Crime Hot-spots Forecasting

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Overview

This is National Institute of Justice's (NIJ) Real-Time Crime Forecasting Challenge, which hopes to provide researchers and the federal government with a better understanding of the potential for crime forecasting in Portland,Oregon.

Website: http://www.nij.gov/funding/Pages/fy16-crime-forecasting-challenge.aspx

Calls-for-service (CFS) records (2013)

CATEGORY	CALL GROUPS	final_case_type	CASE DESC	occ_date	x_coordinate	y_coordinate	census_tract
STREET CRIMES	DISORDER	DISTP	DISTURBANCE - PRIORITY	1/18/2013	7649793	662388	100
STREET CRIMES	DISORDER	DISTP	DISTURBANCE - PRIORITY	1/5/2013	7651202	661479	100
STREET CRIMES	DISORDER	DISTP	DISTURBANCE - PRIORITY	1/28/2013	7647818	663182	100
STREET CRIMES	DISORDER	DISTP	DISTURBANCE - PRIORITY	2/2/2013	7649298	661246	100
STREET CRIMES	DISORDER	DISTP	DISTURBANCE - PRIORITY	1/13/2013	7650935	661746	100
STREET CRIMES	DISORDER	DISTP	DISTURBANCE - PRIORITY	2/17/2013	7650248	660907	100
STREET CRIMES	DISORDER	DISTP	DISTURBANCE - PRIORITY	1/30/2013	7650289	662464	100
STREET CRIMES	DISORDER	DISTP	DISTURBANCE - PRIORITY	3/13/2013	7650182	664208	100
STREET CRIMES	DISORDER	DISTP	DISTURBANCE - PRIORITY	2/16/2013	7649859	665351	100
STREET CRIMES	DISORDER	DISTP	DISTURBANCE - PRIORITY	3/2/2013	7649894	664127	100
STREET CRIMES	DISORDER	DISTP	DISTURBANCE - PRIORITY	3/29/2013	7649298	661246	100
STREET CRIMES	DISORDER	DISTP	DISTURBANCE - PRIORITY	4/27/2013	7647366	665494	100
STREET CRIMES	DISORDER	DISTP	DISTURBANCE - PRIORITY	4/27/2013	7648668	662094	100
STREET CRIMES	DISORDER	DISTP	DISTURBANCE - PRIORITY	5/2/2013	7650785	661371	100
STREET CRIMES	DISORDER	DISTP	DISTURBANCE - PRIORITY	5/12/2013	7647366	665494	100
STREET CRIMES	DISORDER	DISTP	DISTURBANCE - PRIORITY	5/31/2013	7650022	663852	100
STREET CRIMES	DISORDER	DISTP	DISTURBANCE - PRIORITY	6/1/2013	7648386	663997	100
STREET CRIMES	DISORDER	DISTP	DISTURBANCE - PRIORITY	5/27/2013	7648851	662894	100

