

Integrated Safety Incident Forecasting and Analysis

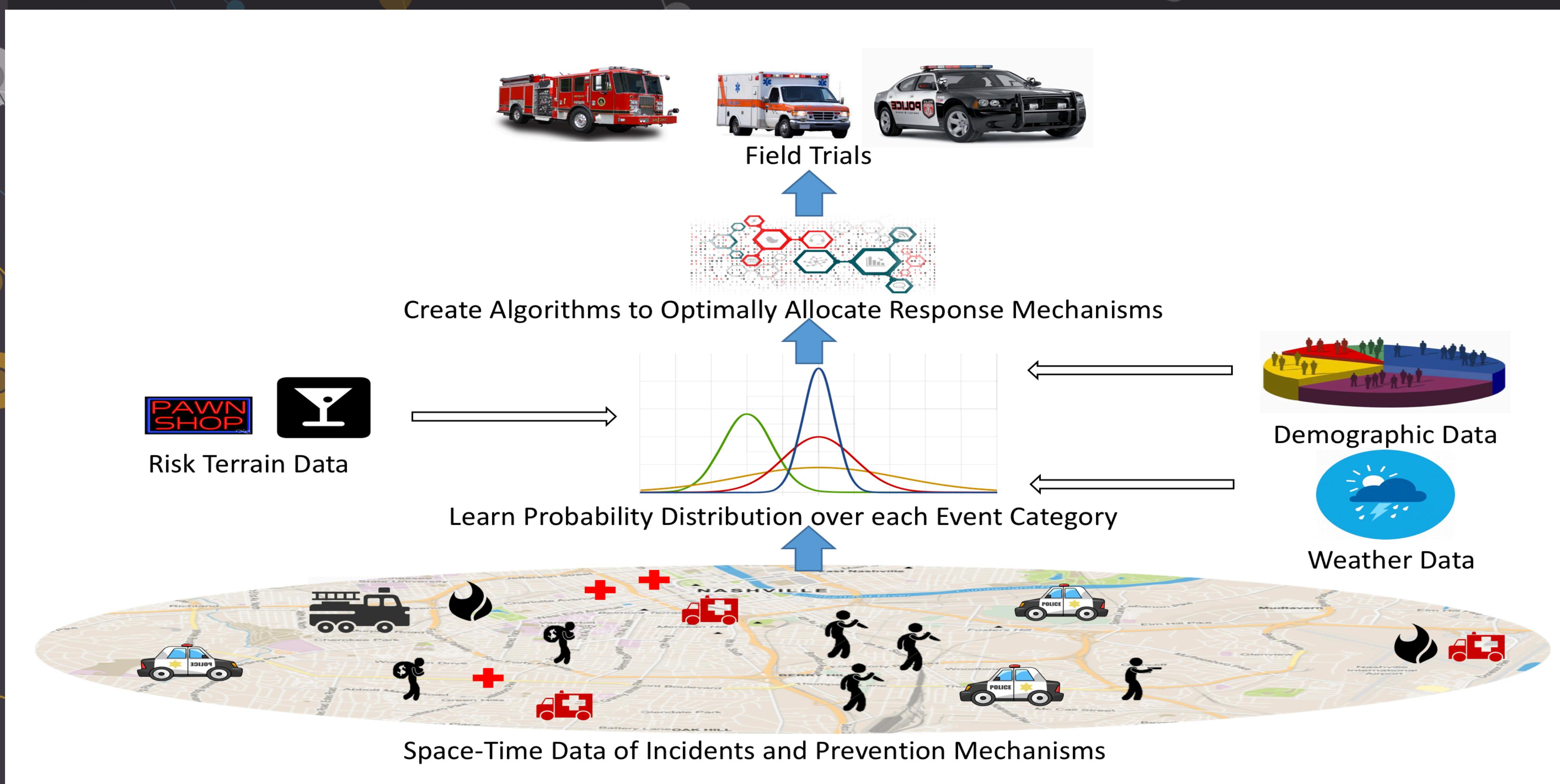
Yevgeniy Vorobeychik, Abhishek Dubey, Gautam Biswas, EECS, Vanderbilt University

Students: Ayan Mukhopadhyay, Benjamin Richard Stadnick, Geoffrey Andrew Pettet, Gerald Stanje, EECS, Vanderbilt University

