Using After School Programs to Reduce Crime Rates

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Motivation and Overview

Being both educators and students, Connor and Zach wanted to look into how educational resources can be used to positively influence their community. Given the tools and resources we had, we decided to investigate after school programs.

This project developed a linear program that maximized the effectiveness for the placement of programs. We decided to focus on the the data for the location of crimes that are most often committed by teenagers for 2014 in Denver. From this information, we decided the optimal locations for after school programs for various integer amounts.

Methods/Software Used

- AMPL and CPLEX
- Excel
- Open Refine
- MAT 5993 Linear Programming (Steffen Borgwardt)
- epsg.io – for transforming coordinates
- Google Maps

Generalizations

- Crime 2+ miles away from potential after school program were not used in calculation

- Crimes that were within ~5 ft - ~2 blocks away from an afterschool program were considered to be equivalent distance

- Only general locations are recommended. We leave the specifics of the actual location (rent, type, size) to the policy makers
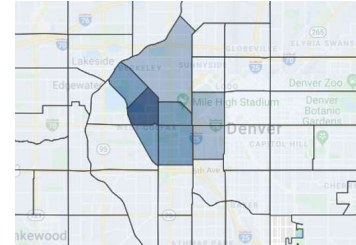
Visualizations and Methodologies

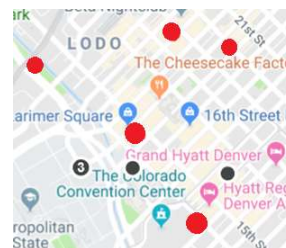### Big Picture

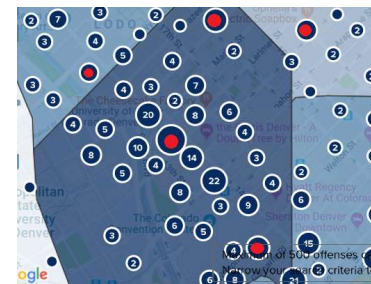**After School Programs in Existence**
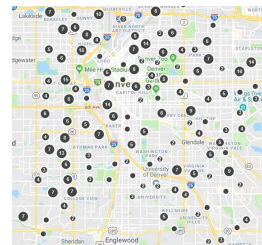
Location of Crimes

Localized Region

After School Programs in Focused Location

Location of Crimes In Focused Area

Results

Top 2 Locations:

1. 1947 Lawrence Street, Denver CO 80202

2. 700 14th Street, Denver CO 80202

Linear Program

$$\min \sum_{y \in Y} f(y) \left(\frac{\sum_{s \in S_y} d(y,s)^{-2} + \sum_{y' \in Y} f(y')d(y',y)^{-2}}{|S_y| + n - 1} - \frac{\sum_{c \in C_y} d(c,y)^{-2}}{|C_y|} \right)$$
$$\text{s.t} \sum_{y \in Y} f(y) = n, f(y) \in \{0,1\}$$

- Y – possible after school programs
- S_y – existing after school programs within 2 miles of possible location y
- C_y – theft, vandalism, and alcohol/drug use crimes within 2 miles of possible location y
- d – distance function
- $f(y)$ – whether or not to select location y
- n – number of desired new after school programs
- Quadratic binary program, converted to a linear binary program using AMPL

Big Picture

Minimize how close on average other after school programs are minus how close on average the location is to crimes often committed by teenagers. Although additional locations were tested, the results are focused in the localized region

Possible Extensions

- Automate program more
- Include age specific population data
- Include costs of using various locations
- Extend to more locations/more feasible locations

Sources

"TOP 25 Types of Referrals Crimes, Offenses and Violations Youth/Teen/Student/Peer Court", https://www.globalyouthjustice.org/resources/top-25-crimes/ © 2018 Global Youth Justice

Data Sets:

"After School Programs," Locations of varied programs (chorale singing, summer day camp, junior success tutoring, etc.), 2016 https://www.denvergov.org/opendata/dataset/city-and-county-of-denver-afterschool-programs

"Crime" Previous 5 calendar years plus data from present year https://www.denvergov.org/opendata/dataset/city-and-county-of-denver-crime