Calls-for-service (CFS) records (2013)
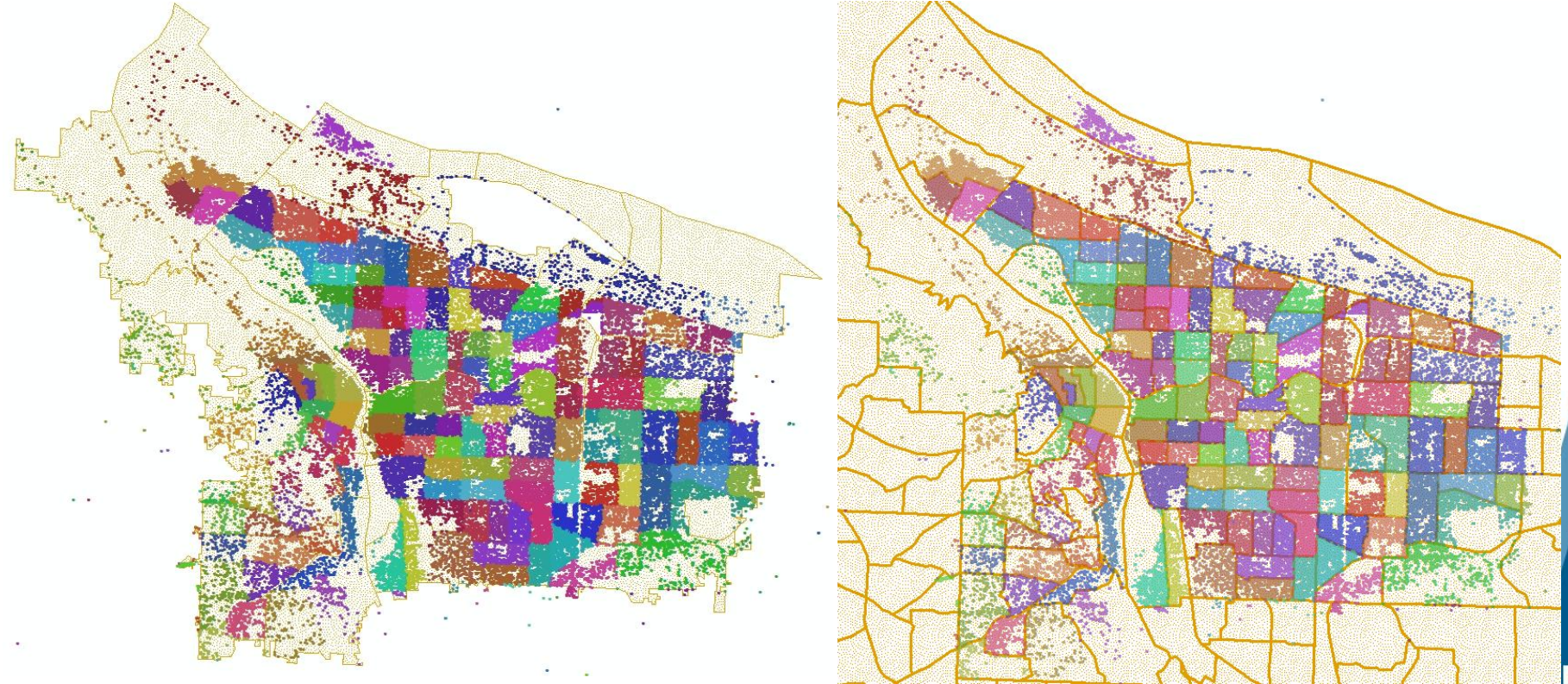
2013 Data for the Month of Jan to Dec

Submission of hot spot map

Table 2: Requirements for Entries	
Requirement	Description of Requirement
Required files	.dbf .prj .sbn .sbx .shp .shx
Projection of files	NAD_1983_HARN_StatePlane_Oregon_North_FIPS_3601_Feet_Intl
Required variables	Unique ID for each cell A binary variable (1 – hot spot, 0 – not) Area for each cell measured in square feet to 4 decimal places
Cell shape	Any shape
Individual cell area*	$62{,}500 \text{ ft}^2 - 360{,}000 \text{ ft}^2$
Total forecasted area	$0.25 \text{ mi}^2 - .75 \text{ mi}^2$

*Cells forming the outer boundary of the study area (Portland Police Districts, see file in Section X.) must be trimmed so that the total area of all cells equals 147.71 square miles (+/-0.02 square miles). The area of each interior cell must be equal to one another.

Judging Criteria
- Prediction Accuracy Index (PAI)

$$\frac{\left(\frac{n}{N}\right)*100}{\left(\frac{a}{A}\right)*100} = \frac{HitRate}{AreaPercentage} = \text{Prediction Accuracy Index} \qquad (1)$$

where n is the number of crimes in areas where crimes are predicted to occur (e.g. hotspots), N the number of crimes in study area, a the area (e.g. km^2) of areas where crimes are predicted to occur (e.g. area of hotspots), and A the area (e.g. km^2) of the study area.

Reference:

- Chainey, S., Thompson, L., & Uhligh, S. (2008). The Utility of Hotspot Mapping for Predicting Spatial Patterns of Crime. Security(21), 4-28.

Judging Criteria
- Predictive Efficiency Index* (PEI*)

- The $PEI*$ will measure the efficiency of the forecast with the following equation:

$$PEI^* = \frac{PAI}{PAI^*}$$

- Where $PEI*$ equals the maximum obtainable PAI value for the amount of area forecasted, a. As such:

$$PEI^* = \frac{n}{n^*}$$

- Where $n*$ equals the maximum obtainable n for the amount of area forecasted, a.

