Adding Geospatial Context to 'Big Data' with Risk Terrain Modeling

Joel M. Caplan, Ph.D.
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Justice Research and Statistics Association

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ADDING GEOSPATIAL CONTEXT TO ‘BIG DATA’ WITH RISK TERRAIN MODELING

Joel M. Caplan
October 2017
E.G., PLAYFUL BEHAVIOR
“DARK ALLEYWAYS”
THE RTM PROCESS

1. Test Inputs
   - Vacant
   - Parks
   - Gas
   - Bars
   - Schools
   - ATMs
   - Pawn

2. Weight Valid Factors
   - Bars
   - Parks
   - ATMs
   - Schools

3. Output Final Model
   - Produce Map

The RTMDx Software Makes RTM Easy and Accessible
PROVEN RESULTS

In the USA and Worldwide

- Glendale, AZ: 42% drop in robberies.
- Colorado Springs, CO: 33% drop in MVT.
- Newark, NJ: 35% drop in gun violence.
- Fayetteville, NC: 11% city-wide crime drop.
- Atlantic City, NJ: 20% drop in violent crimes.
- Chicago, IL: Assessed real-time risks of ambush or injury to LEOs during calls for service.
- Research from PA shows RTM to accurately predict Active Shooter events, allowing for proactive preparedness response protocols.
- City of Edmonton (Canada) for problem-solving and city planning.
- Royal Canadian Mounted Police for border security and to interdict arms smuggling & human trafficking.
- Red Cross (Honduras) to efficiently allocate EMS & reduce response times.
- Transcrime (Italy) to predict organized crime-related homicides.
- French government to assist with terrorism investigations.
- The World Bank (Latin America) to predict & prevent crime, including drug trafficking.
- US Gov. (worldwide) to assess risks to Olympic athletes; for military intel; and for terrorism risk assessments.
NO MORE WHACK-A-MOLE

Stop chasing the hot spots
ACTIONABLE INTEL

Take full advantage of your data
People interact with their environments. Connect data at these places to learn how.
RTM FOR POLICING

Predict, Prevent & Investigate Many Issues

1) Forecast high-risk locations to deploy resources
2) Direct and coordinate efforts to reduce risks
3) Analyze geographic profiles to clear cases

Violent Crimes

Property Crimes

Gangs & Organized Crimes

Overdoses, Drugs & Drug Markets

Traffic Crashes
Diagnosing environmental attractors of crime makes very accurate forecasts.
PREVENTION

Focus directed patrols at forecasted risky places
Spatial intel helps to mitigate crime risks

<table>
<thead>
<tr>
<th>Robbery Risk Factors</th>
<th>OP</th>
<th>SI</th>
<th>RRV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Restaurants- ABC</td>
<td>Density</td>
<td>154 (half block)</td>
<td>5.1</td>
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<tr>
<td>Schools</td>
<td>Proximity</td>
<td>154</td>
<td>5.0</td>
</tr>
<tr>
<td>Hotels &amp; Rooming Houses</td>
<td>Density</td>
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<td>4.8</td>
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<tr>
<td>Convenient Stores</td>
<td>Proximity</td>
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<td>3.6</td>
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<tr>
<td>Parking Lots</td>
<td>Density</td>
<td>154</td>
<td>3.4</td>
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<tr>
<td>Vacant Properties</td>
<td>Density</td>
<td>154</td>
<td>2.3</td>
</tr>
<tr>
<td>Spa &amp; Massage Parlors</td>
<td>Proximity</td>
<td>924 (3 blocks)</td>
<td>2.2</td>
</tr>
<tr>
<td>Retail Clothing &amp; Accessories</td>
<td>Proximity</td>
<td>924</td>
<td>2.1</td>
</tr>
<tr>
<td>Laundromats</td>
<td>Density</td>
<td>462 (1½ blocks)</td>
<td>2.0</td>
</tr>
</tbody>
</table>

Vacant Property

Convenience Store

Laundromat

Liquor Store
Coordinate efforts at high-risk places

Police patrol at peak times; Public Works adds street lights

Police focus patrols and conduct business checks...

