



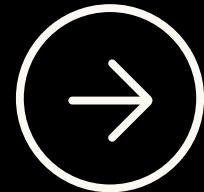
Group 3

297301 Applied Machine Learning and Big Data Processing

PREDICTING RENTAL PRICES PER REGION

17 October 2024

GROUP MEMBERS



23017442

Tamsin Rodgers

23001226

Yang Li

23017224

Samantha Quilat

19042501

Xinyu Cao

INTRODUCTION

Topic: Predicting Rental Prices by Region

Data Sources:

- Rent Data: New Zealand Tenancy Services
 - <https://www.tenancy.govt.nz/about-tenancy-services/data-and-statistics/rental-bond-data/>
- Crime Data: Statistics New Zealand
 - [https://explore.data.stats.govt.nz/vis?pg=0&snb=20&tm=crime&vw=tb&df\[ds\]=ds-nsiws-disseminate&df\[id\]=JUS_CAL_001&df\[ag\]=STATSNZ&df\[vs\]=1.0&dq=.00.T.T.T.16%2B23%2B29%2B100%2B200%2BT.&ly\[rw\]=YEAR_JUS_CAL_001&ly\[cl\]=COURT_CLUSTER_JUS_CAL_001%2CSENTENCE_JUS_CAL_001&to\[TIME\]=false](https://explore.data.stats.govt.nz/vis?pg=0&snb=20&tm=crime&vw=tb&df[ds]=ds-nsiws-disseminate&df[id]=JUS_CAL_001&df[ag]=STATSNZ&df[vs]=1.0&dq=.00.T.T.T.16%2B23%2B29%2B100%2B200%2BT.&ly[rw]=YEAR_JUS_CAL_001&ly[cl]=COURT_CLUSTER_JUS_CAL_001%2CSENTENCE_JUS_CAL_001&to[TIME]=false)

Scope:

- Time period: 1980s to 2020s
- Analyzing the relationship between rental prices and crime rates over time
- Goal: Provide accurate rental price forecasts for different regions using both rental and crime data predictions

PREDICTED DATA

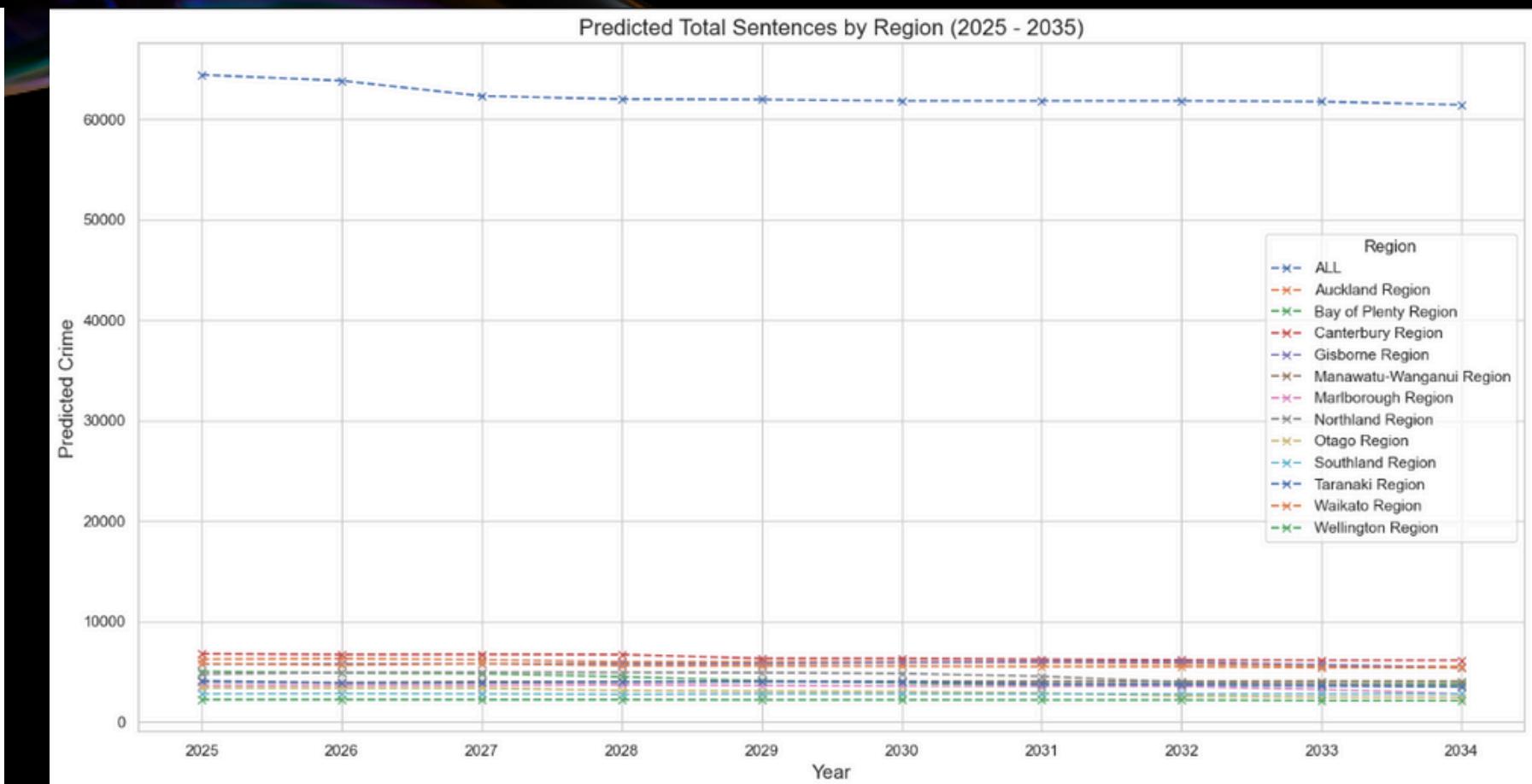
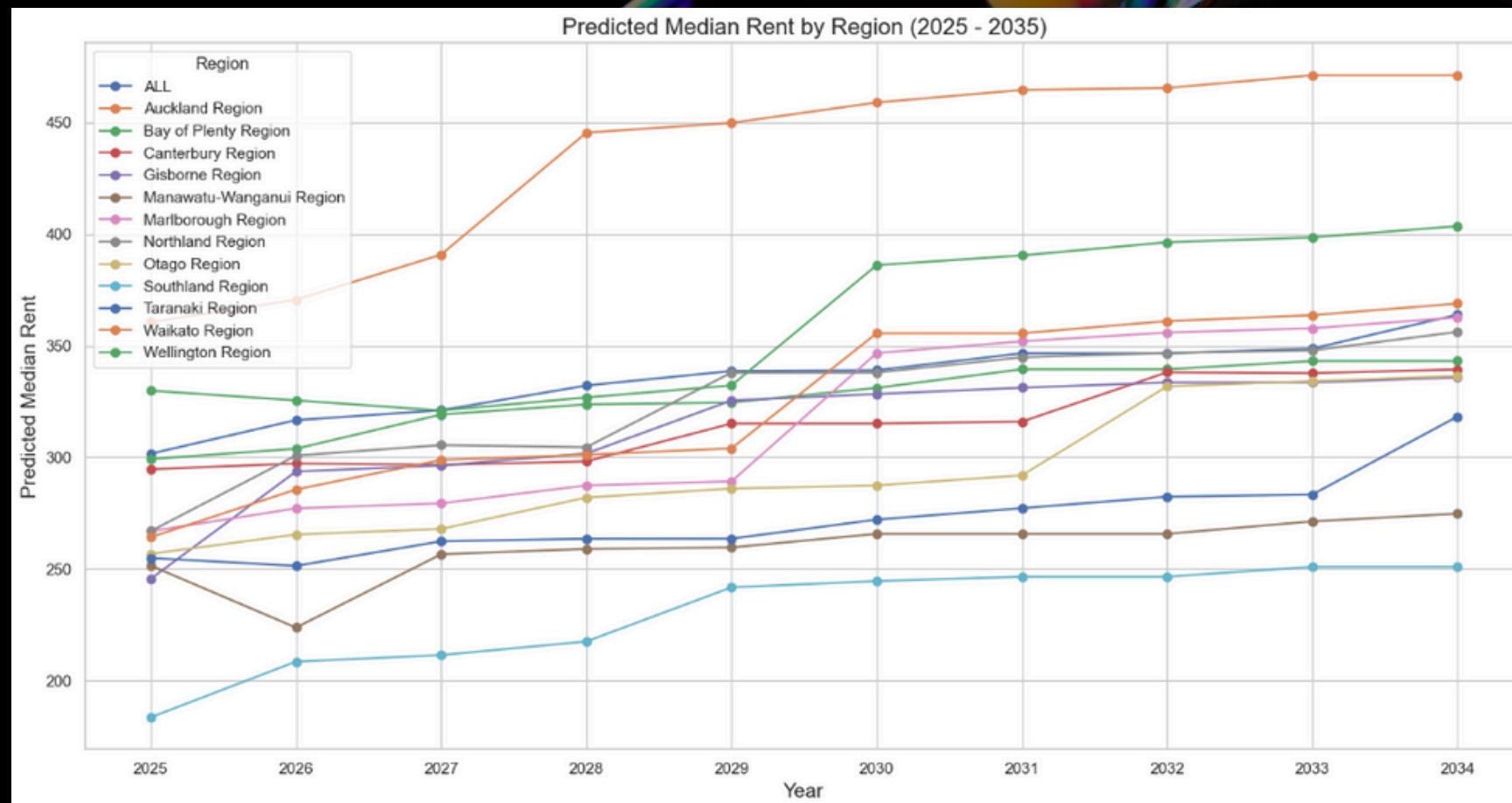
	Year	Region	Target	Model	MSE	Predicted
0	2025	ALL	Median Rent	XGBoost	959.701955	297.917572
1	2026	ALL	Median Rent	XGBoost	959.701955	312.763641
2	2027	ALL	Median Rent	XGBoost	959.701955	323.911102
3	2028	ALL	Median Rent	XGBoost	959.701955	323.928986
4	2029	ALL	Median Rent	XGBoost	959.701955	339.739441
...	
775	2030	Wellington Region	Total Sentences	CatBoost	84369.870036	2210.870710
776	2031	Wellington Region	Total Sentences	CatBoost	84369.870036	2174.440923
777	2032	Wellington Region	Total Sentences	CatBoost	84369.870036	2174.440923
778	2033	Wellington Region	Total Sentences	CatBoost	84369.870036	2118.826197
779	2034	Wellington Region	Total Sentences	CatBoost	84369.870036	2118.826197