Reference:

- **Hunt, J. (2016). Do Crime Hot Spots Move? Exploring the Effects of the Modifiable Areal Unit Problem and Modifiable Temporal Unit Problem on Crime Hot Spot Stability. Archived with ProQuest Dissertations & Theses.**

Requirements for final submission

We will have to submit one shape file, with required variables
- unique ID for each cell
- A binary variable(1 - hot spot , 0 - not)
- Area for each cell measured in sq.ft
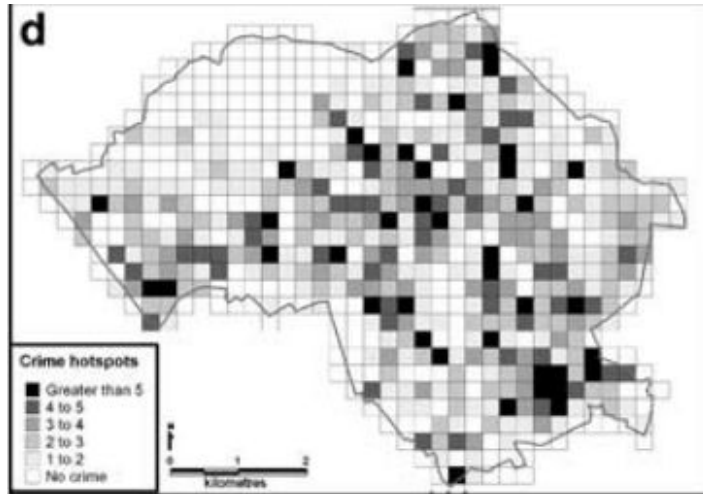
Evaluation (1 hot spot)

Hot spot map

1 week (3/1-3/7) evaluation

		(orange)
1		

1

2	3	6
1	0	7
2	5	1

PAI = (6/27) / (1/9) =2

PEI* = 6 / 7

$$PAI = \frac{\left(\frac{n}{N}\right)*100}{\left(\frac{a}{A}\right)*100} = \frac{HitRate}{AreaPercentage} = \text{Prediction Accuracy Index}$$

$$PEI^* = \frac{n}{n^*}$$

- Where n^* equals the maximum obtainable n for the amount of area forecasted, a.
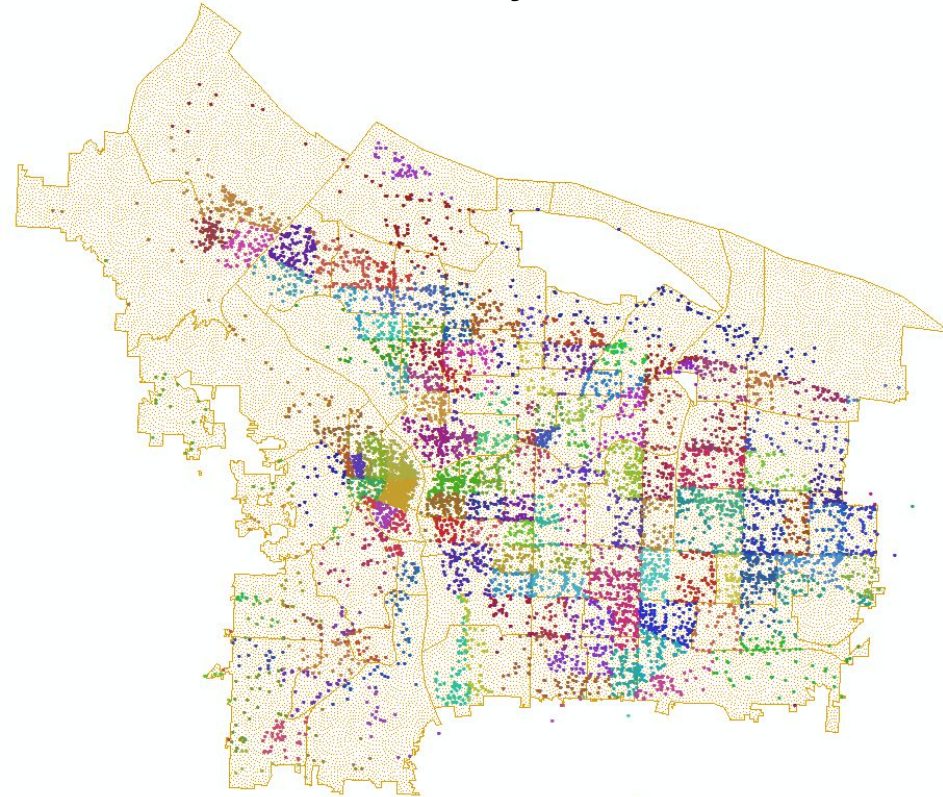
Evaluation (2 hot spots)

