Exploring Gun Violence with Principal Component Analysis

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Problem: High dimensions

5-11-2016 ALABAMA MAYSVILLE 1-1

Location

MAY 11, 2016

Cherokee Street
Maysville, Alabama

Participants

- Type: Victim
- Age Group: Teen 12-17
- Gender: Male
- Status: Injured

- Type: Perpetrator
- Name: Demarcus Bonner
- Age: 20
- Age Group: Adult 18+
- Gender: Male
- Status: Injured

Incident Characteristics

- Shot - Wounded/Injured
- Defensive Use
- Defensive Use - Crime occurs, victim shoots perpetrator
- Armed robbery with injury/death and/or evidence of DGU found

Sources

- URL: http://www.al.com/news/mobile/index.ssf/2016/05/two_mobile_juveniles_injured_i.html#incart_river_index

- URL: http://wkrg.com/2016/05/13/victim-arrested-for-shooting-in-maysville/

Problem: High dimensions

Problem: High dimensions

- More than 100 "Incident Characteristics"
- Want a low dimensional approximation
- Let **X** be the matrix of observations:
  - Each row is an incident
  - Each column is an incident characteristic
    - 1 if the incident has the characteristic
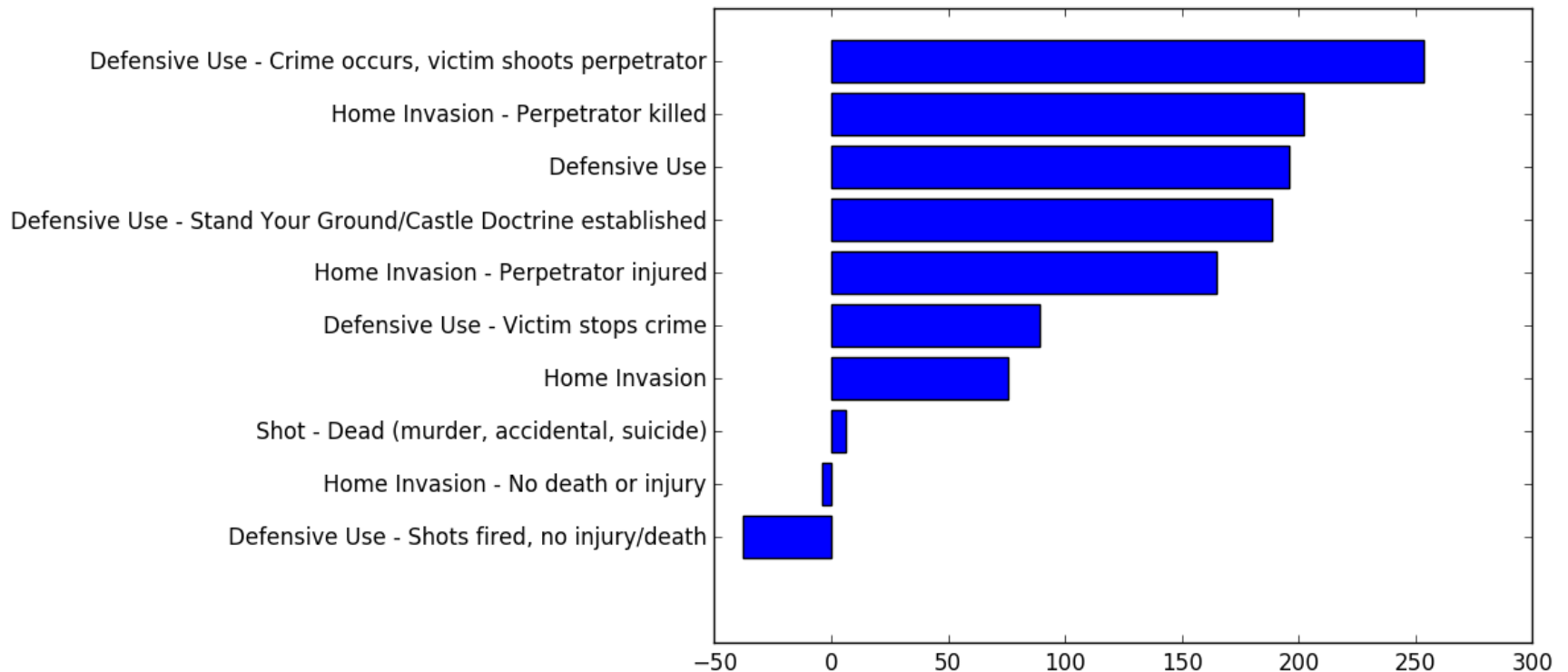   - 0 otherwise