780 rows × 6 columns

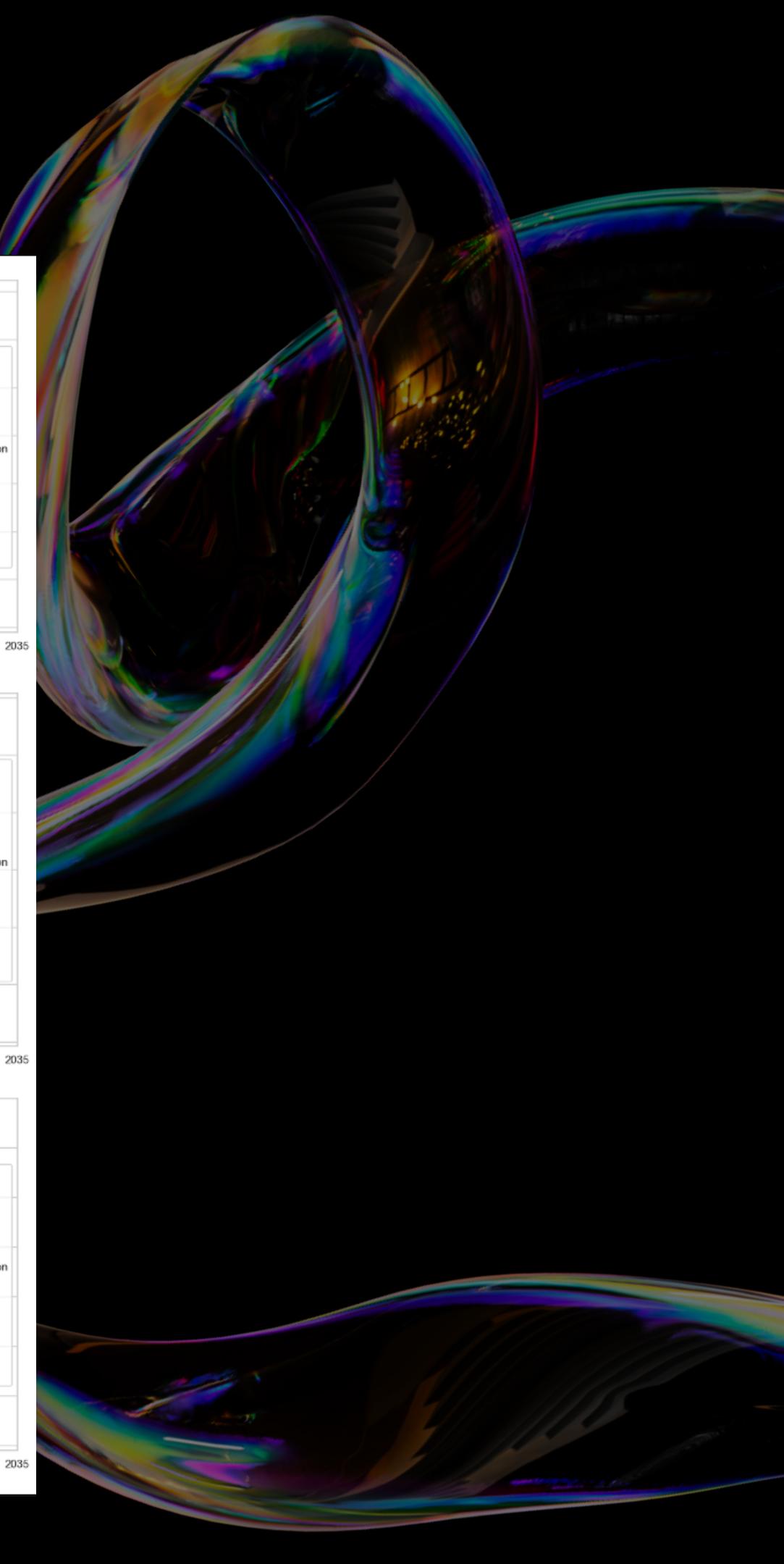
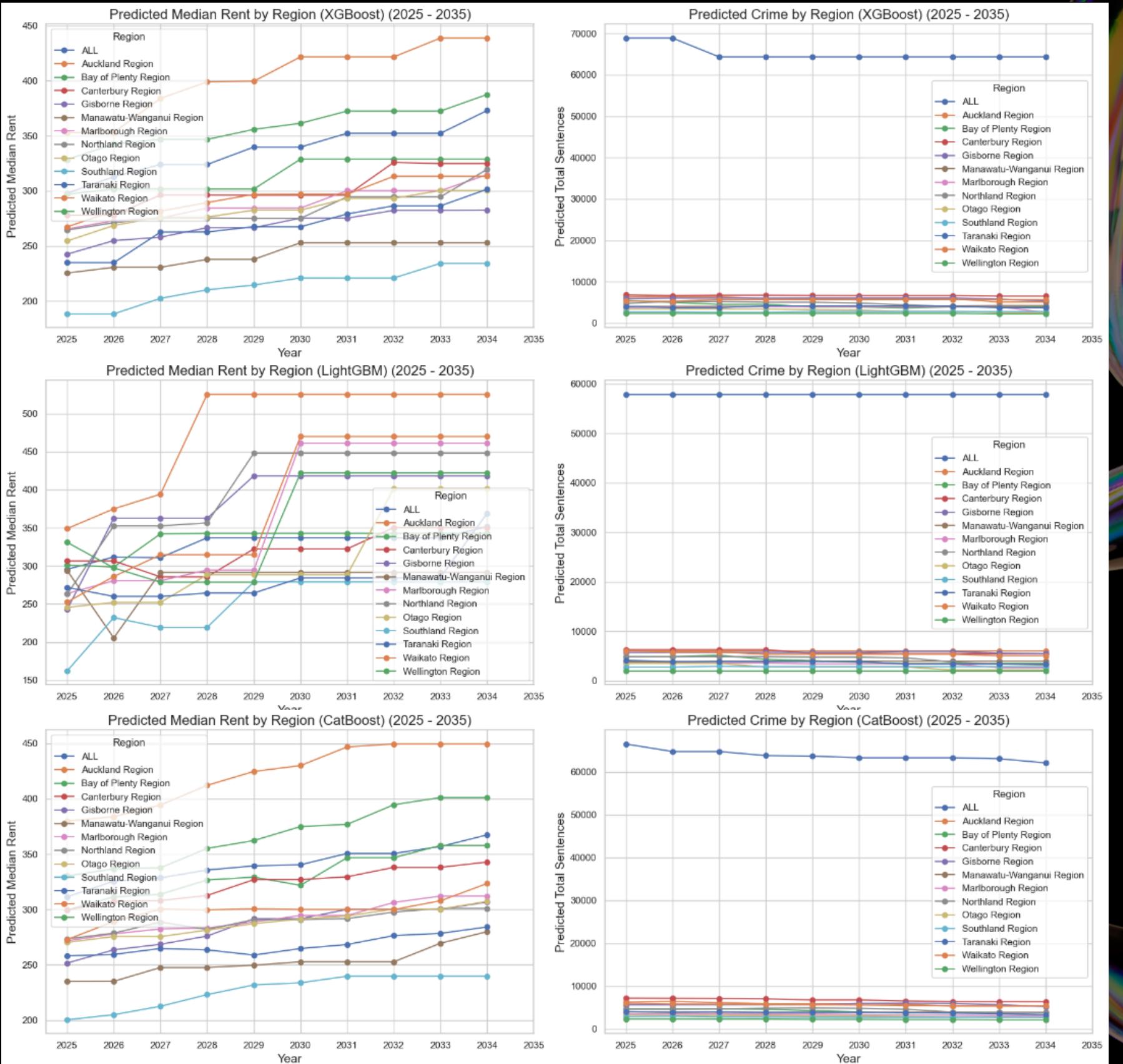
BEST MODEL

	Region	Target	Best Model	MSE
0	ALL	Median Rent	CatBoost	2.450291e+02
1	ALL	Total Sentences	CatBoost	1.924457e+07
2	Auckland Region	Median Rent	CatBoost	2.080181e+02
3	Auckland Region	Total Sentences	XGBoost	4.513987e+05
4	Bay of Plenty Region	Median Rent	CatBoost	8.450351e+02
5	Bay of Plenty Region	Total Sentences	XGBoost	1.291984e+05
6	Canterbury Region	Median Rent	CatBoost	3.005098e+02
7	Canterbury Region	Total Sentences	CatBoost	1.184185e+05
8	Gisborne Region	Median Rent	CatBoost	2.433888e+02
9	Gisborne Region	Total Sentences	CatBoost	8.254360e+04
10	Manawatu-Wanganui Region	Median Rent	XGBoost	1.026584e+03
11	Manawatu-Wanganui Region	Total Sentences	CatBoost	2.373600e+04
12	Marlborough Region	Median Rent	CatBoost	8.406723e+01
13	Marlborough Region	Total Sentences	CatBoost	2.715969e+04
14	Northland Region	Median Rent	CatBoost	2.968944e+02
15	Northland Region	Total Sentences	CatBoost	5.528629e+04
16	Otago Region	Median Rent	CatBoost	2.469281e+02
17	Otago Region	Total Sentences	XGBoost	6.840805e+04
18	Southland Region	Median Rent	CatBoost	2.349098e+02
19	Southland Region	Total Sentences	XGBoost	3.387335e+04
20	Taranaki Region	Median Rent	CatBoost	5.343198e+02
21	Taranaki Region	Total Sentences	XGBoost	5.104693e+04
22	Waikato Region	Median Rent	CatBoost	2.559920e+02
23	Waikato Region	Total Sentences	CatBoost	3.484156e+05
24	Wellington Region	Median Rent	CatBoost	6.315425e+01
25	Wellington Region	Total Sentences	CatBoost	8.436987e+04

