Seattle Crime

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Business Goal

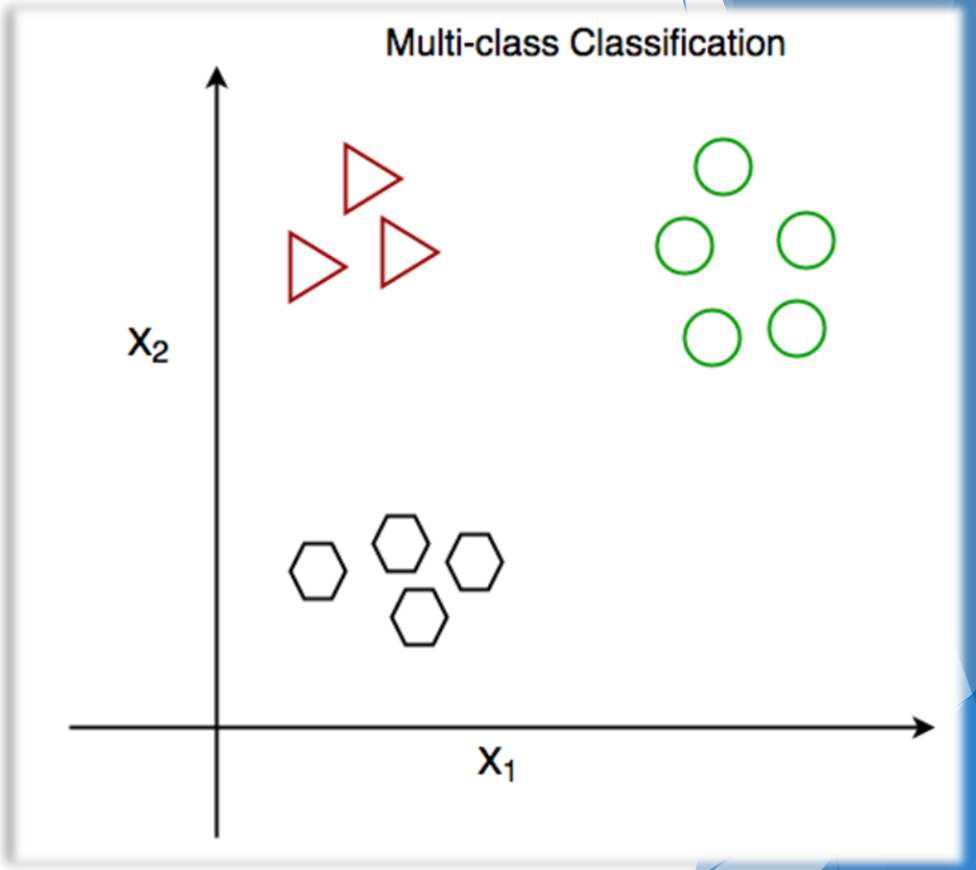
- Seattle one of top 50 largest US cities
- One of the fastest growing in US
- Seattle recently ranked among least safest cities in US
- Make city and people feel safer
- Generate positive image

Method

- Use of Multiclass Classification models
- Pick best one
- Able to classify new crimes as a certain category
- New crime location
- What is Multiclass Classification?

