ATLSHIELD

Data-Driven Crime Analysis and Predictive Policing for a Safer Atlanta

TEAM 33 | ATHARVA GULHANE | MOAZZAM ALI | SHREYA CHIVILKAR | SHRUTI MURARKA | TWISHA SHAH

Motivation/ Introduction

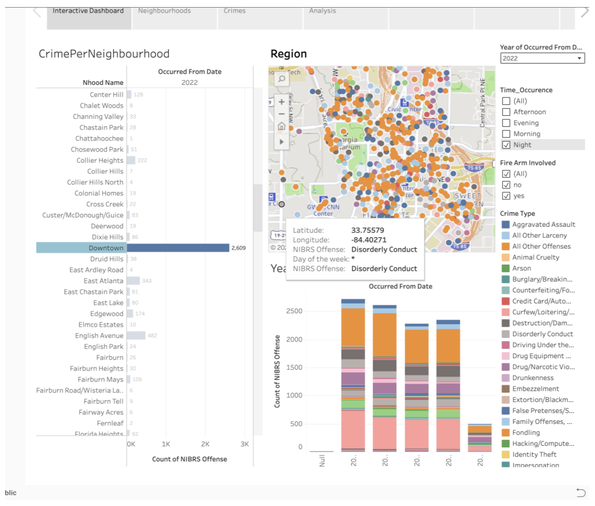
Urban crime continues to challenge cities like Atlanta, impacting safety, trust, and community well-being. While vast amounts of crime data exist, they're rarely leveraged to their full potential. **ATLShield** aims to change that by using machine learning and interactive dashboards, we uncover hidden spatial and temporal patterns to forecast crime, identify hotspots, and guide smarter patrol strategies. Our goal: enable data-driven policing for a safer, more proactive Atlanta.

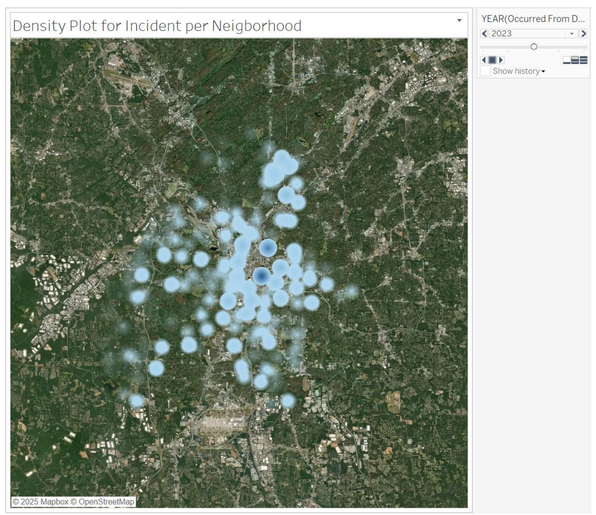
Data

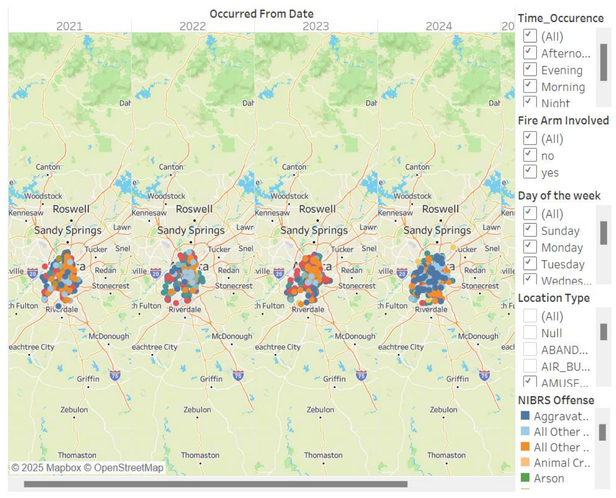
- Crime data from Atlanta Police Open Data Portal (2021–2025), ~300K records
- Includes date, time, neighborhood, crime type, NIBRS codes, location
- Temporal and spatial: supports hourly/monthly analysis with ~30 crime categories
- Cleaned missing/invalid values; engineered features like time-of-day slots and patrolling modes (foot, bike, vehicle)