VISUALIZATION



VISUALIZATION





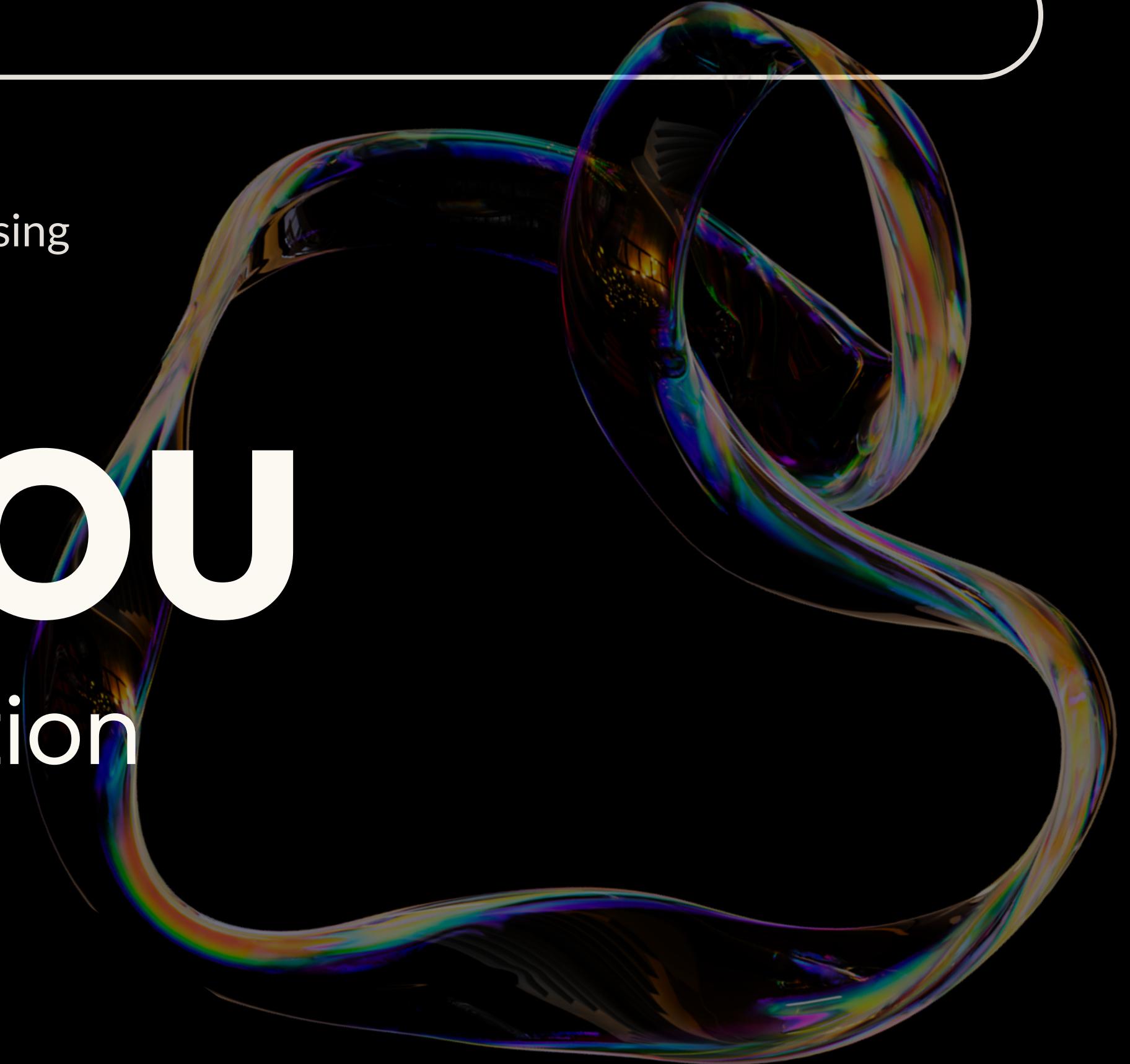
Group 3

297301 Applied Machine Learning and Big Data Processing

THANK YOU

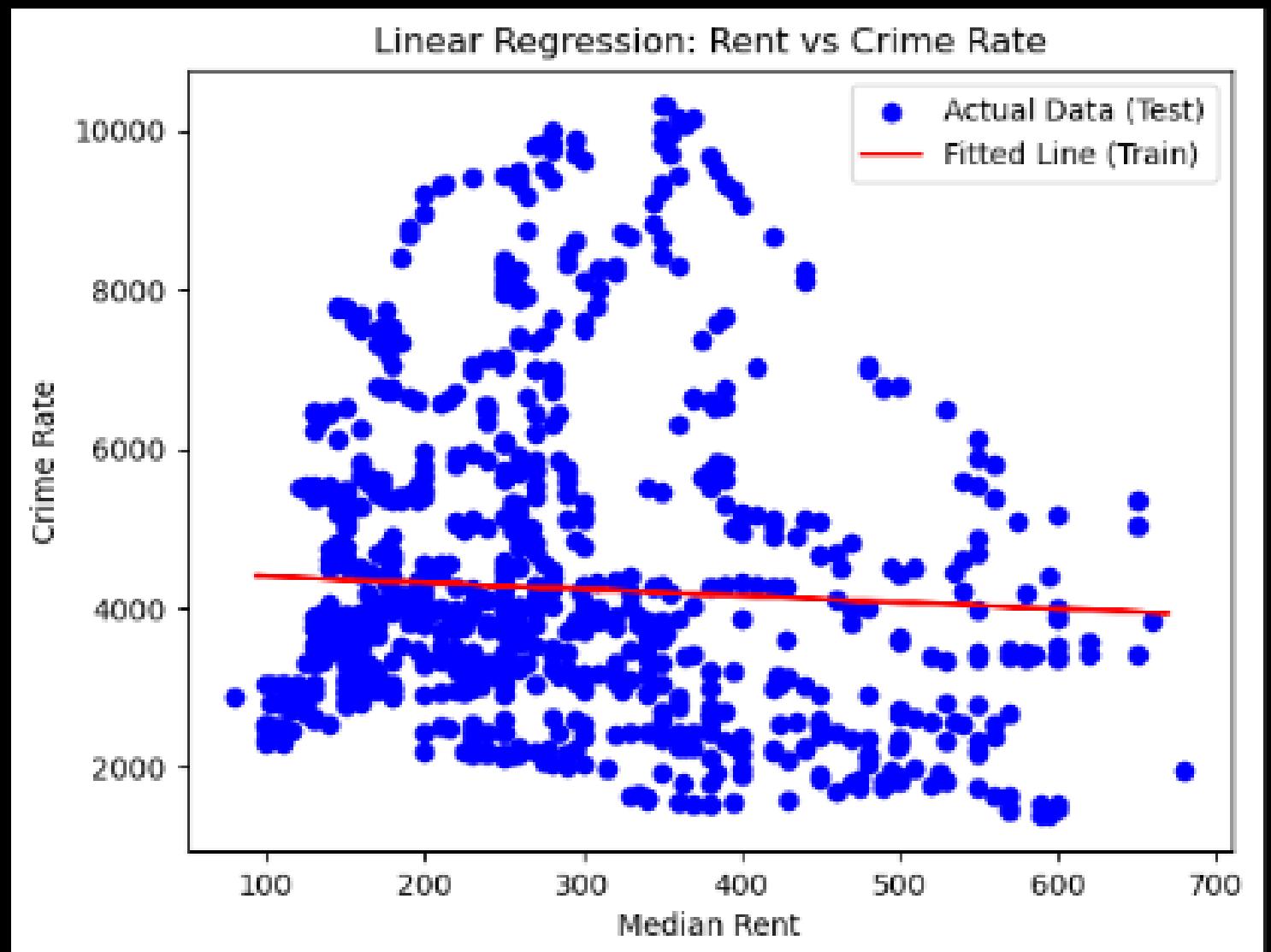
for your time and attention

17 October 2024



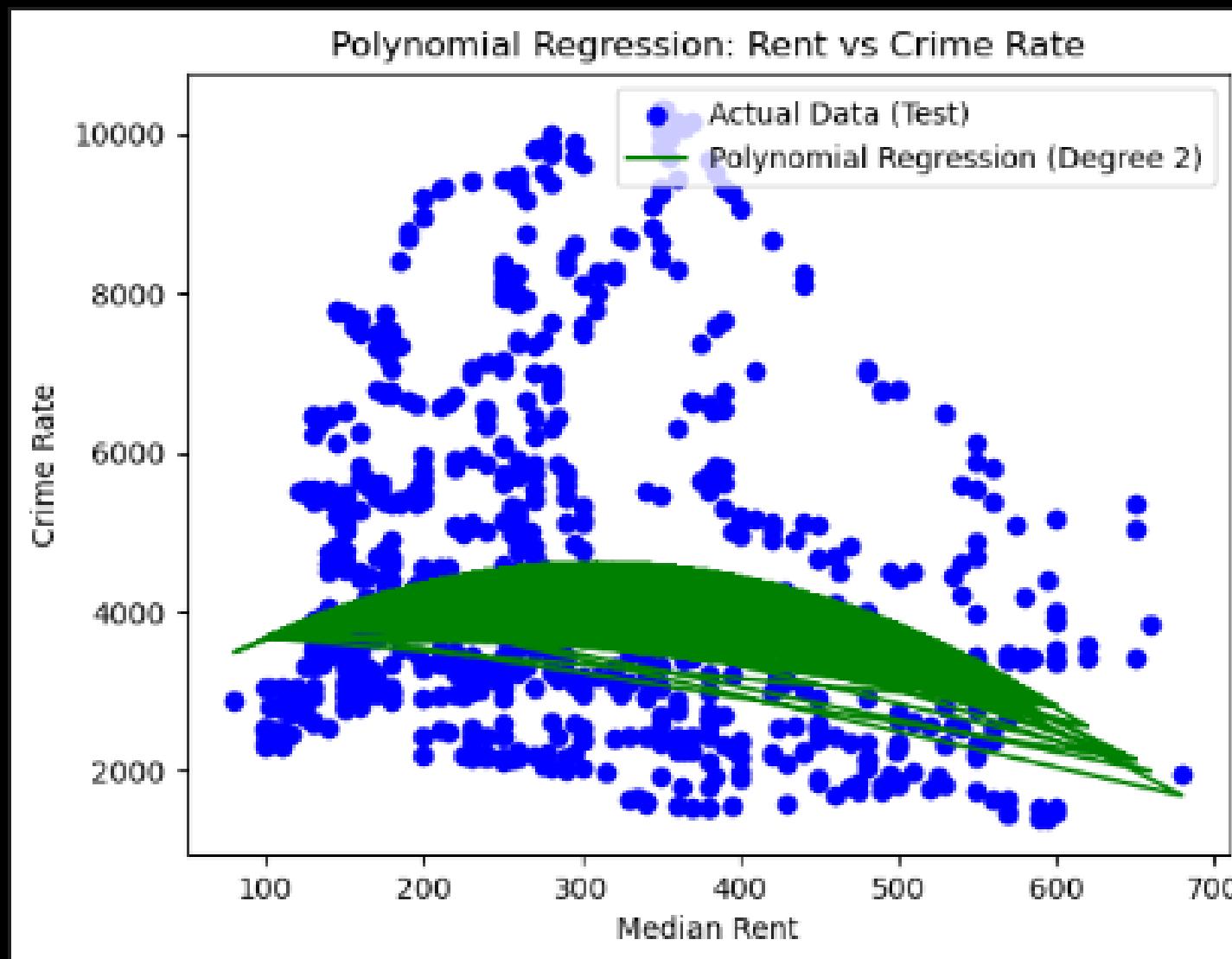
Analysis of the Relationship Between Rent and Crime Rate Using Regression Models

Linear Regression:



