

Project Update: Law Enforcement Resource Allocation (LERA) Visualization System

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Motivation:

- It is difficult to assess the real impact of different policy decisions and management programs on crime rates
 - E.g., Do anti-drug programs help to reduce youth crime rates?
- Searching for relationships between different variables in a large dataset can be time consuming and frustrating
- In many cases, crime analysts perform this type of analysis using a statistics program (e.g., SAS, SPSS, R) or a data analysis program (e.g., Excel)

Our goal:

- To enable crime analysts to answer these types of questions by bringing together both crime data and crime enforcement policies into a single INTERACTIVE visualization system that supports correlation/regression analysis

The Data:

- We have 2 types of data sets for about 800 US law enforcement agencies for the year 2000:
 - Crime report data
 - Violent (e.g., murder, robbery, rape, etc) and non-violent (e.g., burglary, motor vehicle theft, larceny-theft,) crime rates for an agencies jurisdiction
 - Law Enforcement Management data
 - Specialized units operated by an agency (e.g., juvenile crime unit, drug education in schools, etc)
 - Investment in technology, training, budgets

Supported tasks:

- We aim to support three different types of tasks required of a crime analyst:
 - How does a program impact a crime rate
 - E.g., How does field training impact violent crime?
 - How does a program impact different crime rates
 - E.g., Do drug education programs have an impact on motor vehicle theft rates? How about larceny-theft?
 - ✓ How do different programs impact a crime rate
 - E.g., Which programs have been most successful in reducing violent crime rate?

Solutions considered:

- We considered 4 different solutions for the task of interactively visualizing correlation:
 - Parallel Coordinates
 - Repeating an axis for a program; not many dimensions used
 - Table Lens
 - Interested in trends and patterns, not detailed numerical info
 - ✓ General Graph Drawing Techniques
 - No compelling info for connecting local agencies by edges
 - ✓ Scatterplots
 - ✓ Tool commonly used by crime analysts

Our solution:

- An interactive scatterplot visualization system
- Implementation:
 - Java
 - Prefuse Java toolkit
 - Support for scatterplots, tables, SQL queries
 - And for display issues such as mapping from field values to axes, colour, shape, etc
 - Statistical toolkit
 - We have located a Java class that contains formulae for calculating different types of regression curves (linear, quadratic, exponential, etc)

Our solution:

- Specific features:
 - Outlier removal - ability to easily remove outliers, manually and automatically
 - Regression curves
 - ✓ Ordering of small multiples – using some scagnostic (e.g., correlation based one?)
 - ✓ Aggregation – a focus and context feature
 - ✗ Marking – simultaneous, interactive on multiple scatterplots
 - ✗ Use of filtering to select one or more states

Anticipated Challenges:

- Finding a Java statistics toolkit with support for outlier detection and regression curve generation
- Determining good orderings of scatterplot small multiples
- Finding a domain expert to use our tool and assess its usability

Progress:

- Phase 0 – completed
 - ✓ Downloaded and cleaned sample data
 - ✓ Using Prefuse toolkit for scatterplots
 - ✓ Found Java code for regression curve generation
 - ✗ Unable to find Java code for outlier detection
- Phase 1 – completed
 - ✓ Single scatterplot has been implemented
 - ✓ Domain expert has been contacted for usability study; waiting for confirmation of participation

Progress:

- Phase 2 Part 1 – in progress
 - Implementation of statistical methods: regression curves, manual outlier removal
 - Plan evaluation component
- Phase 2 Part 2 – to begin Nov 24
 - Implementation of small multiples
- Phase 3 – to begin Dec 1
 - System evaluation
 - Implementation of optional features – marking
 - Draft report