The Analytical Policeman

Visualization for Law and Order

Image of Lady of Justice removed due to copyright restrictions.
The Analytical Policeman

- The explosion of computerized data affects all parts of society, including law and order.

- In the past, human judgment and experience was the only tool in identifying patterns in criminal behavior.

- Police forces around the US and the world are augmenting human judgment with analytics – sometimes described as “predictive policing.”
“I’m not going to get more money. I’m not going to get more cops. I have to be better at using what I have, and that’s what predictive policing is about… If this old street cop can change the way that he thinks about this stuff, then I know that my [officers] can do the same.”

- Los Angeles Police Chief Charlie Beck
Role of Analytics

• The analytical tools you have learned in this class can be used to make these “predictive policing” models

• However, communicating the results of these models is essential – a linear regression output table will not be of use to a policewoman on patrol

• Visualization bridges the gap between the data and mathematics and the end user
Understanding the Past

• Before we even consider a predictive model, we should try to understand the historical data.

• Many cities in the US and around the world provide logs of reported crimes, usually including the time, location, and nature of the event.

• We will use data from Chicago about motor vehicle thefts.
Crime Over Time

• Suppose we wanted to communicate crime patterns over the course of an average week
• We could display daily averages using a line graph, but this does not seem like it would be too useful
Crime Over Time

• We can replace our x-axis with the hour of the day, and have a different line for every day of the week, but this would be a jumbled mess with 7 lines!

• We could use no visualization at all, and instead present the information in a table.

• This is valid, but how can we make the table more interesting and usable?

<table>
<thead>
<tr>
<th></th>
<th>MO</th>
<th>TU</th>
<th>WE</th>
<th>TH</th>
</tr>
</thead>
</table>
| 03:00 | 34 | 32 | 31 | ...
| 04:00 | 15 | 24 | 22 | ...
| 05:00 | 22 | 10 | 33 | ...
| 06:00 | 13 | 14 | 19 | ...
| …   | …  | …  | …  | …  |
Heatmaps

- **Heatmaps** are a way of visualizing data using three attributes. The **x-axis** and **y-axis** are typically displayed horizontally and vertically.

- The **third attribute** is represented by shades of color. For example, a **low** number might be **blue**, and a **high** number might be **red**.

Legend (z-axis):

- 5
- 4
- 3
- 2
- 1
Heatmaps

- We can pick **different color schemes** based on the **type of data** to convey different messages.

- The x-axis and y-axis don’t need to be continuous – they can be **categorical**.

- We could even combine a heatmap with a **geographical map** – we will discuss this later in the class.
A Chicago Crime Heatmap

• We will use Chicago motor vehicle theft data to explore patterns of crime:
  • Over days of the week
  • Over hours of the day

• We’re interested in the total number of car thefts that occur in any particular hour of a day of the week over the whole data set
Eye on Crime

• Criminal activity-related data often has both components of time and location

• Sometimes all that is required is a line chart, but heatmaps can visualize data that would be too big for a table

• Plotting data on maps is much more effective than a table for location based data, and is eye-catching
Predictive Policing

• Many police forces are exploiting their databases to focus finite resources on problem areas

• Not only do analytics help improve policework, the outputs are also good communication tools to decision makers in government and to the wider public

• The application of analytics to data like this is new and growing, with companies like PredPol and Palantir leading the effort