SHIFTING HOT SPOTS
The Benefits of Spatiotemporal Crime Analysis

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Spatiotemporal Crime Analysis

• Current trend: Micro-Level Crime Analysis
• Moving beyond the Neighborhood level
• Pareto’s Principle (‘80 / 20 rule’)
• Many think WHERE, then WHEN.
• Why not WHEN, then WHERE…
NYPD Crime Data


Bronx is 14% of NYC Land Area
16% of NYC population

<table>
<thead>
<tr>
<th>VIOLENT CRIME</th>
<th>NYC</th>
<th>BRONX</th>
<th>BX as % of NYC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Murder</td>
<td>2,622</td>
<td>657</td>
<td>25%</td>
</tr>
<tr>
<td>Rape</td>
<td>6,694</td>
<td>1,510</td>
<td>23%</td>
</tr>
<tr>
<td>Robbery</td>
<td>105,788</td>
<td>23,069</td>
<td>22%</td>
</tr>
<tr>
<td>Assault</td>
<td>84,541</td>
<td>21,564</td>
<td>26%</td>
</tr>
<tr>
<td>Shootings</td>
<td>7,998</td>
<td>2,791</td>
<td>35%</td>
</tr>
</tbody>
</table>
Subway Ridership
Avg Weekday: 367k
Avg Weekend: 187k
Day of Week Trends (Monday – Sunday)

- **Shooting**
  - MON: 300
  - TUE: 300
  - WED: 300
  - THU: 300
  - FRI: 300
  - SAT: 300
  - SUN: 300

- **Assault**
  - MON: 500
  - TUE: 500
  - WED: 500
  - THU: 500
  - FRI: 500
  - SAT: 500
  - SUN: 500

- **Robbery**
  - MON: 2600
  - TUE: 2700
  - WED: 2800
  - THU: 2900
  - FRI: 3000
  - SAT: 3100
  - SUN: 3200
Hour of Day Trends (7am – 6am)

- **Shootings**
  - Peak at 3pm

- **Assault**
  - Peak at 3pm

- **Robbery**
  - Peak at 3pm
Spatiotemporal Robbery Patterns
# Violent Crime Location Types

<table>
<thead>
<tr>
<th></th>
<th>Robbery</th>
<th>Assault</th>
<th>Shootings</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n= 23,069</td>
<td>N= 21,564</td>
<td>N= 2,791</td>
</tr>
<tr>
<td>Street (57%)</td>
<td>Street (37%)</td>
<td>Street (40%)</td>
<td></td>
</tr>
<tr>
<td>Apartment (14%) (private)</td>
<td>Apartment (30%) (private)</td>
<td>Apartment (28%) (private)</td>
<td></td>
</tr>
<tr>
<td>NYCHA (5%) (public housing)</td>
<td>NYCHA (8%) (public housing)</td>
<td>NYCHA (18%) (public housing)</td>
<td></td>
</tr>
<tr>
<td>+ 39 other location types</td>
<td>+58 other location types</td>
<td>+24 other location types</td>
<td></td>
</tr>
</tbody>
</table>
Hour of Day Trends (7am – 6am)

21,564 Total Assaults
36% occur on Saturday and Sunday
35% occur between 8pm – 2am
Spatiotemporal Assault Clusters
Spatiotemporal Assault Clusters
2,791 Total SHOOTINGS

55% occur on Saturday and Sunday
70% occur between 8pm – 4am
Spatiotemporal Shooting Clusters
Spatiotemporal Shooting Clusters
Spatiotemporal Shooting Clusters
Micro-Level Nnh Clustering Methods

• Find the streets that Intersect or are Contained within the cluster areas.
• Analyze the streets and temporal patterns.
• Find **when & where** Crime Clusters occur
• Determine what routine activities are within clusters (**why-dunnit**)
Nnh Robbery Clusters

- ¼ Mile Nnh Cluster
- 91 Streets Intersect or Within
- 675 Robberies
- 2 Subway Lines
- 3 Subway Stations

- 91 Streets
- 48 Streets (53%) ≤ 1 robbery per year
- 20% of streets (19) contain 67% of robbery
Robbery Temporal Analysis – Total Robbery Clusters (3PM PEAK)

Robbery Temporal Analysis – Robbery Streets (3AM PEAK)
Hot Spots Robbery Patterns
Hot Spots Robbery Patterns
Streets Inside Robbery Hot Spots

- .1 mile KDE Hot Spots
- Total of 1.08 Sq.Miles
- 4,305 Robberies (19% of total)
- 641 Streets (6% of total streets)
- 389 Streets (61%)
  < 1 robbery per year
- 22% of streets (139) contain 64% of robbery
Micro-Level Kernel Density Estimation Methods

- Kernel Density Estimation (KDE)
- Create your Hot Spot map
- Using the Raster Calculator – query out the highest / hottest crime density areas.
- Export the highlighted high crime density areas into its own shapefile.
- Find the streets that Intersect or are Contained within the new high crime density area shapefile.
- Analyze the street temporal patterns.
Spatiotemporal Crime Patterns

• We always think Hot Spots….but we need to do more with less = Spatiotemporal Hot Spots

• Hot Streets are better than Hot Spots

• Find the crime hot spots, then find the time(s) [where, then when]
• Find the crime time(s), then find the hot spots [when, then where]
Special Thanks…

- Marcus Felson (Texas State University)
- Dave LaShell (NYC ESRI Staff)
- Mike King & Lew Nelson (ESRI Public Safety)
- John Jay College of Criminal Justice
- New York City Police Department
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