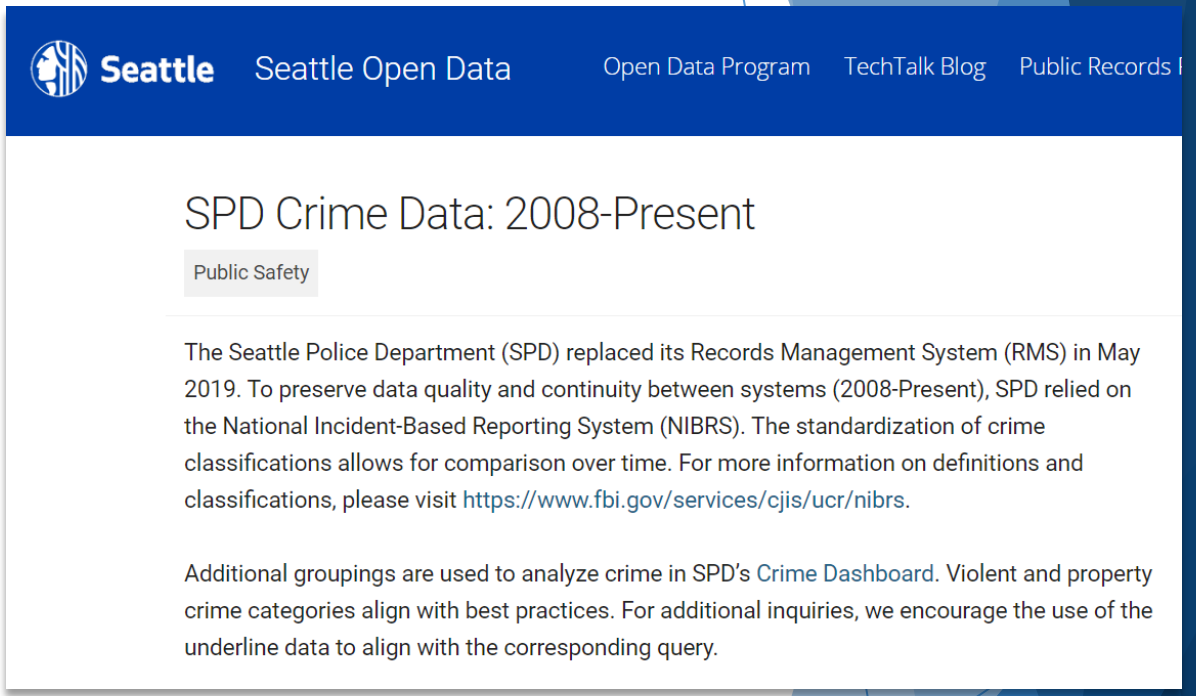
Multiclass Classification

- Process of dividing data into classes/categories
- More than 2 categories
- Can be used to predict future values
- Crime type and location



The Data

- City of Seattle's site (Seattle.gov)
- SPD crime dataset(2008-present)
- Publicly available
- Over 1 million rows
- Crime date, crime category, crime location, etc

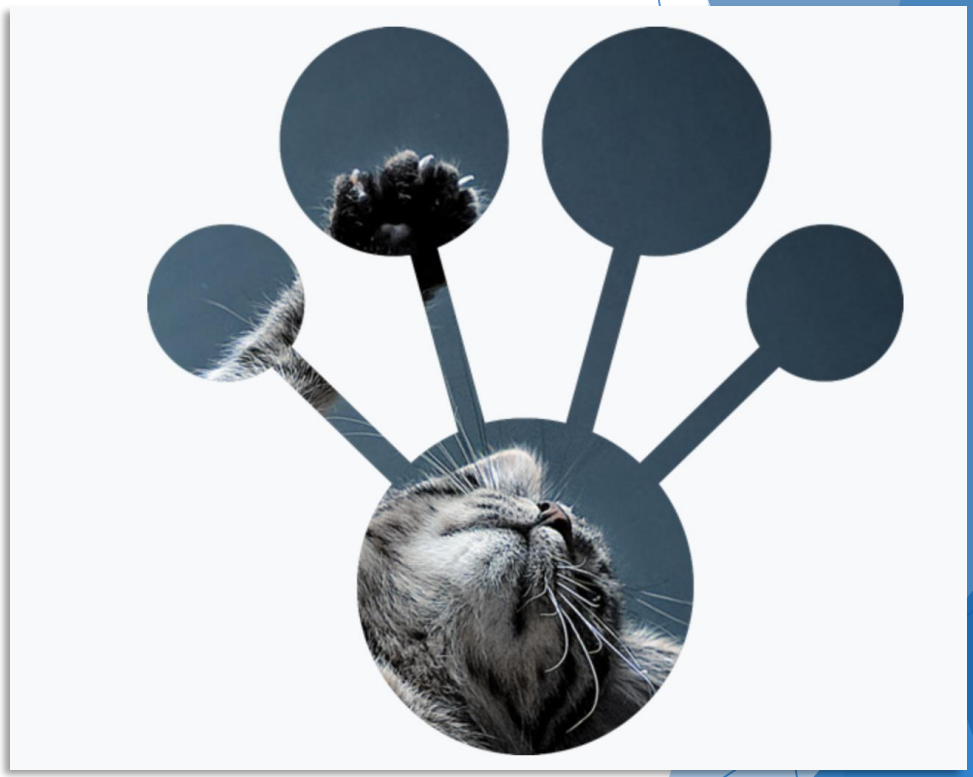


The Models

- Built two separate models
- Used two different algorithms
- Built initial models then improved
- CatBoost (gradient boosted decision tree)
- Random Forest

