

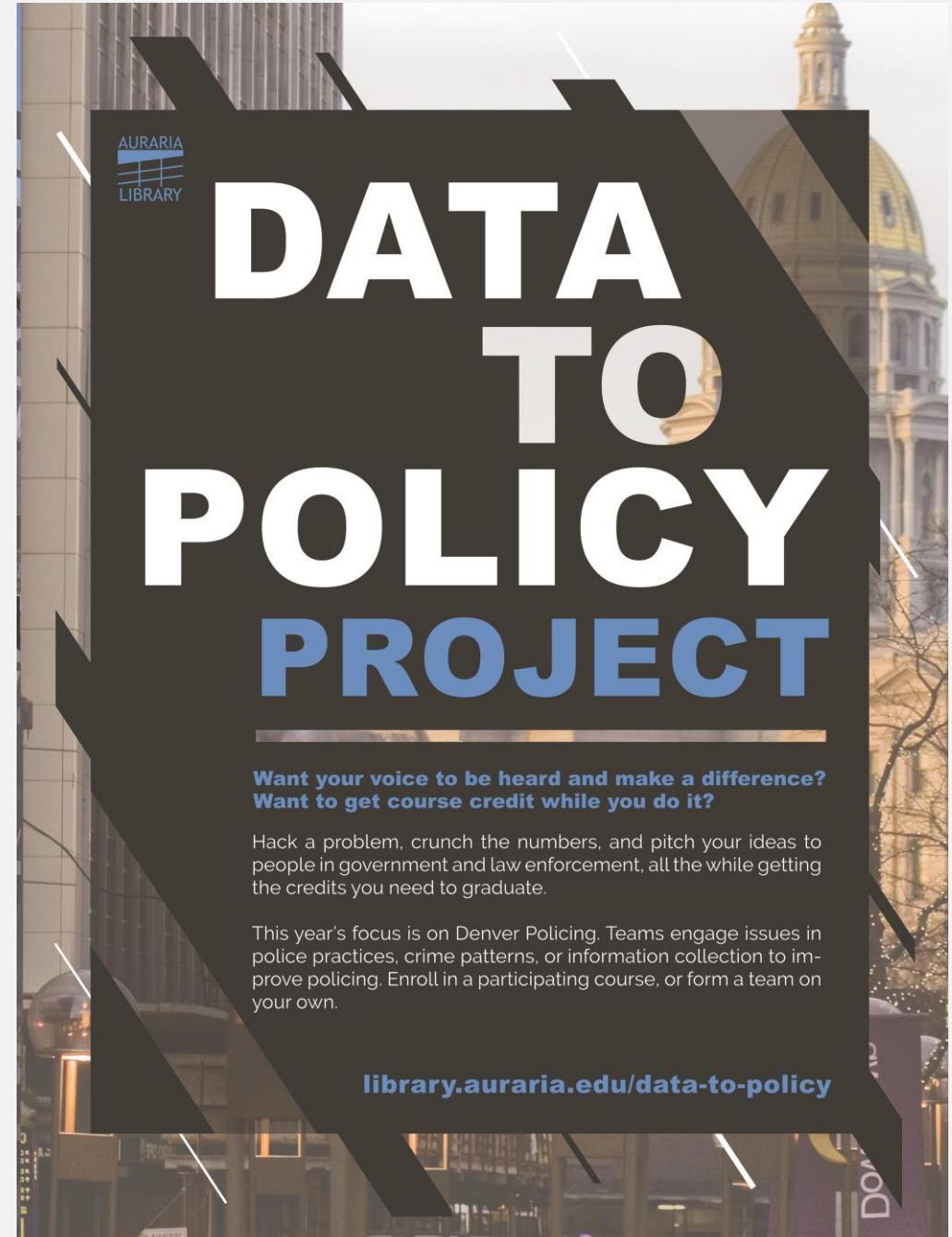
# DATA TO POLICY PROJECT

Using real data to solve real problems



## INSPIRATION

Giving students a  
constructive voice to  
respond to police shootings





AND



- Get your data USED
- You know questions that need to be answered
- Student analysis & policy work can contribute to local government
- Bridge between students and employers

## TOPICS

2017-2018:

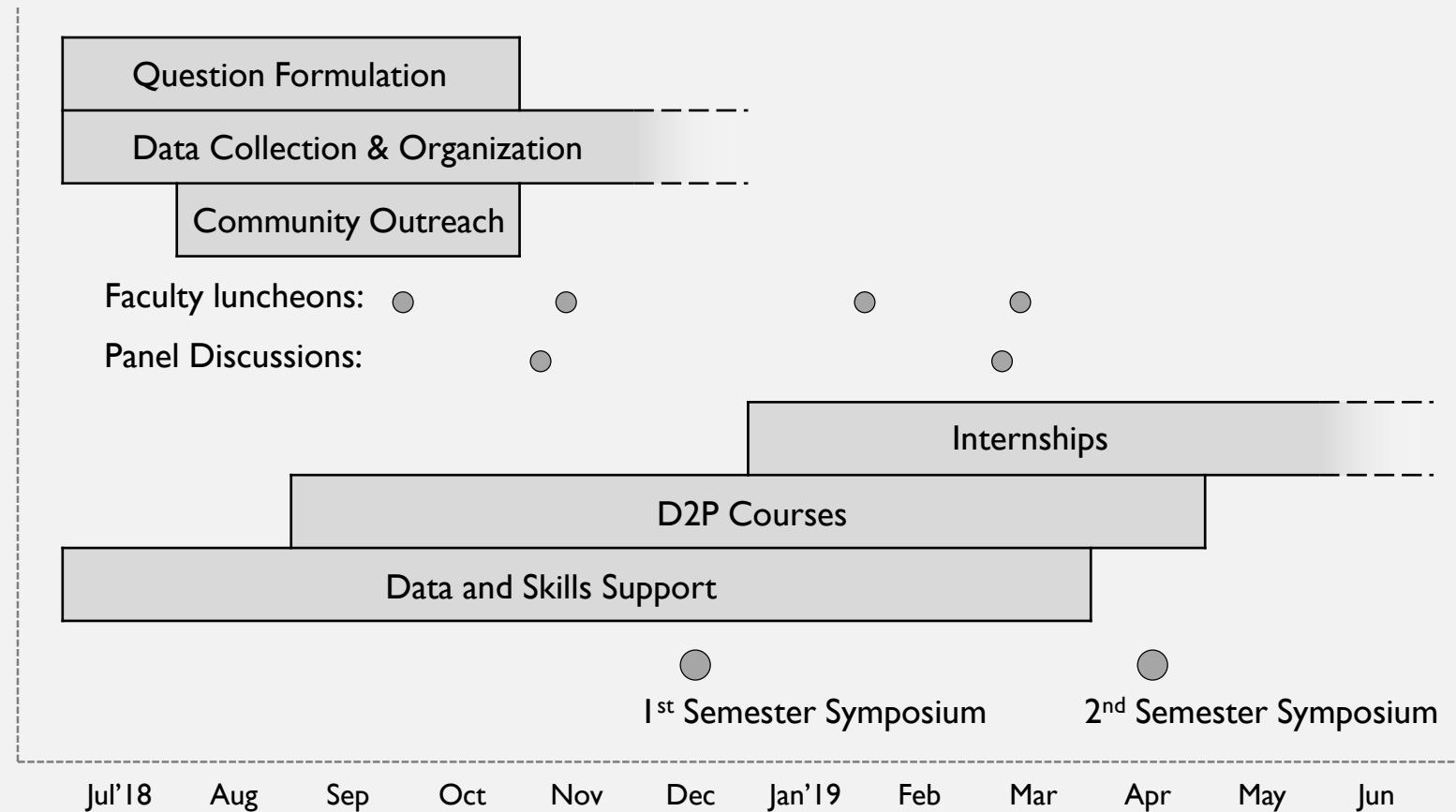
- Denver Policing
  - Patterns in Crime
  - Policing Practices
  - Information Collection

2018-2019:

- Policing
- Affordable Housing



# D2P PROJECT STRUCTURE



## PANELS AND SYMPOSIUMS



Photo: Matt Mariner

## EXAMPLE PROJECTS SPRING 2018

- Tree canopy and other factors used to predict crime frequency with linear regression

[Grand prize – Montepagano and Younkes]

- Localization of auto-theft hotspots
- Cellular Automata model for creating a heat map of likely crime using building footprints



# “POLICING PRACTICES” WINNING TEAM

Alexa Desautels

Christina Ebbn

Anna Gibala

Joshua Luginbill

## Optimized Allocation of Police Officers in Denver County

Authors: Alexa Desautels, Christina Ebbn, Anna Gibala, Joshua Luginbill



### Abstract

Police presence is known to be a key factor in reducing violent crime in an area. However, the question of where officers should be located, and in what quantity, in order to best reduce violent crime is rarely trivial. In this work, we propose an Integer Linear Programming formulation for the optimization of police officer allocation across police districts in Denver County. This allocation takes into account the population, budget, number of officers, and violent crime data for Denver County from 2014. Moreover, we demonstrate how our allocation will be affected by changes to the budget and number of officers employed.