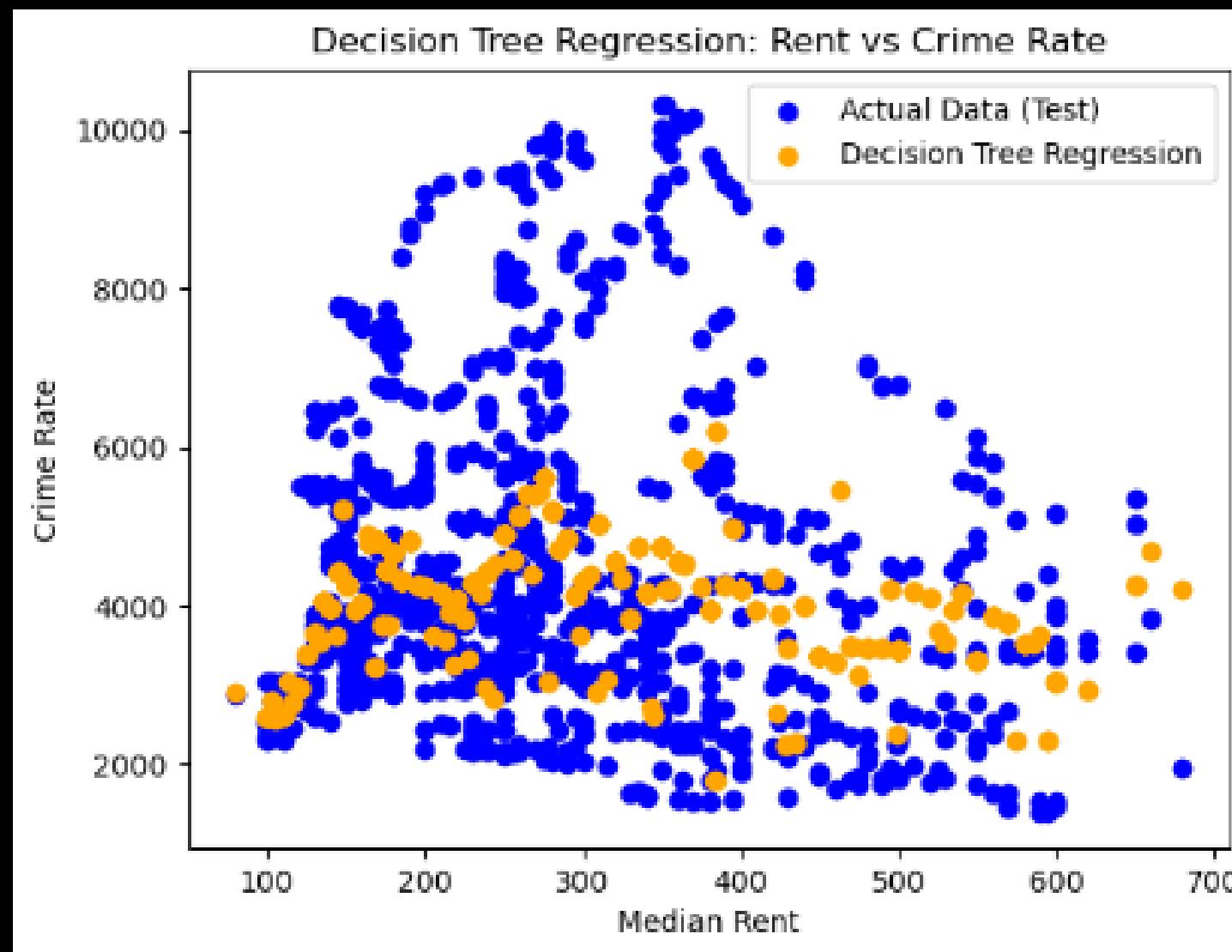
Mean Squared Error (MSE) on
test set: 3784922.4367936132

Polynomial Regression



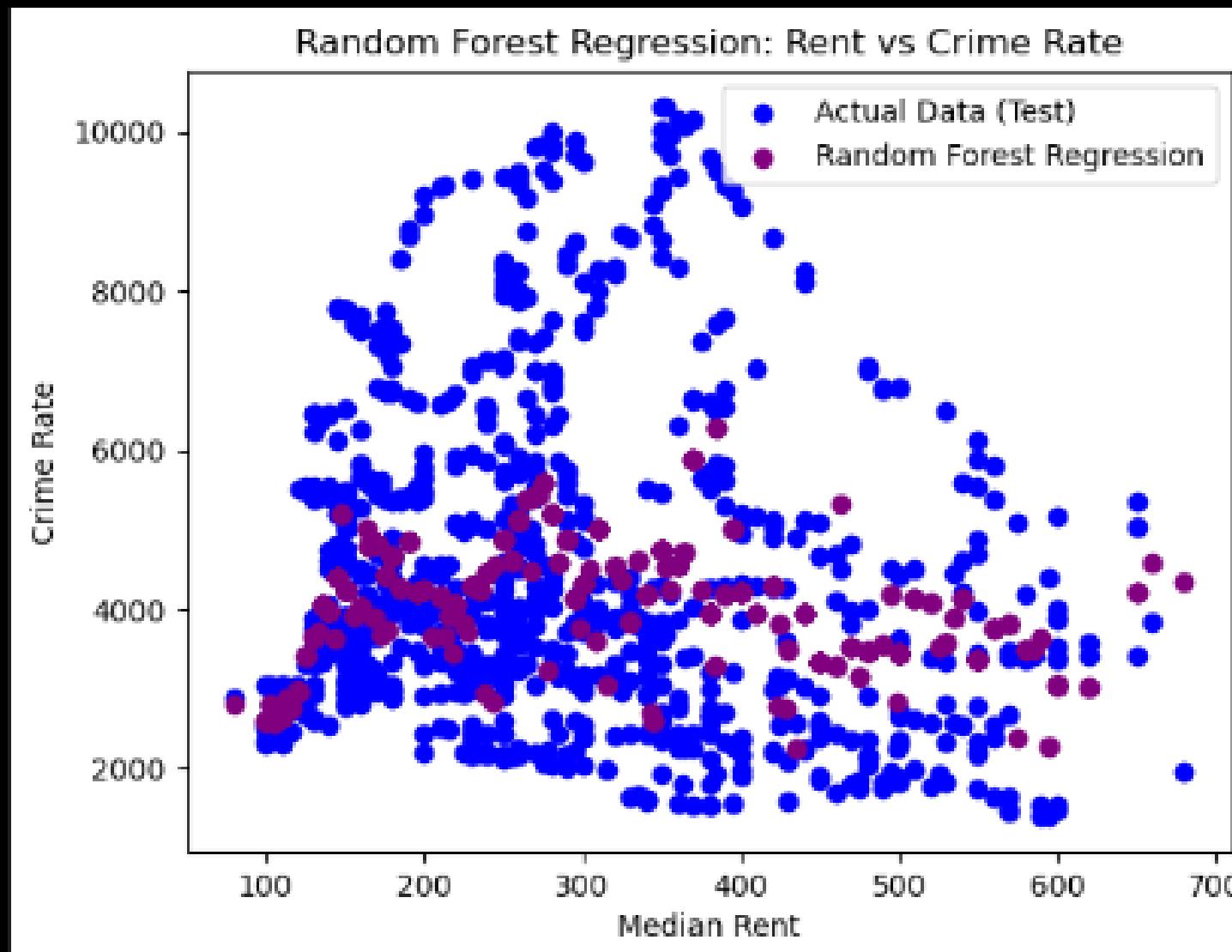
Polynomial Regression MSE: 3591895.1143798

Decision Tree Regression



Decision Tree Regression MSE: 3477557.2277455907

Random Forest Regression



Random Forest Regression MSE: 3445444.104684107

Forecasting Rent and Crime

Yearly Rent Predictions

Predicted quarterly rents for each location for the next year:

Location: Auckland

2024-Q4 : 654.60
2025-Q1 : 659.20
2025-Q2 : 663.78
2025-Q3 : 668.36

Location: Bay of Plenty

2024-Q4 : 658.67
2025-Q1 : 667.30
2025-Q2 : 675.90
2025-Q3 : 684.46

Rent predictions

Location: Northland

2024-Q4 : 565.92
2025-Q1 : 571.80
2025-Q2 : 577.65
2025-Q3 : 583.46
2025-Q4 : 589.23
2026-Q1 : 594.96
2026-Q2 : 600.66
2026-Q3 : 606.32
2026-Q4 : 611.95
2027-Q1 : 617.54
2027-Q2 : 623.10
2027-Q3 : 628.62
2027-Q4 : 634.10
2028-Q1 : 639.55
2028-Q2 : 644.97

2028-Q3 : 650.35
2028-Q4 : 655.69
2029-Q1 : 661.01
2029-Q2 : 666.29
2029-Q3 : 671.53
2029-Q4 : 676.75
2030-Q1 : 681.93
2030-Q2 : 687.07
2030-Q3 : 692.19
2030-Q4 : 697.27
2031-Q1 : 702.32
2031-Q2 : 707.34
2031-Q3 : 712.32
2031-Q4 : 717.27
2032-Q1 : 722.20
2032-Q2 : 727.09
2032-Q3 : 731.95
2032-Q4 : 736.78
2033-Q1 : 741.58
2033-Q2 : 746.35
2033-Q3 : 751.08
2033-Q4 : 755.79
2034-Q1 : 760.47
2034-Q2 : 765.12
2034-Q3 : 769.74
2034-Q4 : 774.33
2035-Q1 : 778.89
2035-Q2 : 783.42
2035-Q3 : 787.92

2032-Q2 : 727.09

2032-Q3 : 731.95

2032-Q4 : 736.78

2033-Q1 : 741.58

2033-Q2 : 746.35

2033-Q3 : 751.08

2033-Q4 : 755.79

2034-Q1 : 760.47

2034-Q2 : 765.12

2034-Q3 : 769.74

2034-Q4 : 774.33

2035-Q1 : 778.89

2035-Q2 : 783.42

2035-Q3 : 787.92

Location: Otago

Crime Predictions

Predicted Crime Rates for 2030:

Location: Auckland

Q1: Crime Rate = 10303.57

Q2: Crime Rate = 10718.30

Q3: Crime Rate = 11147.38

Q4: Crime Rate = 11590.80

=====

Location: Bay of Plenty

Q1: Crime Rate = 7849.64

Q2: Crime Rate = 8143.83

Q3: Crime Rate = 8447.44

Q4: Crime Rate = 8760.48

=====

Predicted Crime Rates for 2034:

Location: Auckland

Q1: Crime Rate = 18660.60

Q2: Crime Rate = 19304.84

Q3: Crime Rate = 19963.42

Q4: Crime Rate = 20636.35

=====

Location: Bay of Plenty

Q1: Crime Rate = 13687.99

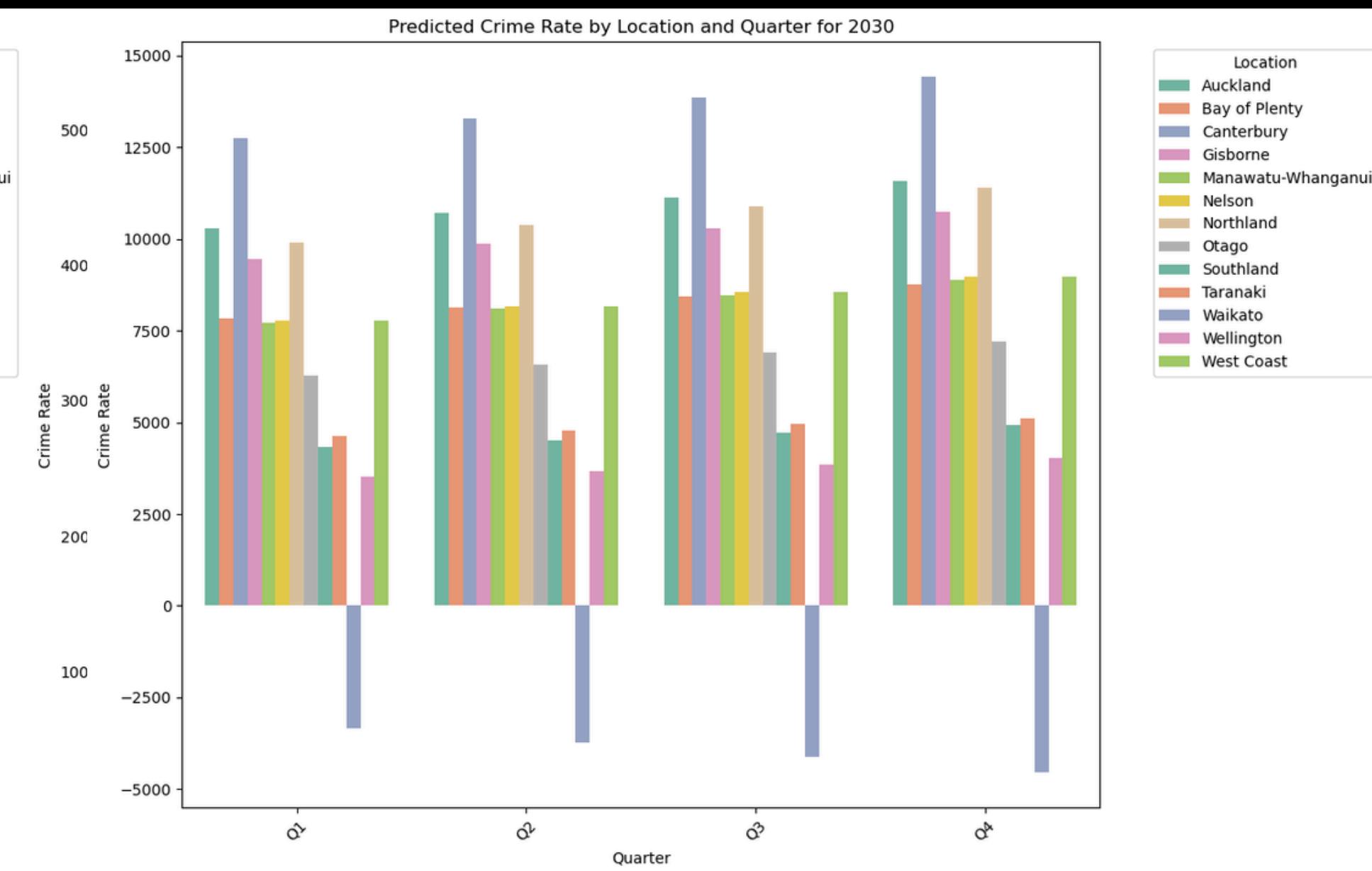
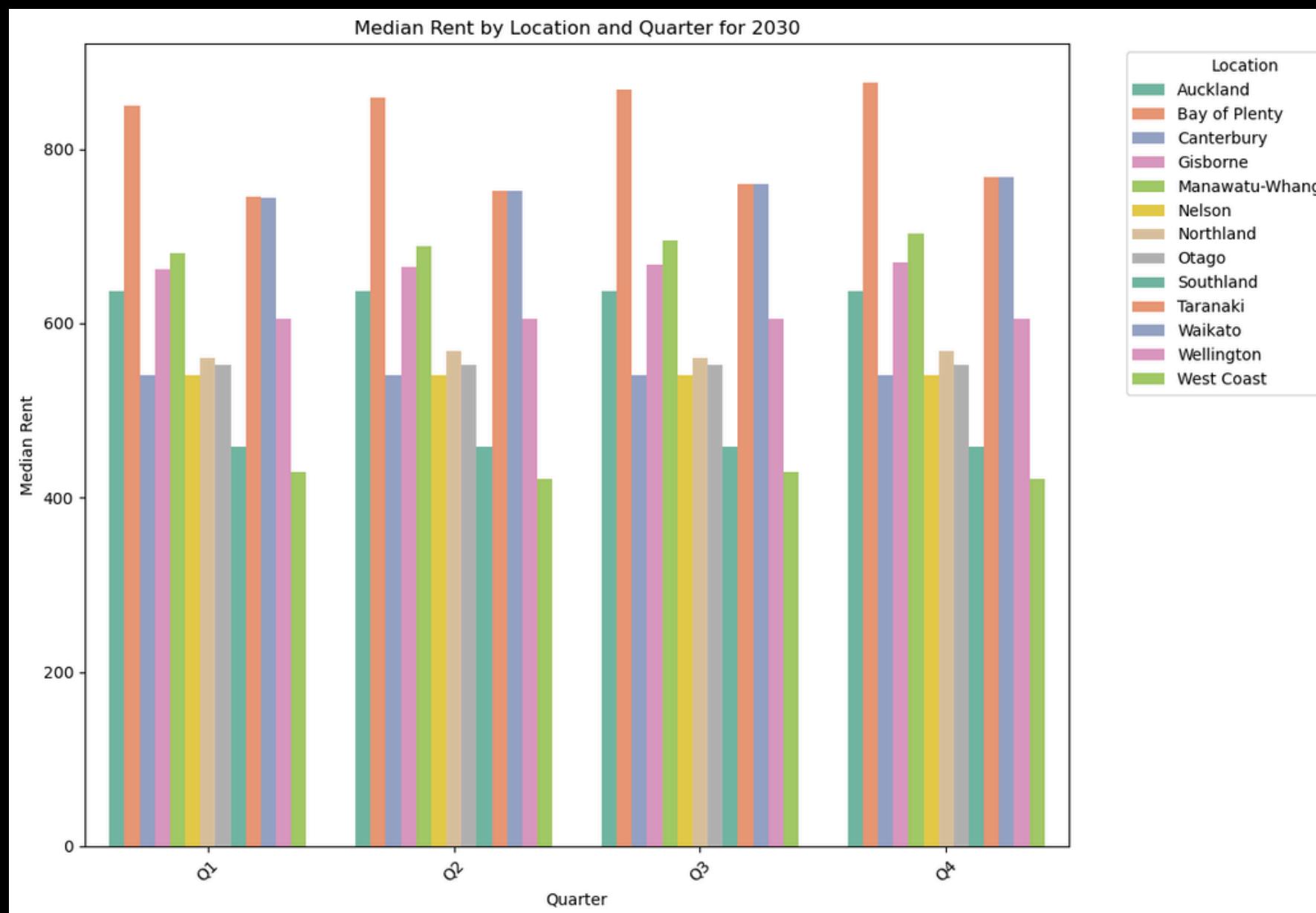
Q2: Crime Rate = 14133.03