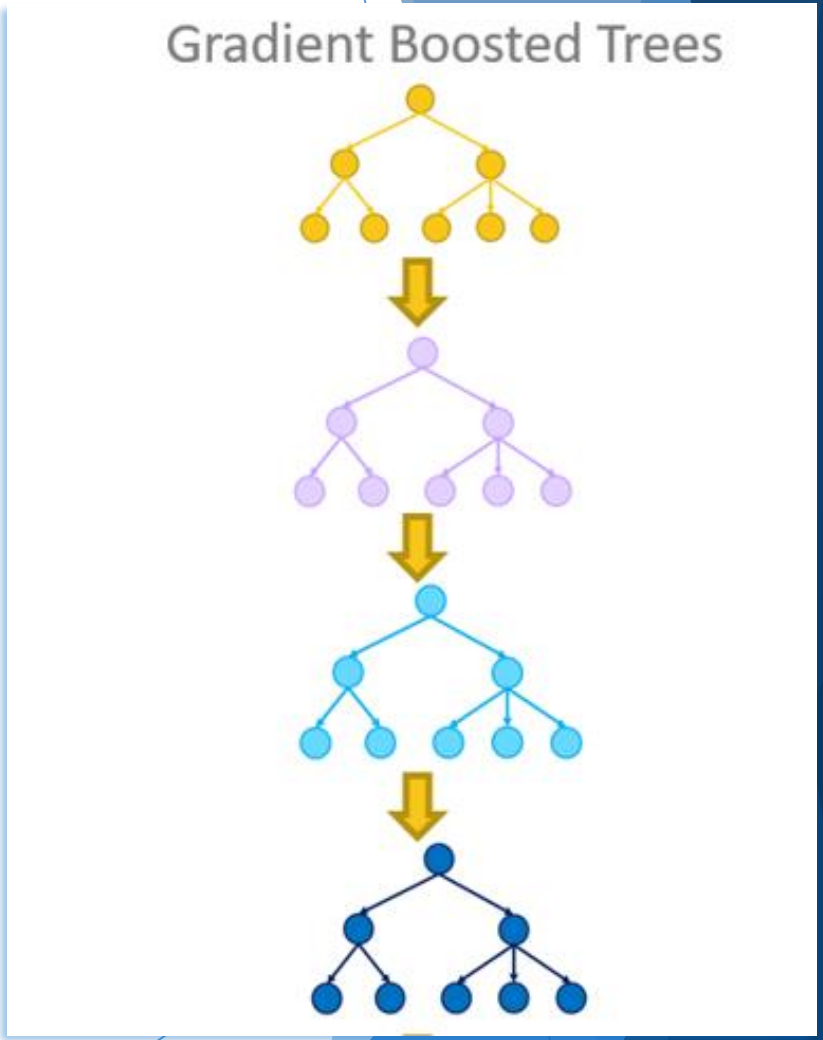
CatBoost

- Gradient boosted Decision Tree
- Decision tree splits data into series of decisions
- At end, final decision reached and data is categorized
- Decision Trees prone to overfitting