Hot spot map

1

1
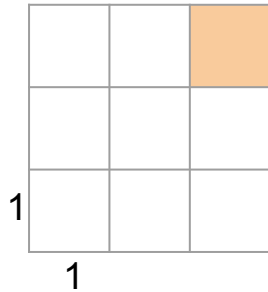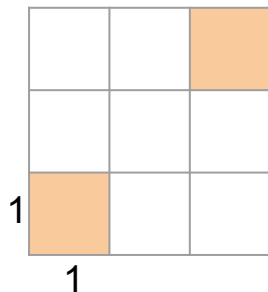
1 week (3/1-3/7) evaluation

2	3	6
1	0	7
2	5	1

PAI = (8/27) / (2/9) =16/3

PEI* = 8 / (6+7) = 8/13

$$PAI = \frac{\left(\frac{n}{N}\right)*100}{\left(\frac{a}{A}\right)*100} = \frac{HitRate}{AreaPercentage} = \text{Prediction Accuracy Index}$$

$$PEI^* = \frac{n}{n^*}$$

- Where n^* equals the maximum obtainable n for the amount of area forecasted, a.
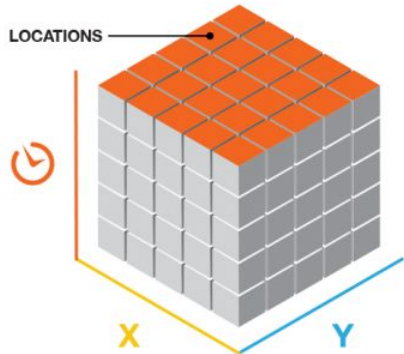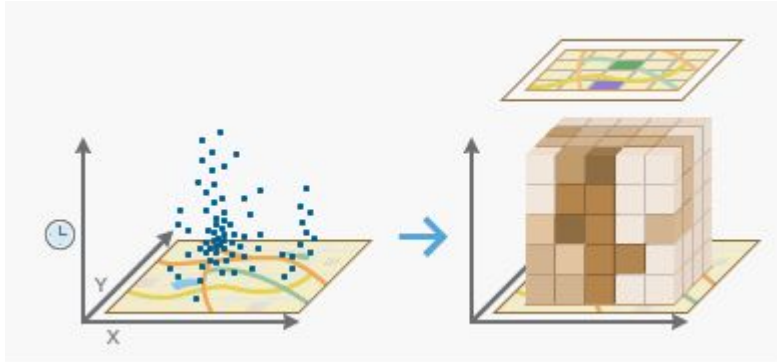
Space time cube