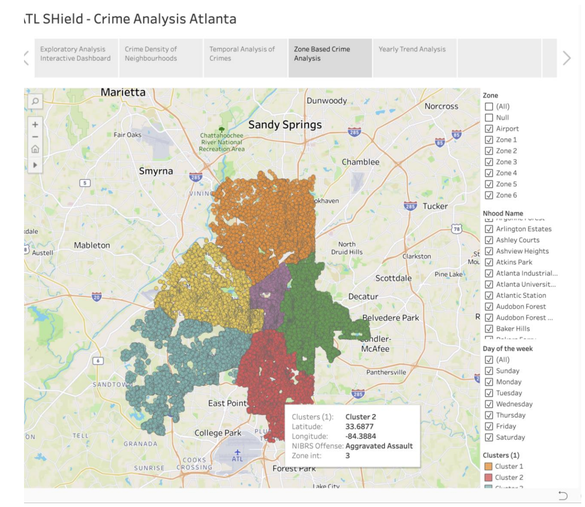
Approaches

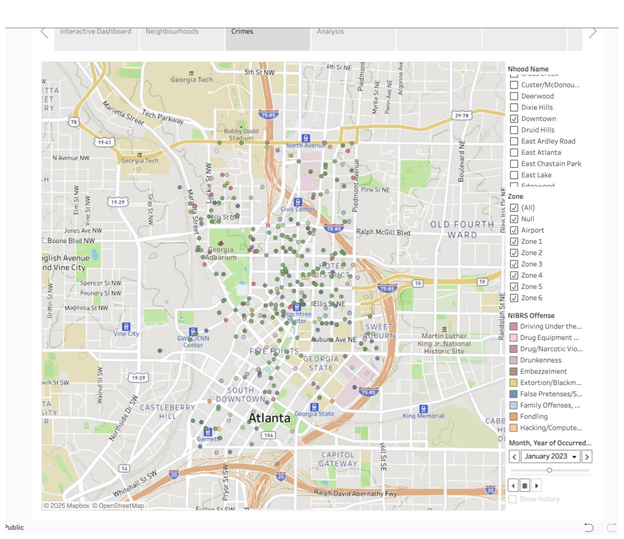
- **What?** : Random Forest models (Regressor + Classifier) for crime prediction and patrol suggestion, deployed via Flask REST API on AWS, integrated with Tableau + TabPy for interactive, real-time visualizations.
- **How?** : Models learn spatial-temporal patterns; Tableau filters trigger API calls, returning predictions that update dashboards with trends, heatmaps, and patrol types.
- **Why?** : Crime follows patterns across time and location—our models use these to support proactive policing and smarter deployment.
- **What's New?** : Real-time Tableau + TabPy integration, patrol recommendations, and hourly predictions on AWS. Unlike other papers which used ARIMA, we used Random Forest as it outperformed ARIMA by capturing nonlinear spatial-temporal trends more effectively.