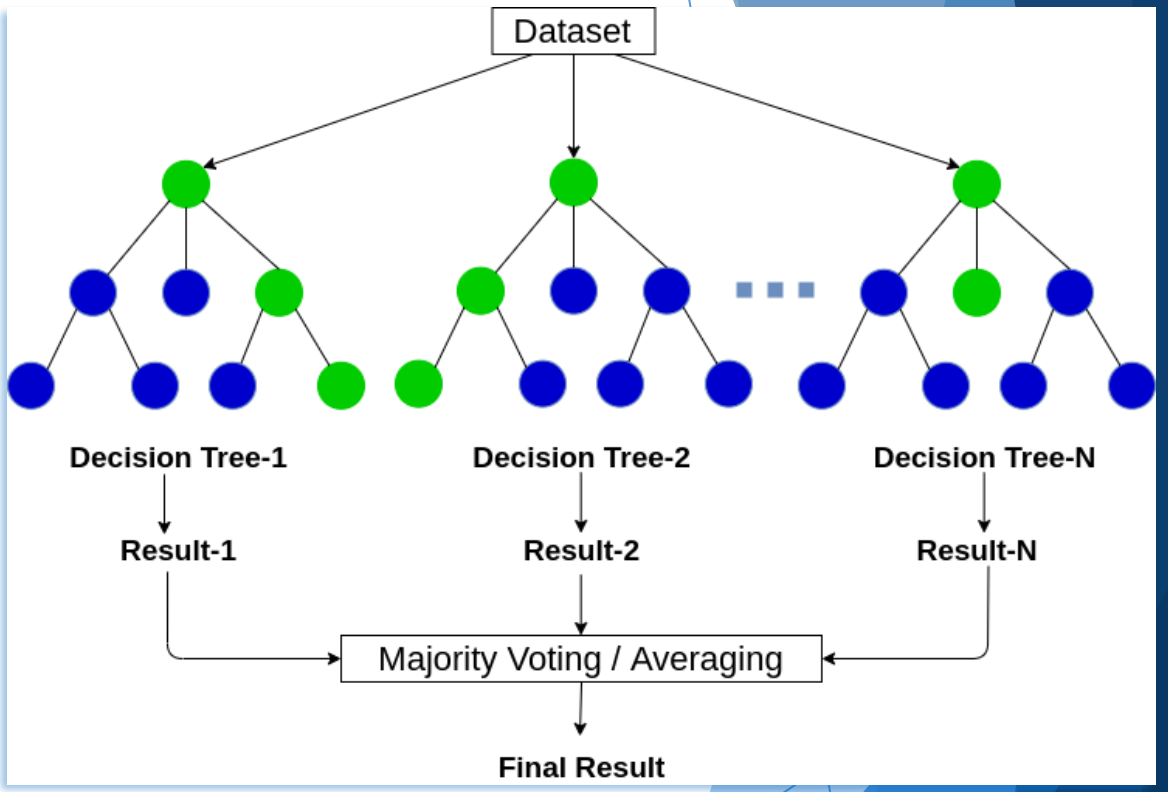
CatBoost Continued

- Use gradient boosting
- Adding series of decision trees, each one improves upon last
- CatBoost used when data is categorical
- Great default models
- Train on GPU



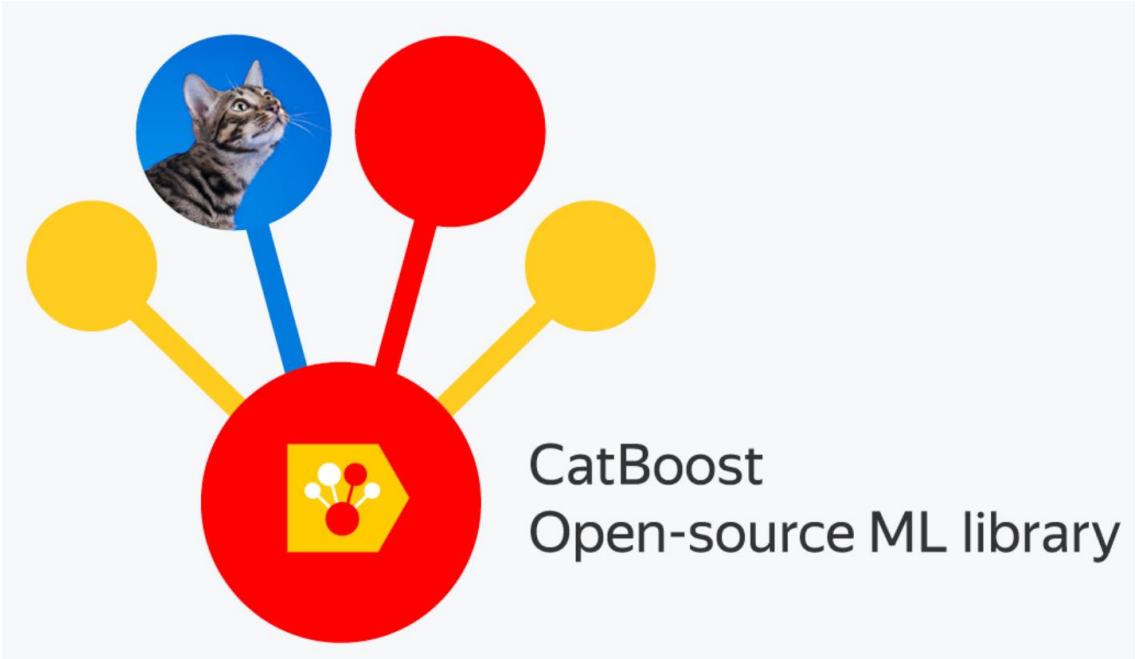
Random Forest

- Random samples created from data
- Individual decision trees made for each sample
- All tree predictions compared together
- Majority vote for best prediction