Each bin includes multiple features
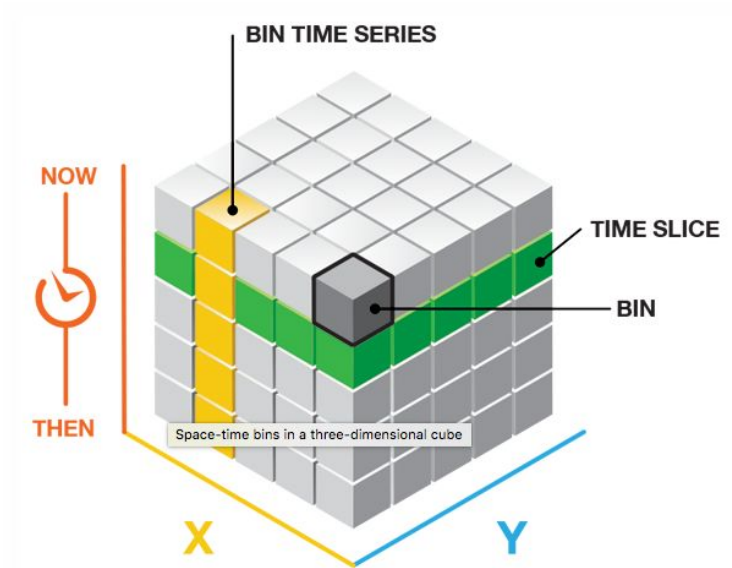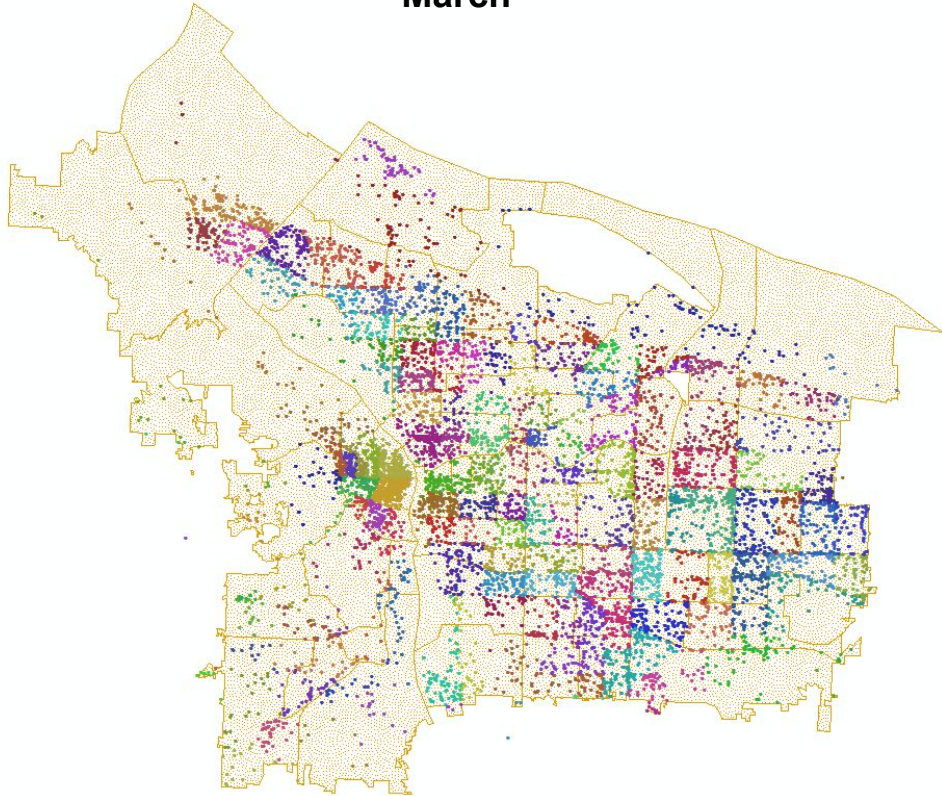