Law Enforcement Resource Allocation (LERA) Visualization System

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Outline

- Background
- Implementation overview
- LERA prototype demo
- Usability study results
- Challenges
- Future work
Background

- Crime analysts assess the impact of different policy decisions on crime rates
- The most sophisticated type of analysis is linear regression (36%)
- The most commonly used tool is a data analysis program such as Excel (60%)

Source: Crime Analysis in America, Center for Public Policy, University of South Alabama, 2002
Background

- Very large data set
  - 2 types of data – crime rates & policy
  - 100 data fields
  - 800 US law enforcement agencies

- Searching for relationships – tedious & frustrating
Background

Current tool (e.g., Excel) used for exploring the effects of policies on crime rates is:

- Not easy to use
- Not intuitive
- Not interactive
Project goal

To support crime analysts by bringing together both crime data and crime enforcement policies into an interactive, easy-to-use visualization system.
Implementation

Interactive scatterplot visualization tool

Implementation:

- Java
- Prefuse Java toolkit
  - Support for scatterplots
- Statistical features
  - From scratch
Implemented features

- Statistical support – outlier removal, regression lines
- Small multiples - linked highlighting & ordering by scagnostics
- Focus & context – aggregates
- Filtering – select one or more states
- Visual encoding - X, Y, Colour, Size
Demo

**Burglary rate (X) v. Robbery rate (Y)**

- 1,190
- 990
- 790
- 590
- 390
- 190
- 990 1,290 2,990 3,990 4,990 5,990
Usability study

- Comparative evaluation of LERA to Excel
- Think-aloud observation
- Limited number of participants
  - One expert statistician
- Six different tasks done independently on each application
Version of LERA prototype tested
User feedback on Excel

✓ Regression lines easy to add
✗ Tedious to find input data in spreadsheet
✗ outlier removal difficult
   - In data worksheet & must make copy
   - Mouseover of point only gives x and y
✗ Comparison of clustering impossible
   - No linking in Excel & no labels for points
User feedback on LERA

- Volume of info with mouseover
- Ability to specify colour for a variable
- Linked highlighting & mouseover
- Too easy to remove points
- No undo button for outlier removal
- Colours are overwhelming
Usability study – ease of use

Task #3: Participants' Usability Ratings
(Manual outlier removal)

Ease of Use on a Scale of 1 to 10
(1 = Very difficult, 10 = Very easy)

- Participant 1: Excel 8, LERA 6
- Participant 2: Excel 1, LERA 9
- Participant 3: Excel 1, LERA 9
- Participant 4: Excel 10, LERA 10
Usability study – time

Improvement in Completion Time
(Using LERA as opposed to Excel)

Relative Decrease in Completion Time

Expert #1 Expert #2 Novice #1 Novice #2
Challenges

- Prefuse
  - Not sure how much effort was saved

- Statistical support
  - No statistics toolkit
  - Less sophisticated, fewer statistical methods
Future work

Features
- Zooming and panning
- More scagnostics, outlier removal methods
- More user control over colour encoding

Minor display issues
- Axis lines on top of points
Questions?