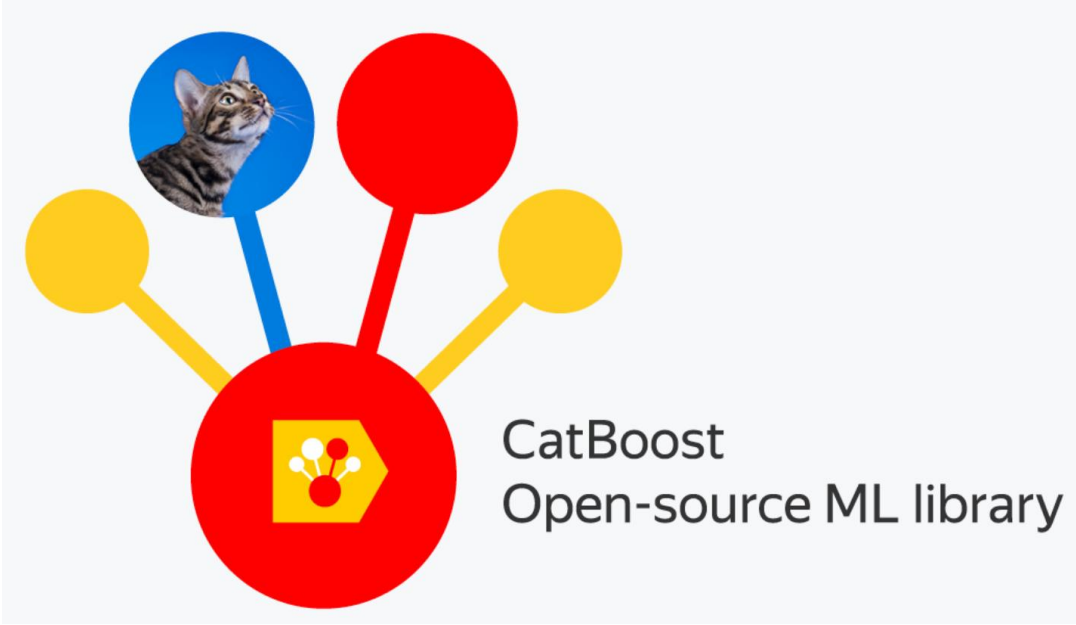
Crime Type Best Model

- Compared Random Forest and CatBoost models
- Found our CatBoost model to be the best model



Crime Location Best Model

- Compared a default CatBoost model and a tuned CatBoost model
- Found initial CatBoost model was our best one



Results

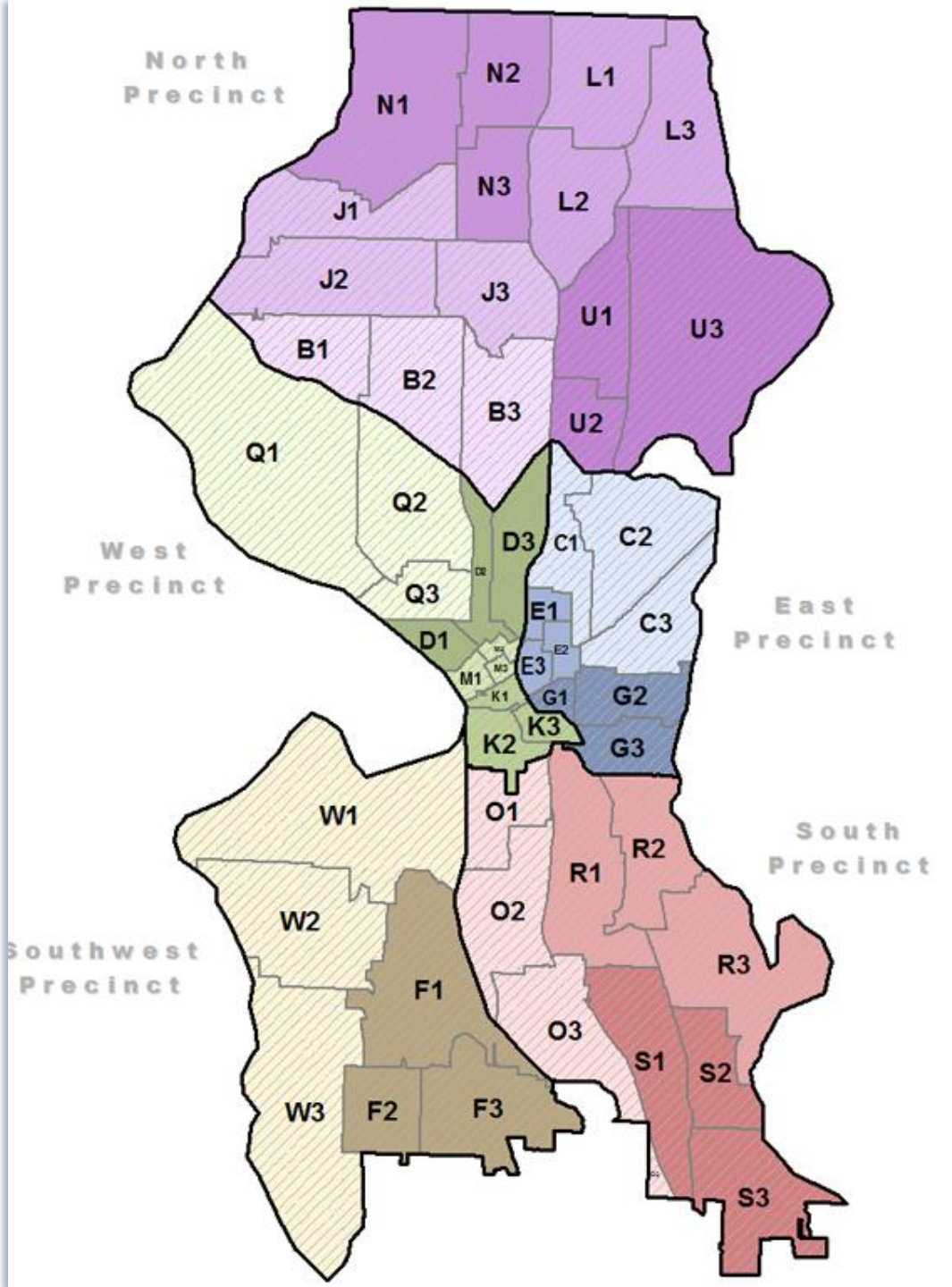
- Crime type, crime locations
- Cover major ones
- Recall, True Positives, False Negatives
- Out of actual total, what percentage of model predictions were correct
- How many correct positive classifications made
- How many incorrect negative classifications made