### Objective

- Objective Function with Constraints

$$\sum_{i=1}^m x_i \leq N$$

The number of officers cannot exceed the total number of available

$$f_i \leq x_i \leq h_i$$

The number of officers should be between the minimum and the ideal number

$$c_i x_i \leq b_i$$

The cost of officers cannot exceed the budget in district  $i$

$$x_i \in \mathbb{N}$$

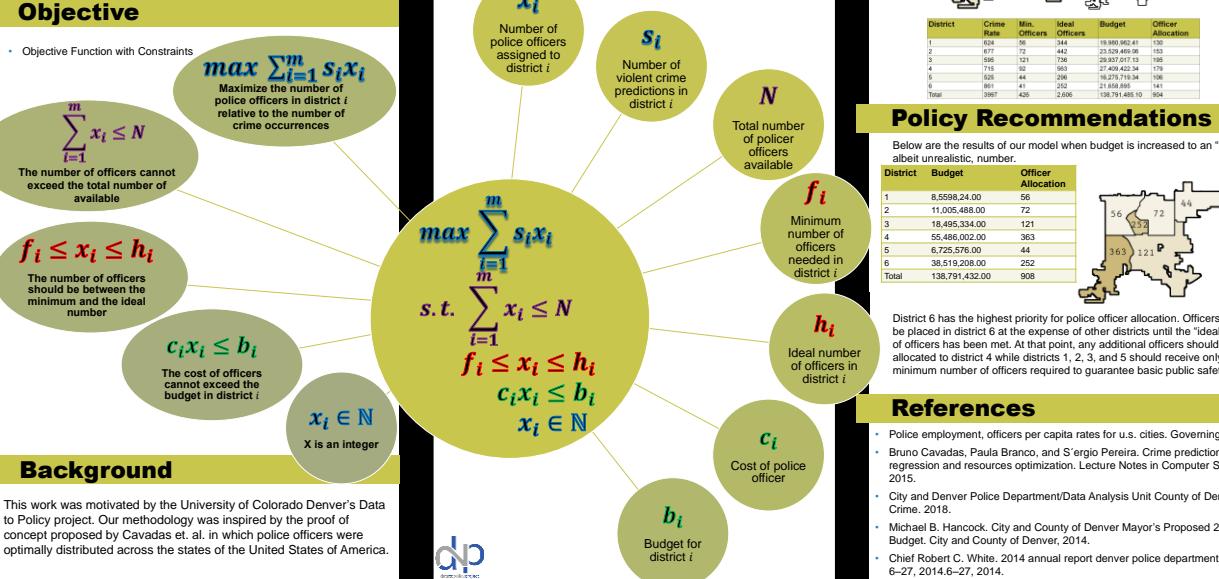
$x$  is an integer

$$max \sum_{i=1}^m s_i x_i$$

Maximize the number of police officers in district  $i$  relative to the number of crime occurrences

### Methods

Given the violent crime data for 2014, we propose to optimize the allocation of police officers across police districts. We considered a certain number of officers to distribute, taking into account violent crime data to allocate more officers to districts where more violent crime occurred. The allocation is constrained by an “ideal number” of officers that each district would like to receive and a budget for each district. Additionally, each district must receive a minimum number of officers needed to ensure basic public safety.



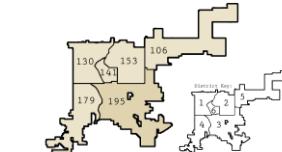
### Background

This work was motivated by the University of Colorado Denver’s Data to Policy project. Our methodology was inspired by the proof of concept proposed by Cavadas et. al. in which police officers were optimally distributed across the states of the United States of America.



### Results

Below are the results of our model using data from 2014.

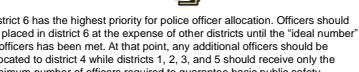


District	Crime Rate	Min. Officers	Ideal Officers	Budget	Officer Allocation
1	624	72	442	19,860,462.41	150
2	877	72	442	23,529,499.06	151
3	595	121	726	29,837,017.13	195
4	715	56	563	27,359,208.00	179
5	626	44	296	16,279,719.34	106
6	861	47	252	21,658,486.00	141
Total	3897	426	2406	138,791,485.10	904

### Policy Recommendations

Below are the results of our model when budget is increased to an “ideal”, albeit unrealistic, number.

District	Budget	Officer Allocation
1	8,559,24.00	65
2	11,005,468.00	72
3	18,495,334.00	121
4	55,486,002.00	363
5	6,725,576.00	44
6	38,519,208.00	252
Total	138,791,432.00	908



District 6 has the highest priority for police officer allocation. Officers should be placed in district 6 at the expense of other districts until the “ideal” number of officers has been met. At that point, any additional officers should be allocated to district 4 while districts 1, 2, 3, and 5 should receive only the minimum number of officers required to guarantee basic public safety.