Q3: Crime Rate = 14587.49

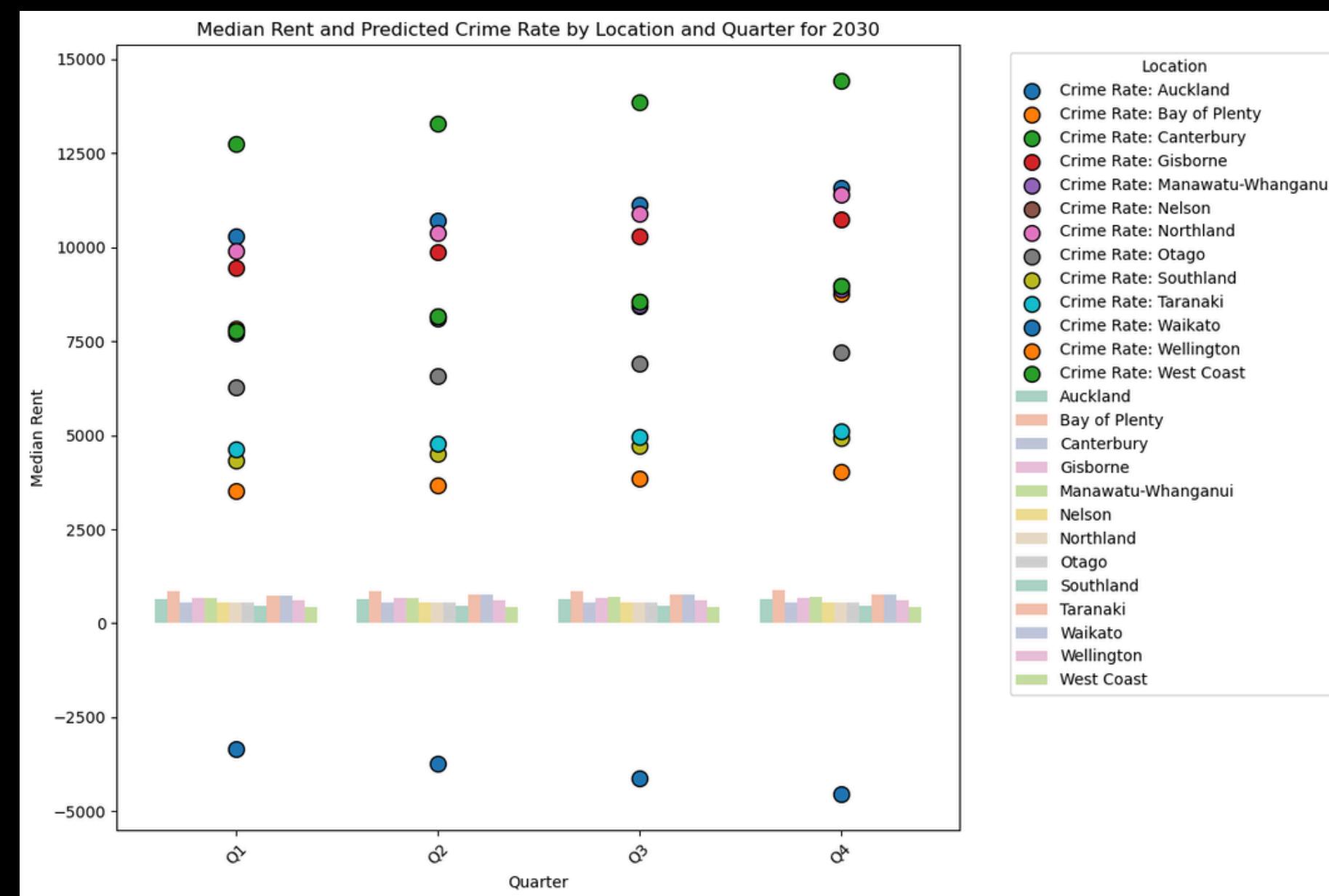
Q4: Crime Rate = 15051.39

=====

Visualisations



Visualisations



AWS

Monthly Data

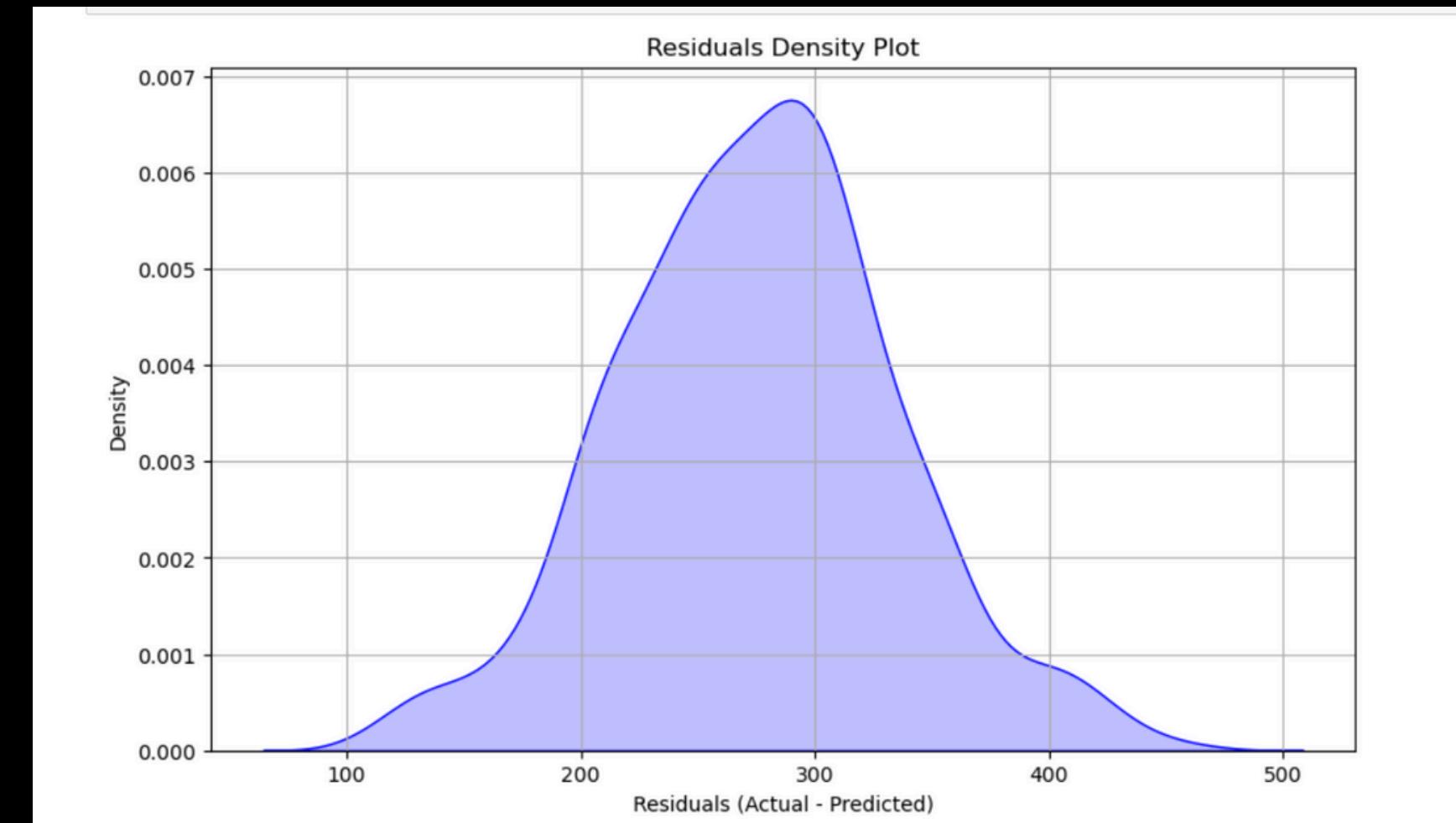
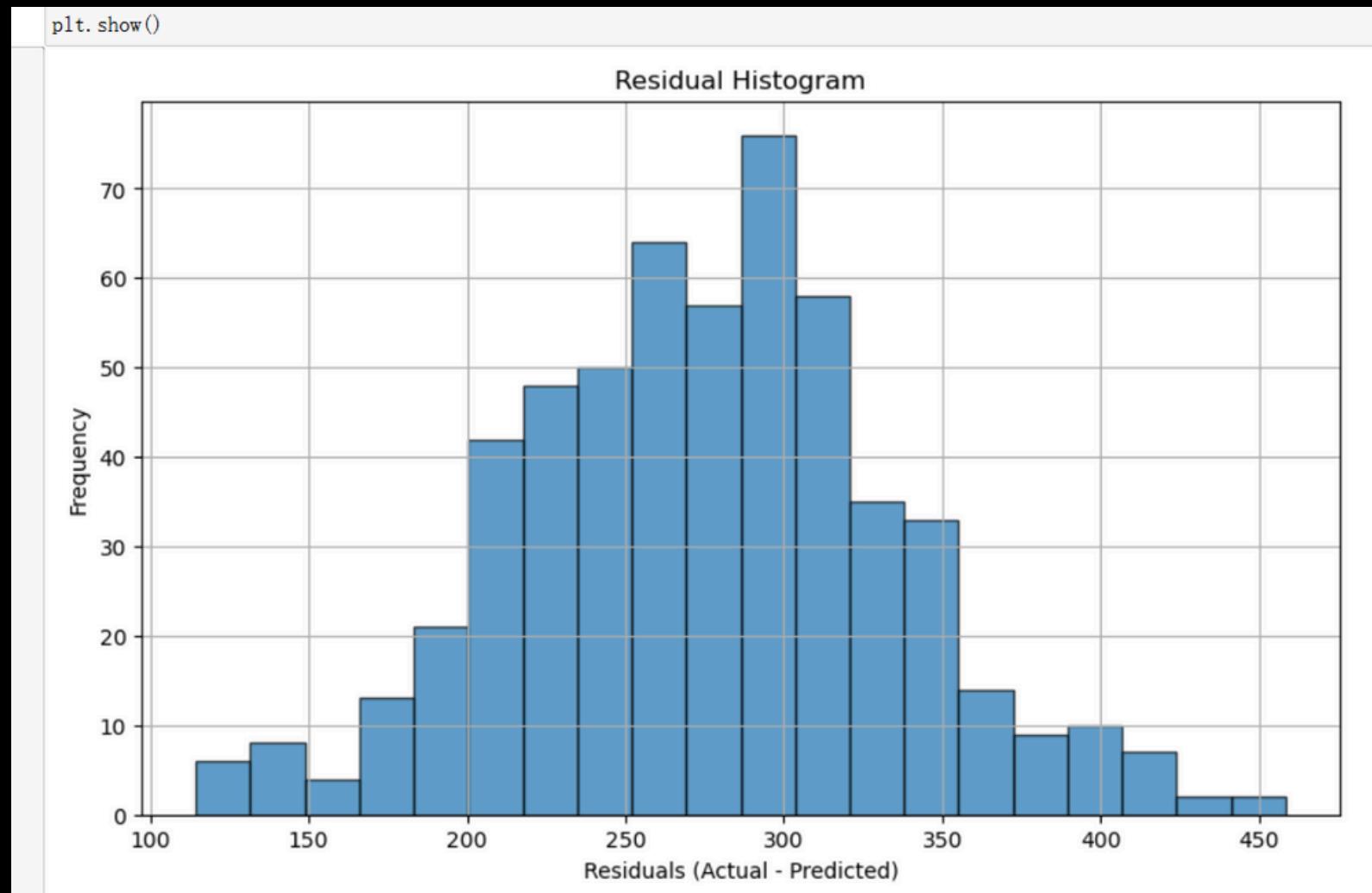
Feature Selection

Location Id	-0.136134
Crime	-0.062997
Crime_Rolling_Mean_3	-0.060479
Crime_Shift_1	-0.060476
Crime_Shift_2	-0.057945
Crime_Rolling_Mean_6	-0.056675
Crime_Rolling_Mean_12	-0.048827
Crime_Rolling_Std_12	0.229875
Crime_Rolling_Std_6	0.241557
Crime_Rolling_Std_3	0.254265
Median Rent	1.000000
Name: Median Rent, dtype:	float64

Monthly Data

Hyperparameters

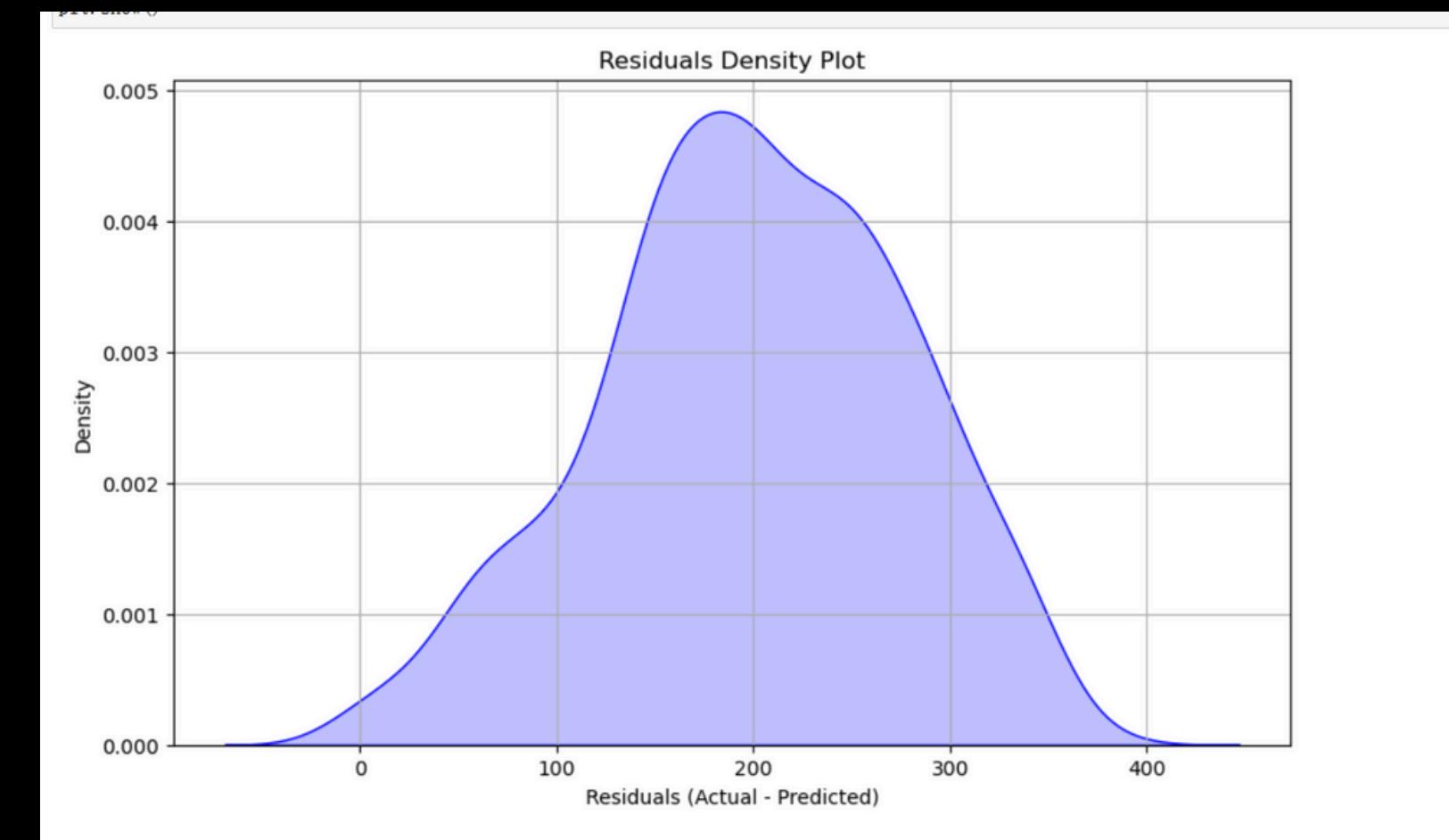
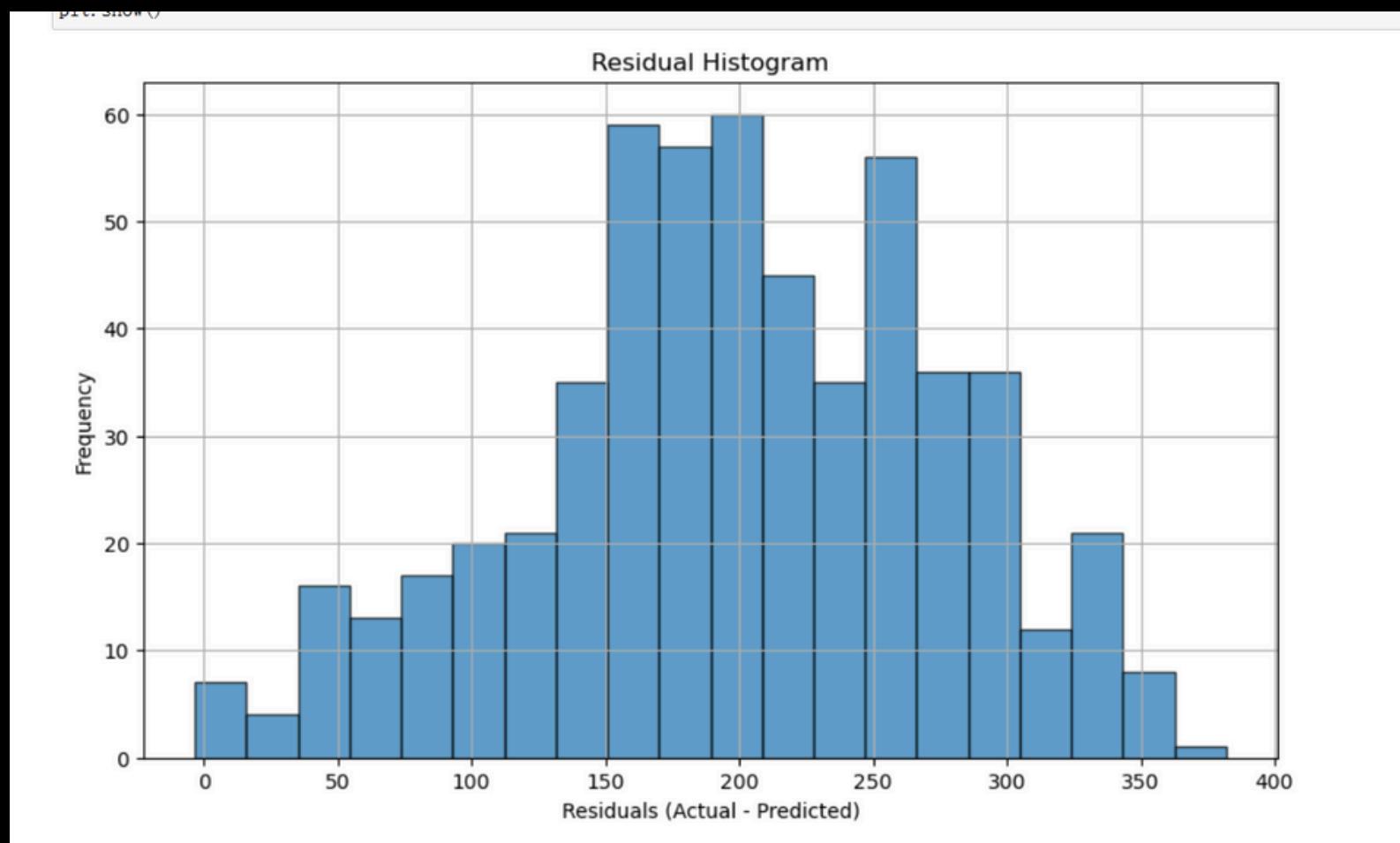
0]	MSE	MAE	MAPE
0	79210.338765	275.097195	0.545191