Crime Type Results

- Top crimes were Shoplifting and Simple Assault
- Shoplifting recall was .62
- 1,859 true positive instances, 1,116 false negative instances
- Simple Assault recall was .56
- 2,139 true positive instances, 1,651 false negative instances

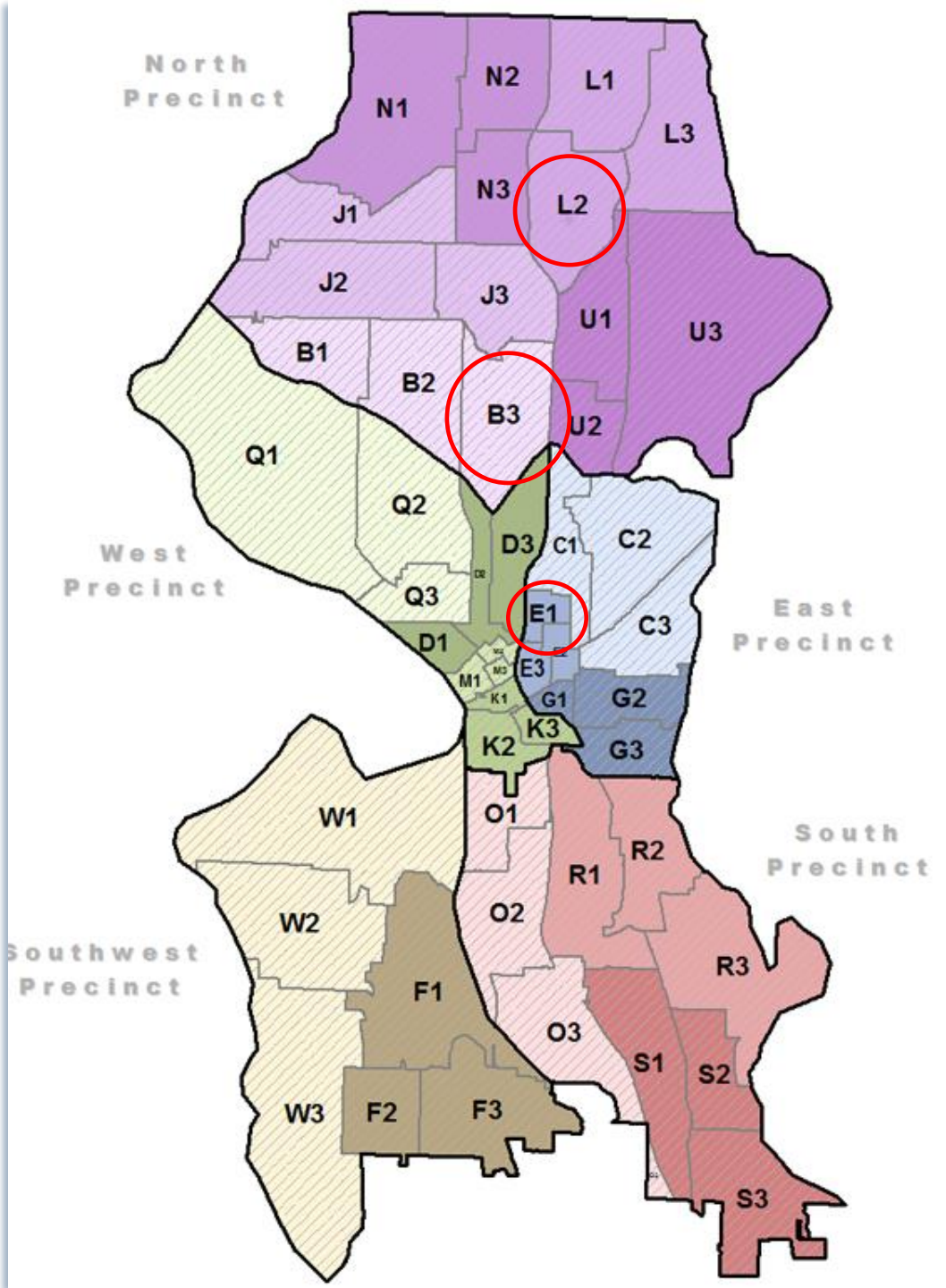
Crime Location Results

- Seattle separated into precincts, sectors, and beats
- Precincts are police station general locations
- Sectors smaller areas within precincts
- Smallest patrol area called Beats