Idea: Principal Components

- The covariance matrix of **X** is symmetric.
- Spectral theorem applies
  - We have our orthogonal transformation
- Under this transformation the columns are now all independent
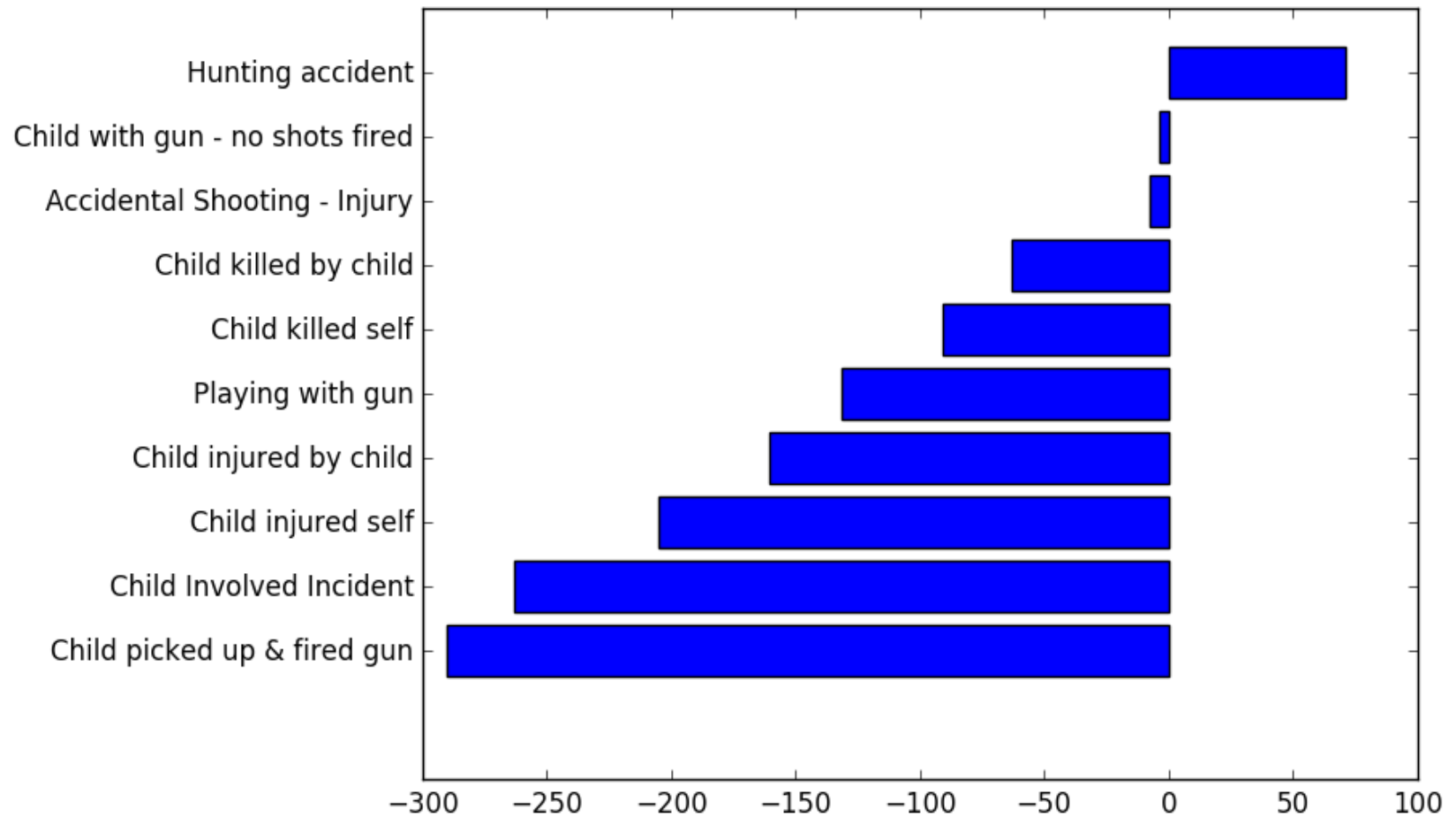- What do the eigenvectors look like?