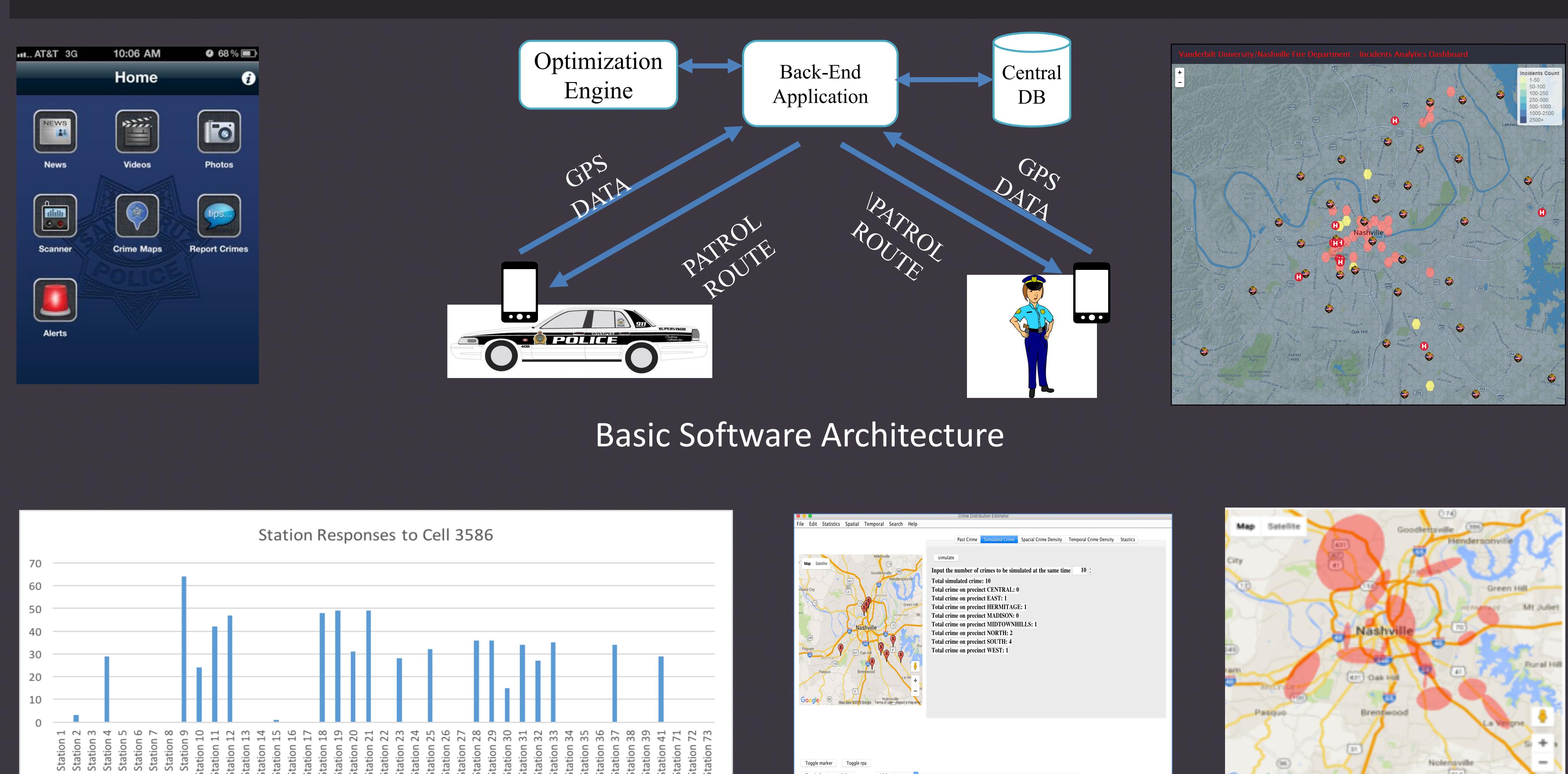


Project Objectives

- Develop methods to effectively **forecast** urban incidents.
- Develop an integrated stochastic **optimization-based architecture** for **emergency responder** in anticipation and response.



- **Research to Practice** : develop tools for easy access, visualization and **analysis** of incident data, its prediction and the optimization framework.



Incident Forecasting

- A decomposable model to predict time to incidents (t) and the urgency (k) to respond to them, based on covariates w .
$$f(t, k|w) = f(t|w)f(k, t|w)$$
- Use Censored Accelerated Failure Survival Analysis Model for $f(t|w)$ and Multinomial Logistic Regression for $f(k|t, w)$.
- Any arbitrary set of covariates can be included in to the model.
- Principled estimation technique of MLE.
- Use Hierarchical and SBAC clustering to learn distribution over number of models.

Responder Placement to Minimize Response Time

- High-dimensional dynamic optimization problem under uncertainty.
- Formally, the model is
$$\min_q \mathbb{E}_{s \sim f}[D(q; s)]$$
 we try to find optimal allocation of resources q minimize the expected response time D to incidents s , distributed as f .
- Use decomposition techniques and heuristic-based approaches to solve hard optimization problems.

Responder Placement to Maximize Deterrence

- Create Patrolling Algorithms to prevent incidents like crimes, traffic violations etc.
- Formally, create a model such that
$$\max_q C_{f|q}$$
 we try to maximize the coverage in anticipation of incidents distributed according to f .
- Create an optimization framework that achieves both deterrence while minimizing response times.



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