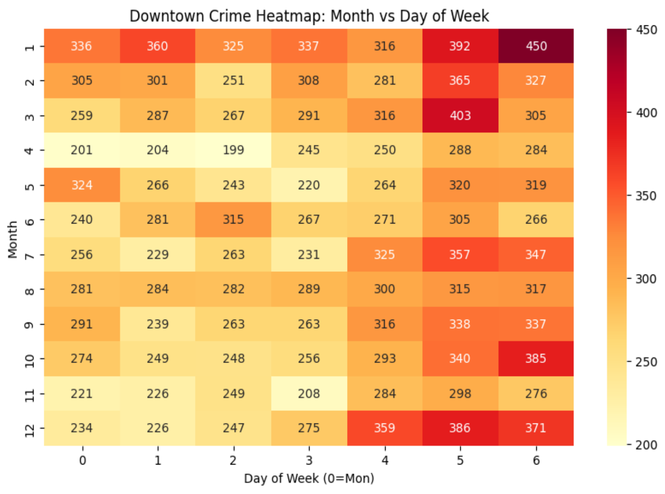


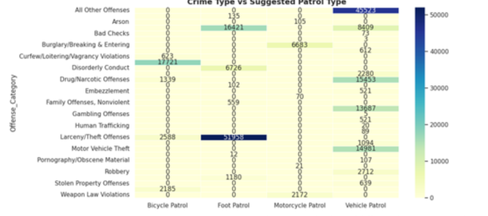


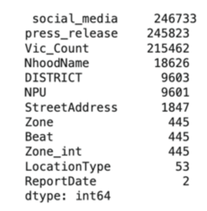


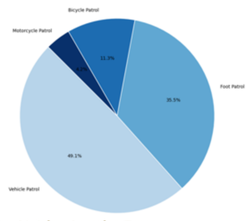


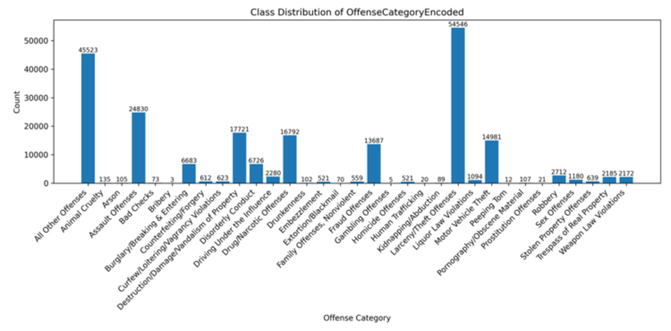


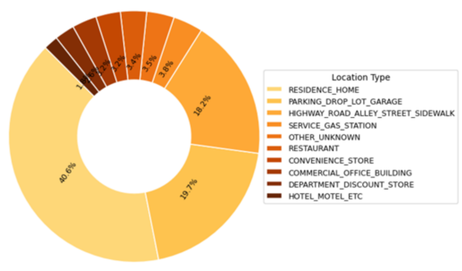






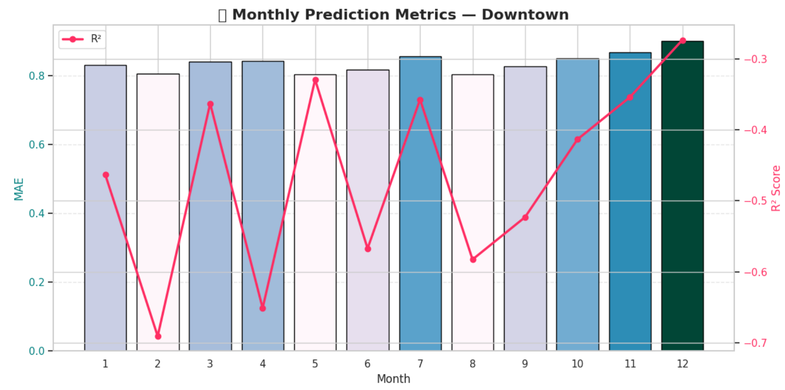


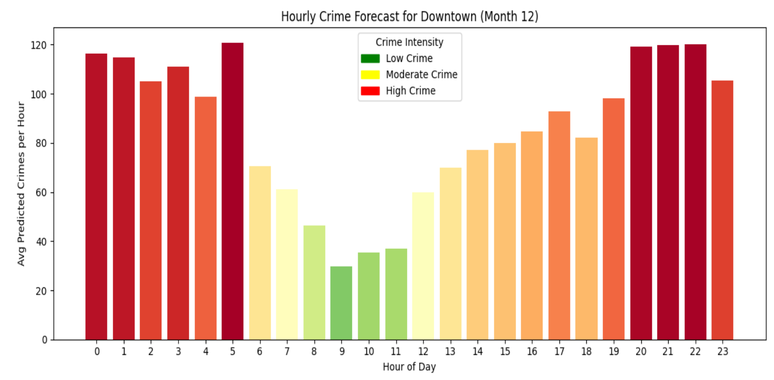




Experiments/Results

- **Model Evaluation:** Our forecasting model captured monthly crime trends with consistent error rates, though short-term daily fluctuations remained challenging. This highlights the need for additional context (like events or weather) to improve accuracy. Compared to other static methods, our approach enables more detailed, day-level crime prediction.
- **Visualization Evaluation**: A user study with 25 participants showed high satisfaction—over 90% in visual appeal, task accuracy, and usability. Features like heatmaps, time series charts, and animations helped users easily explore crime patterns.
- **Results:**
  - MAE Range (Downtown): 3.99 – 5.35
  - Best R^2: 0.35 (Month 12)
  - Dashboard Scores: Visual Appeal – 92%, Task Accuracy – 96%
  - Prediction Output: Integrated with patrol suggestions (e.g., Foot, Vehicle)
- **Innovation:** Our system supports proactive policing, targeted deployment, and real-time decision-making—all through an intuitive, data-driven dashboard.





Conclusion

ATLShield integrates machine learning with interactive visualization to support proactive policing in Atlanta. While our prediction model showed consistent MAE across months, R^2 values indicated challenges in capturing daily crime variability. Nevertheless, our Tableau-integrated dashboard was well-received in user studies and enables data-driven decision-making for resource allocation and crime prevention. Expanding the dataset and including contextual features like weather and demographics will improve model accuracy.

ATLShield is a step toward smarter, safer, and more informed urban policing!!