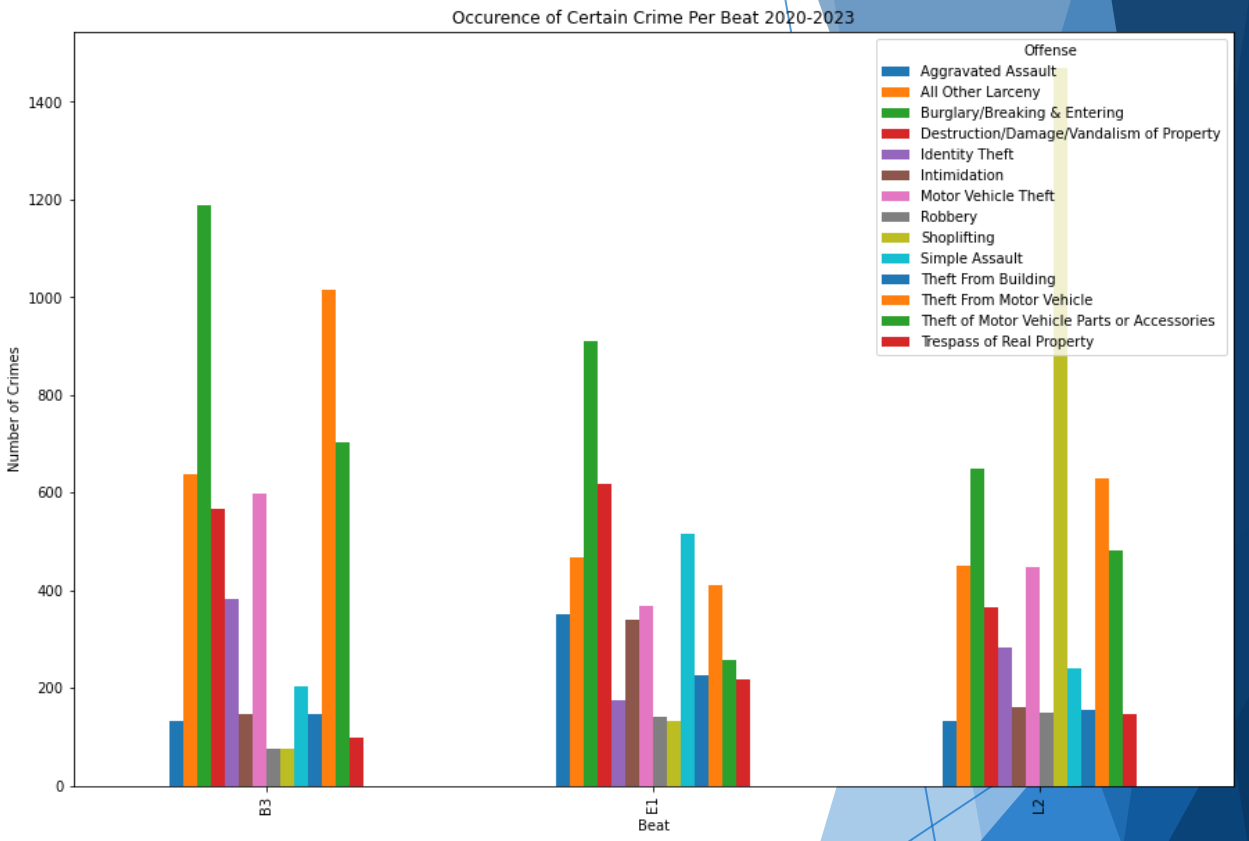
Crime Location Results

- Top crime locations were B3, E1, L2 Beats
- For recall B3(.75), E1(.99), L2 (1.0)
- For TP instance B3(1,187), E1(1,406), L2(1,604)
- For FN instances B3(399), E1(9), L2(0)



Additional Analysis

- Looked at data without the use of ML models
- Looked at which crimes occurred the most in our best predicted Beats
- We can see top crimes between the 3 Beats are Burglarly/Breaking & Entering and Theft From Motor Vehicle crimes