Planning Department boards-up and demolishes priority vacant buildings
Geographically profile offender preferences
Prioritize surveillance locations to catch offenders quickly
INVESTIGATE

Link cases to a suspect’s geo-profile

Burglary matches spatial M.O. and likely connected to same suspect.
RISK NARRATIVES

Apartments, Banks, Bars, Check Cashing Services, Coffee Shops, Grocery Stores, Department Stores, ATMs, Schools, Laundromats, Health Night Clubs, Gyms, Public Libraries, Liquor Stores, Movie Theaters, Parking Lots, Parks, Gas Stations, Pawn/Second Hand Dealers, Pharmacies, Rec Centers, 

Convenience Stores

Laundromats

Vacant Buildings

Robberies

January | February | March
---|---|---
17 | 14 | 12

2016 | 2017

THE PRESS OF ATLANTIC CITY
AS SEEN ON TV

Breakthrough, Season 2 Episode 5
(Predicting the Future)

NATIONAL GEOGRAPHIC
CLICK TO WATCH VIDEO
RISK TERRAIN MODELING (RTM)

The engine under the hood

Actionable, transparent and accurate outputs

Answers where & why
Study Area

Study Area Name
Atlantic City

Boundary Data
ACPD_Districts

Model Type
Aggravating

Study Area Parameters
Risk Terrain Modeling can be done for any geographic area. Specify the dataset and type of model you want to run for the study area of your choice. All fields are required. Click on the 'i' information icons for specific instructions and helpful tips.
Unit of Measurement

Unit of Measurement: Feet

Standard Value: 308

Place Size: 154

Measurement Parameters:
These values affect the statistical analysis to be performed. All fields are required. Click on the ‘?’ information icons for specific instructions and helpful tips.
Analysis Issue

Topic Issue

Robbery

Analysis Issue Parameters

Risk Terrain Modeling can be used to study almost any topic or issue. Specify the dataset and other information for an issue of your choice. All fields are required. Click on the ‘i’ information icons for specific instructions and helpful tips.

Filter By Date Range
Filter By Time of Day
Filter By Value

BACK NEXT
<table>
<thead>
<tr>
<th>Risk Factor Name</th>
<th>Data File</th>
<th>Operationalization</th>
<th>Standard Value Multiplier</th>
<th>Analysis Increments</th>
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</thead>
<tbody>
<tr>
<td>Convenience Stores</td>
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<td>Half</td>
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<tr>
<td>Gas Stations</td>
<td>GasStations</td>
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<td>Half</td>
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<tr>
<td>Hotels Rooming</td>
<td>HotelsRooming</td>
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<td>Half</td>
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<tr>
<td>Laundromats</td>
<td>Laundromats</td>
<td>Proximity or Density</td>
<td>3</td>
<td>Half</td>
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<td>LiquorStores</td>
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<td>Half</td>
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<td>Half</td>
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<td>Parks_Points</td>
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</table>
Summarize & Run

Boundary File: ACPD_Districts
Boundary Name: Atlantic City
Model Type: aggravating
Standard Value: 308 ft
Place Size: 154 ft
Topic or Data File: Robbery_MarchThurApril27_Match
Topic or Data Name: Robbery
Risk Factor 1: AdultBusinessesANDRest, AdultBusinessesANDRest, Proximity or Density, 3, Half
Risk Factor 2: AutoRepairShops, AutoRepairShops, Proximity or Density, 3, Half
Risk Factor 3: BailBonds, BailBonds, Proximity or Density, 3, Half
Risk Factor 4: Banks, Banks, Proximity or Density, 3, Half

Send Notification When Analysis Completes

Email Address:
rutgerscps@gmail.com

Show More

BACK
Run
Map Type
The map(s) to be downloaded or included in the generated report PDF can be previewed to the left.

- Report Options
- Generate Report PDF

Results
You can download the Results of the Analysis, including all of the Map PNGs, a Shapefile of all Risk Scores, KML Files for viewing in Google Earth, and the output of the RTM Analysis R Script.

- Download Results

- Highest Risk
Places with a relative risk score two standard deviations or more above the mean (displayed in red).
Download Google Maps KML

- Above Average Risk
Places with a relative risk score above the mean (displayed in orange) and highest risk places (displayed in red).
Download Google Maps KML

- Priority Places
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**Priority Places**
Places within the study area where past exposures and new vulnerabilities create exceptionally risky places.
Download Google Maps KML

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<tr>
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<th>Relative Risk Score</th>
<th>Operationalization</th>
<th>Spatial Influence</th>
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<td>Proximity and Density</td>
<td>154</td>
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</tbody>
</table>
Help before dangerous situations occur

Researchers develop tool that can predict child abuse before it occurs

THE CENTER FOR PREVENTION OF CHILD MALTREATMENT
led by Cook Children's

Predicting where kids will be abused—with 98% accuracy

Texas researchers use Big Data to keep kids safe

Stop
Environmental contexts for crime vary across different cities and crime types
RISK TERRAIN MODELING

Meets the demands of 21st century governance

- Problem-solving
- Evidence-based decision making
- Sustainability
- Better utilization of resources
- Increased transparency
Questions?