### References

- Police employment, officers per capita rates for u.s. cities. Governing, 2016.
- Bruno Cavadas, Paula Branco, and Sérgio Pereira. Crime prediction using regression and resources optimization. Lecture Notes in Computer Science, 2015.
- City and Denver Police Department/Data Analysis Unit County of Denver. Crime, 2018.
- Michael B. Hancock. City and County of Denver Mayor’s Proposed 2015 Budget. City and County of Denver, 2014.
- Chief Robert C. White. 2014 annual report denver police department. pages 6–27, 2014.6–27, 2014.

## INTERDISCIPLINARY VISION

Framework:  
Building class pairs across  
departments

Applied  
Regression  
Analysis

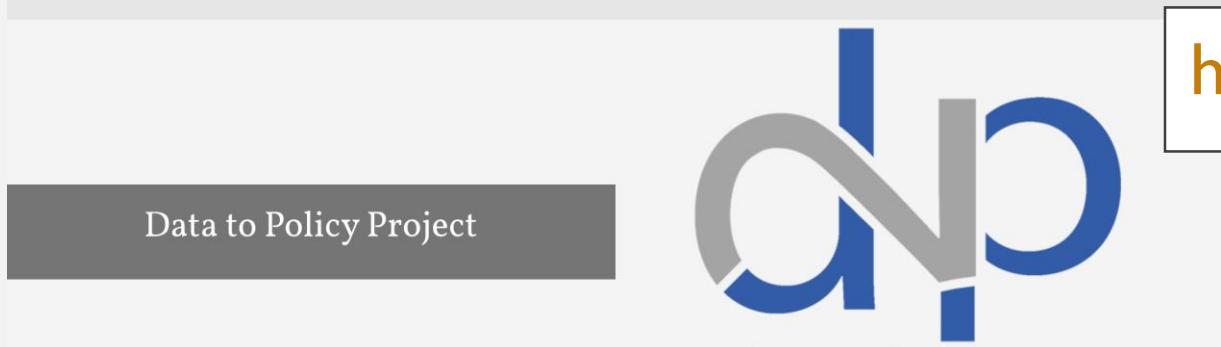
Economic  
Geography

*Skill development  
&  
Project formulation*

*Cooperative  
work*

**Symposium  
Presentation**

# DATA TO POLICY WEBSITE



<https://library.auraria.edu/d2pproject>

Data to Policy Project

HOME / DATA TO POLICY PROJECT



Home

Resources

About

Get Involved

Contact Us

# DATA ACCESSIBILITY

Google spreadsheet with links

A	B	C	D
1	Data Guide for the Data to Policy Project		
2	Main Topic	Subtopic	Source Location
3			Geographic area
4			
5			
6	Crime & Police	Crime	<a href="https://www.denvergov.org/opendata/dataset/city-and-court">https://www.denvergov.org/opendata/dataset/city-and-court</a> Denver County
7		Crime	<a href="https://www.colorado.gov/pacific/cbri/crime-colorado1">https://www.colorado.gov/pacific/cbri/crime-colorado1</a> CO
8		Police shootings	<a href="https://www.denvergov.org/opendata/dataset/city-and-court">https://www.denvergov.org/opendata/dataset/city-and-court</a> Denver County
9		Pedestrian and Traffic Stops	<a href="https://www.denvergov.org/opendata/dataset/city-and-court">https://www.denvergov.org/opendata/dataset/city-and-court</a> Denver County
10		Auraria Campus Crime	<a href="#">Spreadsheets available HERE</a> Auraria Campus
11			<a href="#">Spreadsheets available HERE</a> Auraria Campus
12			<a href="#">Spreadsheets available HERE</a> Auraria Campus



# GitHub

## HOW TO GET INVOLVED

- Data data data
- Contribute to question formulation
- Attend the symposiums
- Be a judge
- Come to the panel discussions or be a panelist
- Help develop internships



## CONTACT - D2P COMMITTEE

Shea Swauger

[shea.swauger@ucdenver.edu](mailto:shea.swauger@ucdenver.edu)

*Project Lead*

Diane Fritz

[diane.fritz@ucdenver.edu](mailto:diane.fritz@ucdenver.edu)

*Data / Faculty & Student liaison*

Matt Mariner

[matthew.mariner@ucdenver.edu](mailto:matthew.mariner@ucdenver.edu)

*Community liaison*

Mike Ferrara

[michael.ferrara@ucdenver.edu](mailto:michael.ferrara@ucdenver.edu)

*Internships*