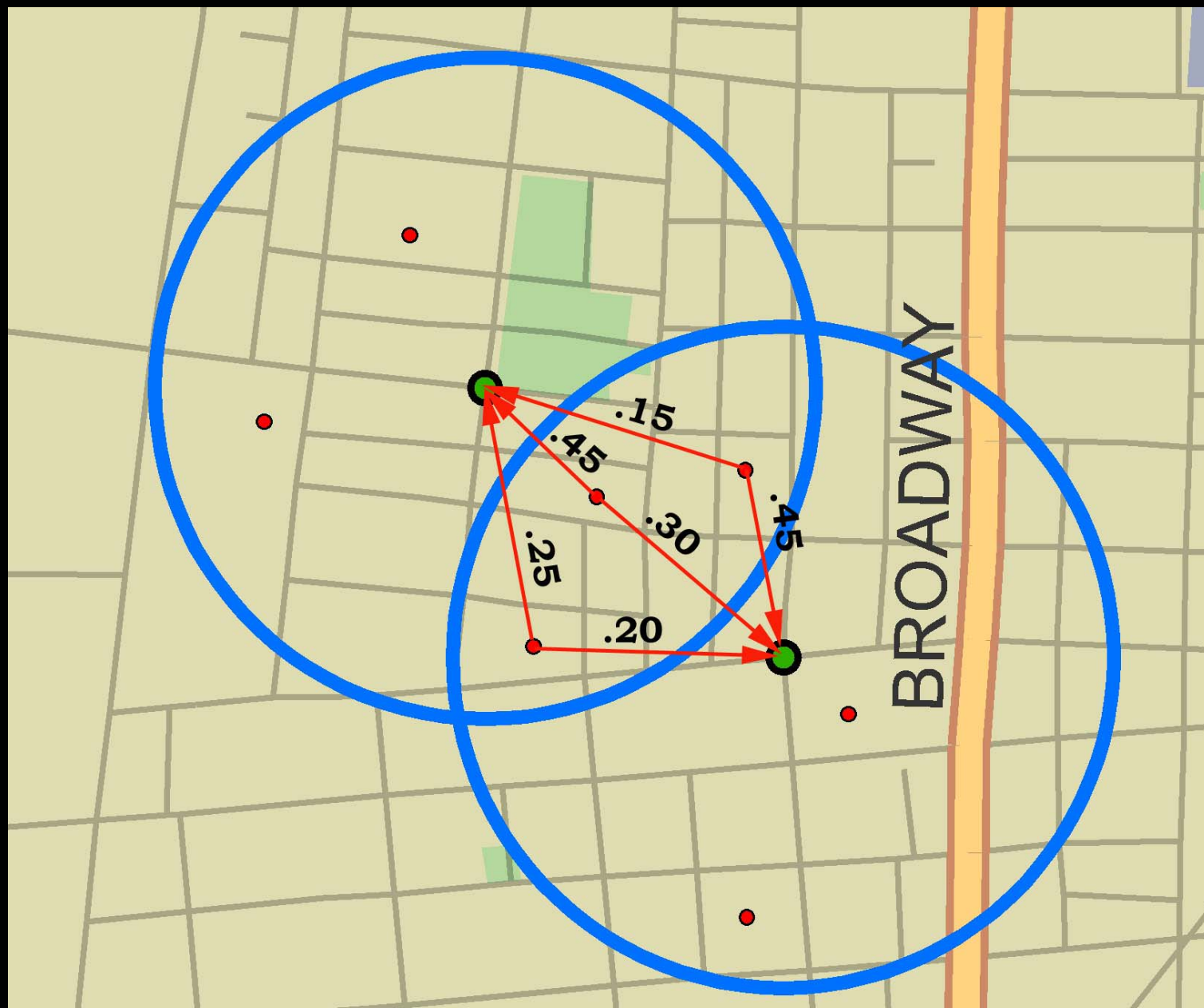
ECCA 11: The Hotspot Matrix as a Framework for the Spatio-Temporal Targeting of Crime Reduction

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Violating assumption of independence



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