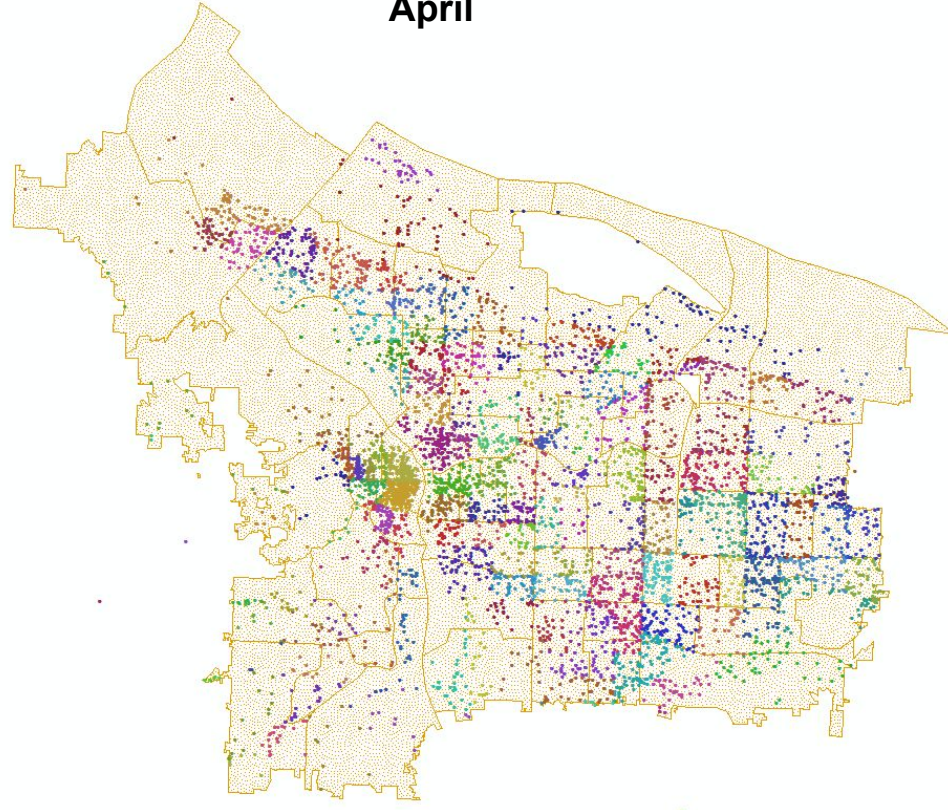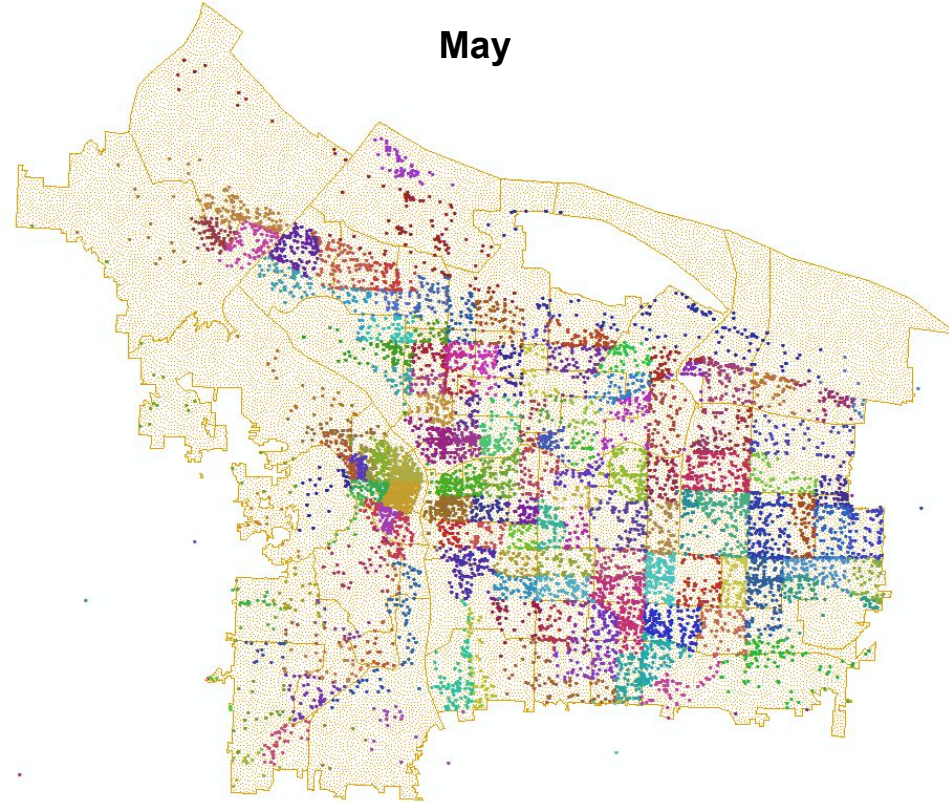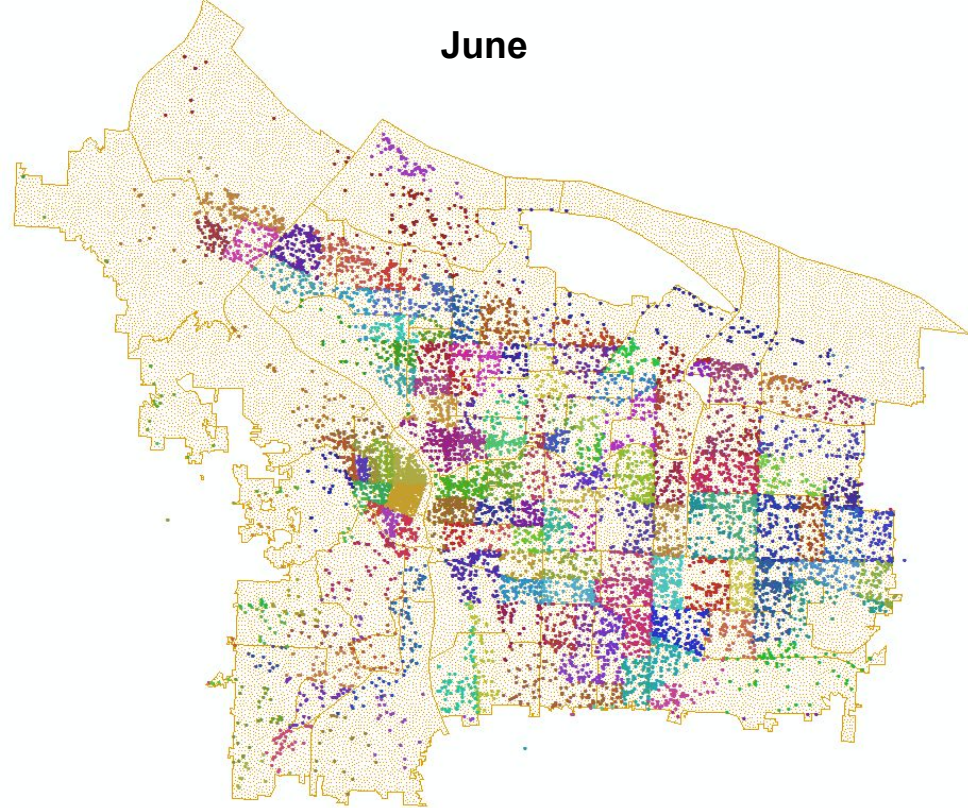
Crimes In 2013