Monthly Data

Autopilot

	MSE	MAE	MAPE
0	45577.800721	199.004536	0.379788

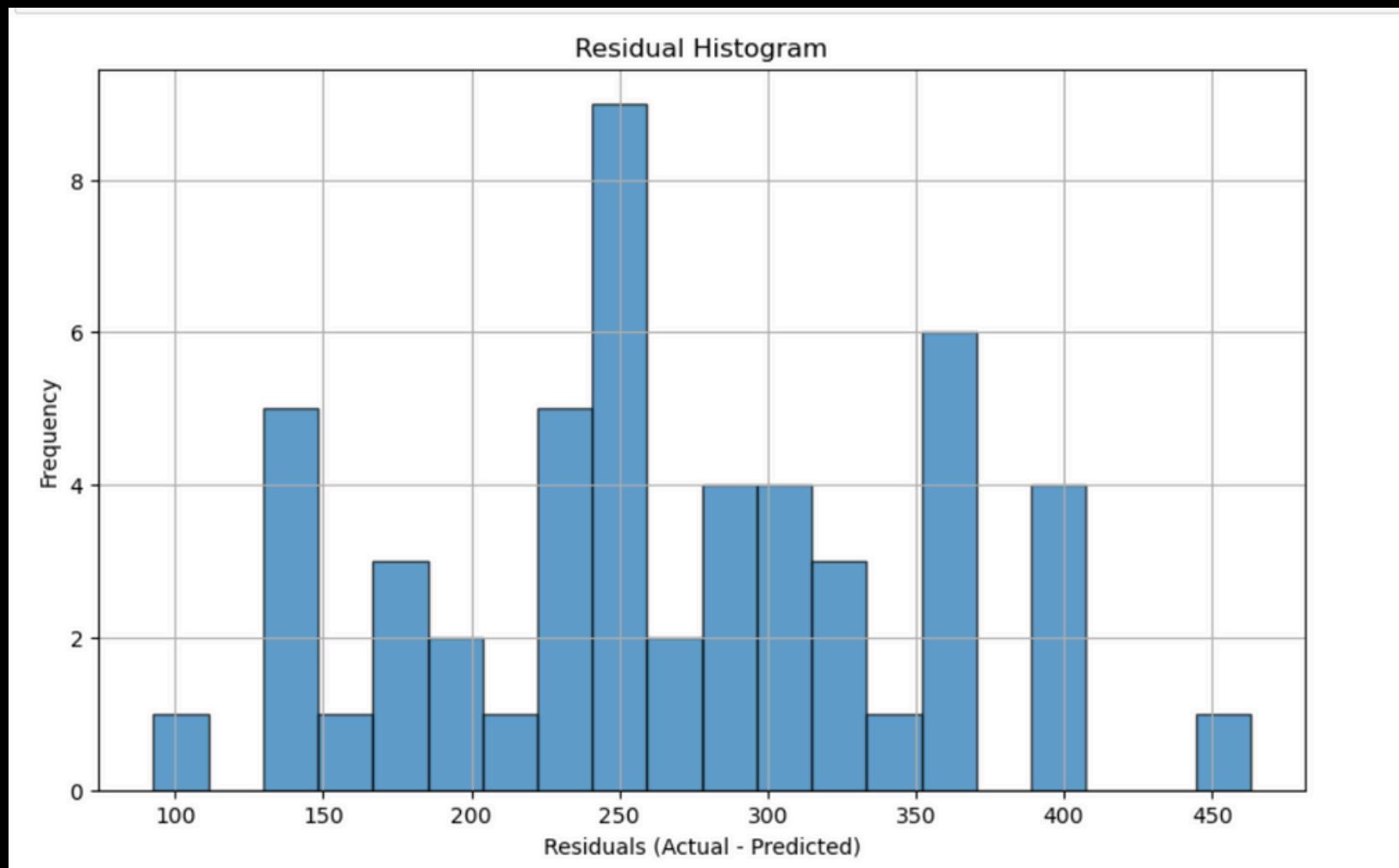


Yearly Data

Feature Selection

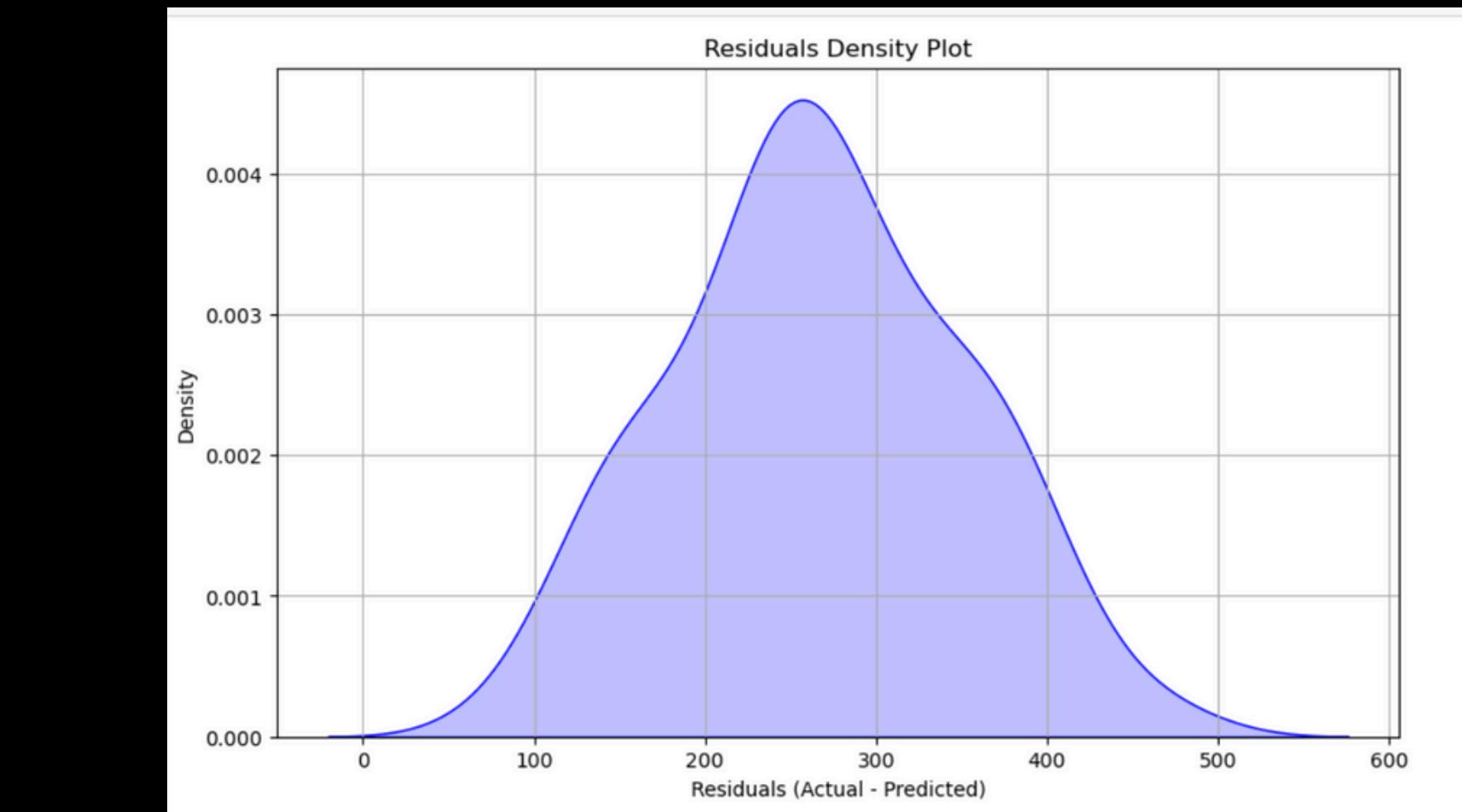
```
Location Id           -0.141490
Crime                -0.066016
Crime_Shift_1        -0.035197
Crime_Rolling_Mean_3 -0.031427
Crime_Shift_2         0.007762
Crime_Rolling_Mean_6 0.032879
Crime_Rolling_Std_3   0.217072
Crime_Rolling_Std_6   0.403186
Median Rent          1.000000
Name: Median Rent, dtype: float64
```

