Auto Theft & Social Disorganization

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Introduction

Auto theft aligns with social disorganization theory (SDT), linking crime to weak social ties and poor community structures. Factors like poverty and family disruption reduce informal controls, fostering crime.

Prevention strategies include community initiatives like neighborhood watch programs, technological solutions such as alarms and GPS trackers, and CPTED measures like better lighting and cameras.

Long-term solutions require addressing structural issues like poverty and unemployment, emphasizing a holistic approach to mitigate auto theft effectively.

Objectives

This study aims to explore the relationship between socio-economic factors, through the lens of social disorganization theory).

- Provide background on how environmental factors like income, education, and income impact crime patterns.
- Build machine learning models that quantify the impact of those environmental factors on crime specifically auto theft.
- Based on model findings offer proposals on what communities can do to reduce auto theft.

Collected Data

The Communities and Crime dataset integrates socio-economic, law enforcement, and crime data from the 1990s, totaling 2,215 observations and 147 features, which include poverty rates, housing vacancies, and median income.

Missing values were removed to maintain data integrity, and heatmap analysis used to reveal strong correlations.

Methodology

Our analysis focused on predicting auto theft rates using socio-economic factors,guided by SDT.

To gain further insight, a heatmap was created to illustrate the strength and direction to the relationships between the features and the target variable. It shows the strongest positive correlation of 0.90 between auto theft and house vacancy.

Selected hyperparameter models were trained and compared to a baseline models, demonstrating superior accuracy in capturing the impact of community dynamics on crime.

Although, Multiple linear regression achieved the best model performance, After plotting residuals, examining their distributions, and analyzing the Q-Q plot, it appears multiple linear regression does not adequately fit the dataset.

The random forest model demonstrated stronger predictive capabilities, with higher accuracy values than other models, suggesting that socio-economic factors are indeed influential in forecasting auto theft.

Results

Table 2

Baseline Model: k-Fold Cross Validation using k =10 and random state = 21

	Mean R-squared	Mean MSE	Mean RMSE
Multiple Linear Regression	0.9131	389608.9792	583.2387
Decision Tree	0.4819	6040805.7781	1797.3123
Random Forest	0.8282	3111806.6436	1217.0095
Naive Bayes	0.0796	10404117.0793	2550.8160
Gradient Boosting	0.7784	2959268.1188	1227.3824

Baseline Models

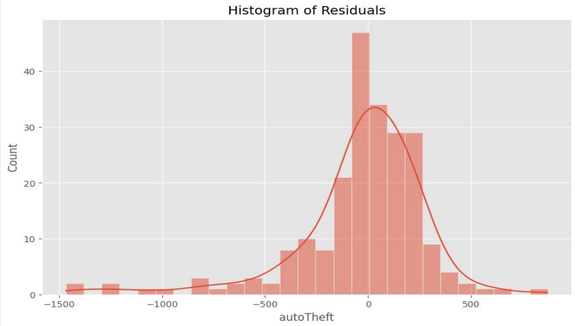
Table 3

Hyperparameter Model: Grid Search using cv = 10 and random state =21

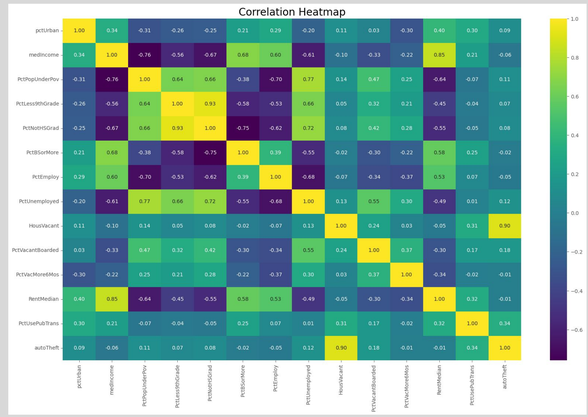
	Mean R-squared	Mean MSE	Mean RMSE
Lasso Regression (L1)	0.7947	100869.6811	317.5999
Ridge Regression (L2)	0.7947	100873.5410	317.6060
Decision Tree	0.7885	103918.8886	322.3645
Random Forest	0.6914	151606.4145	389.3667
Naive Bayes	0.7824	106932.8281	327.0059
Gradient Boosting	0.7885	103918.8886	322.3645

Note. Note. with Cross validation

Hyperparameter Models



Histogram of Residuals



Auto Theft with Other Features

Conclusions

This study examined the relationship between vacant housing and auto theft. The use of predictive modeling revealed the need for targeted, community-focused interventions. Findings underscore the importance of addressing systemic inequalities through collaboration with local governments, law enforcement, and urban planners to implement equitable policies that strengthen neighborhoods and reduce crime. Proposed solutions include (1) Community Revitalization Programs, which reduce housing vacancy and improve surveillance, potentially lowering property crime by 30%, and (2) Technological Interventions, such as GPS trackers, which improve vehicle recovery rates to over 90%.

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