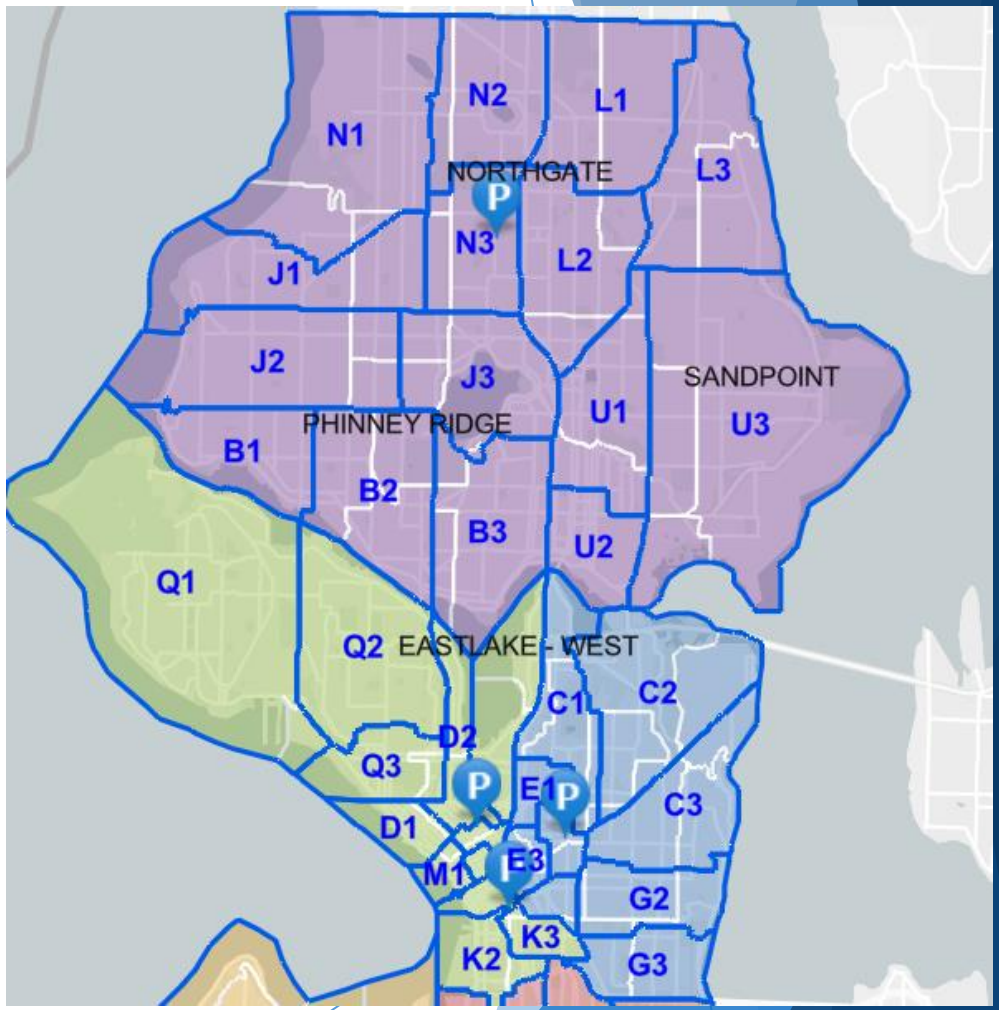


Final Results

- Our model best classifies new crimes as occurring in the B3, E1 and L2 Beats
- Non-location wise, model best predicts Shoplifting and Simple Assault
- Other crimes include Burglary/Breaking & Entering and Theft From Motor Vehicle

Recommendations

- B3, E1, L2 and police stations on map
- Need more station(s) between B3 and L2
- Alternatively divert some southern police forces north
- Lead to faster response times, deterrence of future crimes
- Shortage of officers, due to staffing crisis and quitting
- Another option to form neighborhood watch for each Beat
- Build/improve relations with the public
- SPD budget increased by 15M in past year



Recommendations Continued

- Recommended to install more security cameras in strategic places
- Easier to track crimes, may also deter crime
- Lastly, build more safe and affordable parking
- Reduce theft and create positive feedback from public

Recommendations Continued

- Implement model in Dispatch center
- Police laptops
- Integrate with social media

Next Steps

- Results are great starting point
- Reduce overfitting in location model
- Obtain higher recall scores in crime type model
- Don’t filter data
- Model takes while to run
- Run on GPU/rent GPUs (less than 3$ per hour)

Next Steps

- Once model successfully tuned and implemented, will have numerous positive effects
- Decrease crime, improve police-public relations, increase business/tourism
- Once proven successful, model may even be implemented in other parts WA, and then even other states

Questions and Contact Information

- Questions?
- Any additional inquiries can be directed to linkedin:
  - https://www.linkedin.com/in/alejandro-harrison/

Sources

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