January

February
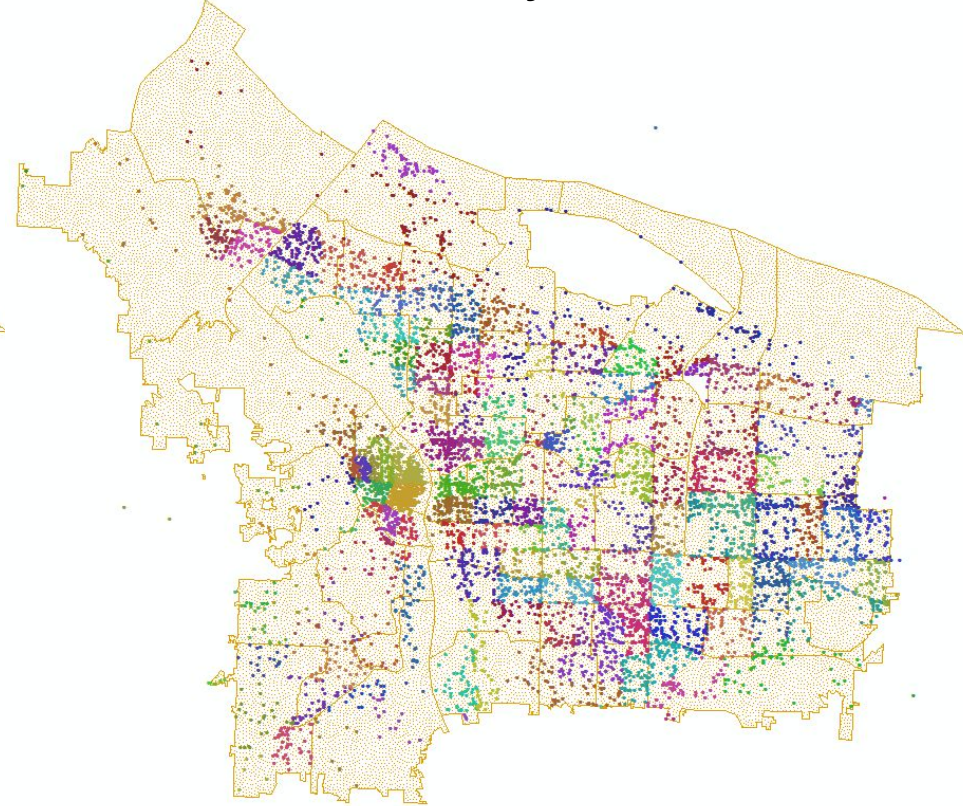
Crimes In 2013

March

April

Crimes In 2013

May

June

Thank You!