Yearly Data Hyperparameters



31]:

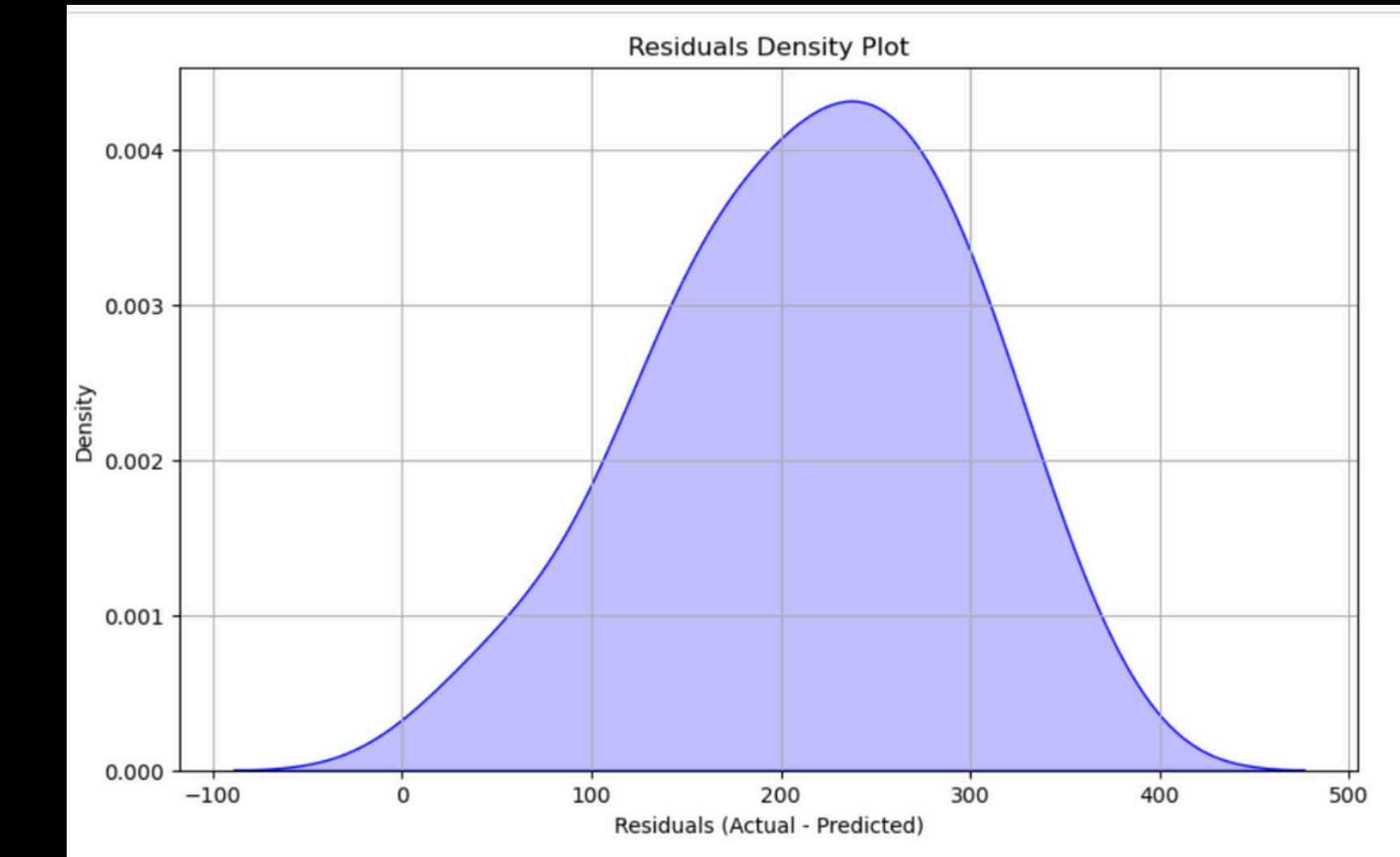
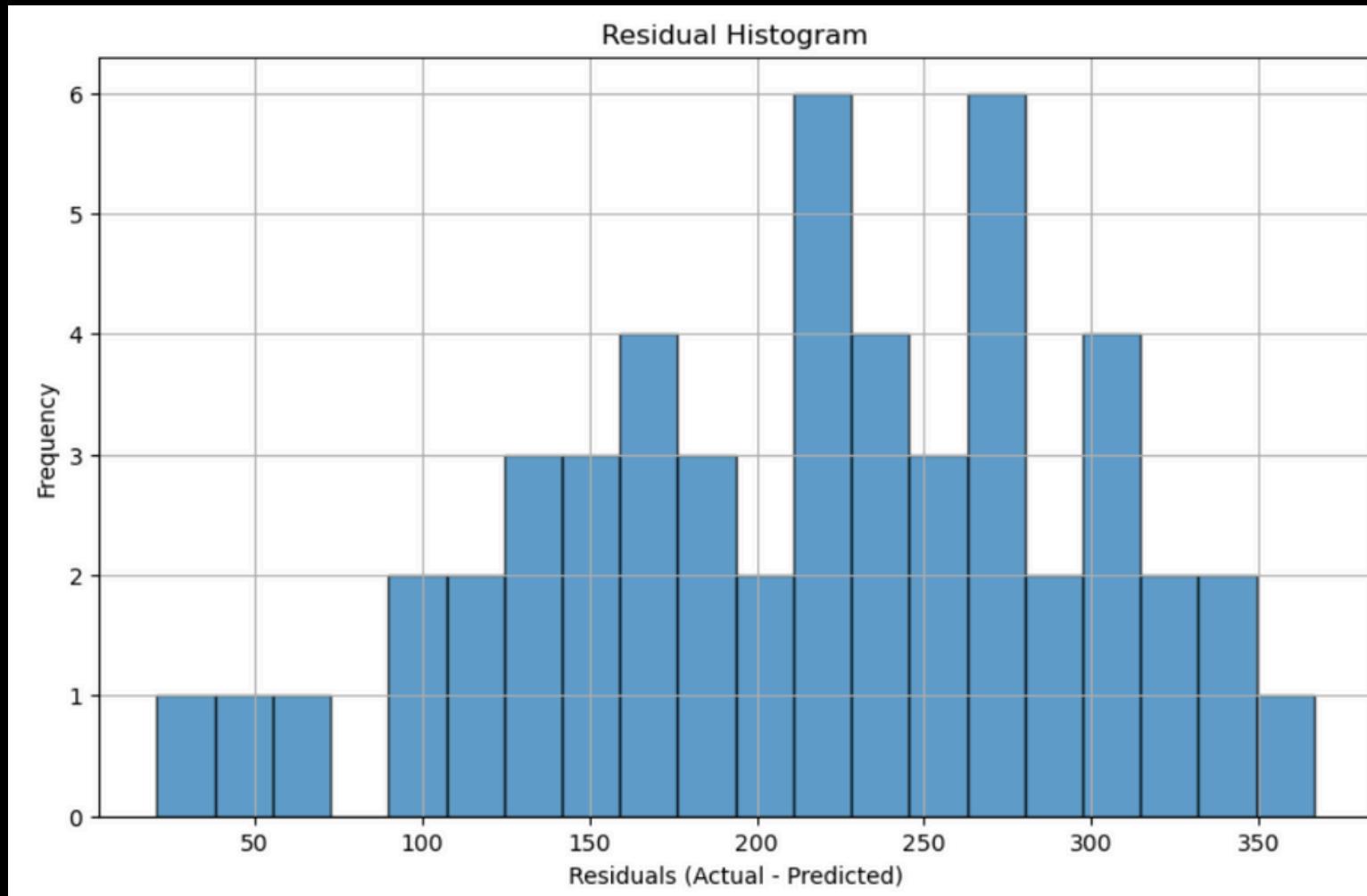
	MSE	MAE	MAPE
0	77918.607144	266.735164	0.521316



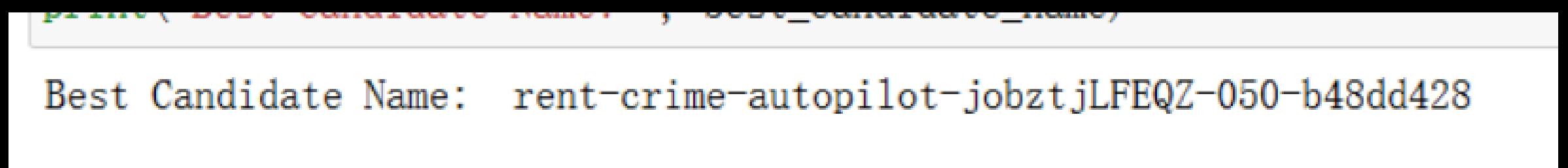
Yearly Data

Autopilot

	MSE	MAE	MAPE
0	52677.665306	215.215647	0.407449



Save Model



Amazon S3 > ... > [hyperparam/](#) > [output/](#) > [rent-crime-auto...](#) > [tuning/](#) > [rent-crime-dpp...](#) > [rent-crime-autopilot-jobztj...](#) > [output/](#) > [model.tar.gz](#)

model.tar.gz Info

[Copy S3 URI](#) [Download](#) [Open](#) [Object actions ▾](#)

[Properties](#) [Permissions](#) [Versions](#)

Object overview

Owner	S3 URI
awslabsc0w4813204t1668264152	s3://c125236a3097401l7846476t1w2750781236-sandboxbucket-zceqpzjq7ylu/hyperparam/output/rent-crime-autopilot-job/tuning/rent-crime-dpp7-xgb/rent-crime-autopilot-jobztjLFEQZ-050-b48dd428/output/model.tar.gz
AWS Region	Amazon Resource Name (ARN)
US East (N. Virginia) us-east-1	arn:aws:s3:::c125236a3097401l7846476t1w2750781236-sandboxbucket-zceqpzjq7ylu/hyperparam/output/rent-crime-autopilot-job/tuning/rent-crime-dpp7-xgb/rent-crime-autopilot-jobztjLFEQZ-050-b48dd428/output/model.tar.gz
Last modified	Entity tag (Etag)
October 9, 2024, 12:34:06 (UTC+13:00)	8de92b4c83ecc40ba5601a4f4e7b6bd7
Size	
5.5 MB	
Type	
gz	

Web Application

Crime and Rent

Year

2025

Month

1

Location

ALL

Crime

0.00

[https://159301-](https://159301-iexjepp2org8mtgpwczcz.streamlit.app/)

[iexjepp2org8mtgpwczcz.streamlit.app/](https://159301-iexjepp2org8mtgpwczcz.streamlit.app/)

Crime and Rent

Year

2025

Month

1

Location

Auckland

Crime

4000.00

Predict