Example: Gun Violence Archive
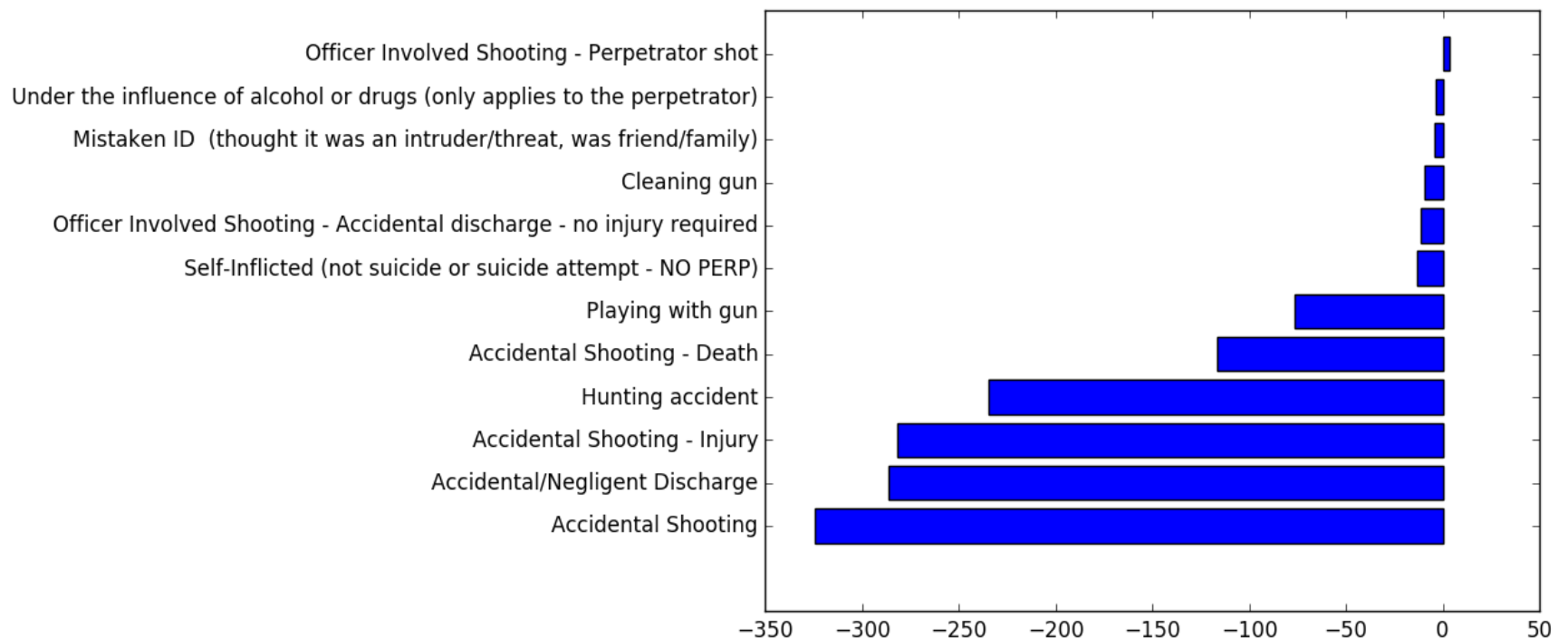
Example: Gun Violence Archive

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---INCIDENT---

12-7-2014 INDIANA MARTIN COUNTY 1-0

Location

DECEMBER 07, 2014

Martin County, Indiana
Geolocation: 38.6938, -86.822

Participants

- Type: Victim
- Gender: Male
- Status: Injured

Incident Characteristics

- Shot - Wounded/Injured
- Accidental Shooting
- Accidental Shooting - Injury
- Accidental/Negligent Discharge
- Hunting accident
- Playing with gun

Notes

Black powder muzzle-loading rifle blasted to pieces when owner tries to shoot deer after loading with smokeless powder; owner loses several fingers.

Guns Involved

1 gun involved.

- Type: Unknown
- Stolen: Unknown

Sources

- URL: http://www.indystar.com/story/news/2014/12/09/indiana-shooter-loses-fingers-rifle-explodes/20137443/

District

Extensions

- Sparse PCA, kernel PCA
- Other domains: 'recommendation' algorithms

- Issues: scaling variables, problems that don't have inherent low-dimensional structure

Questions