Real-time algorithms and software systems for heterogeneous data driven policing of social harm

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Indiana University Purdue University Indianapolis
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Community Partners

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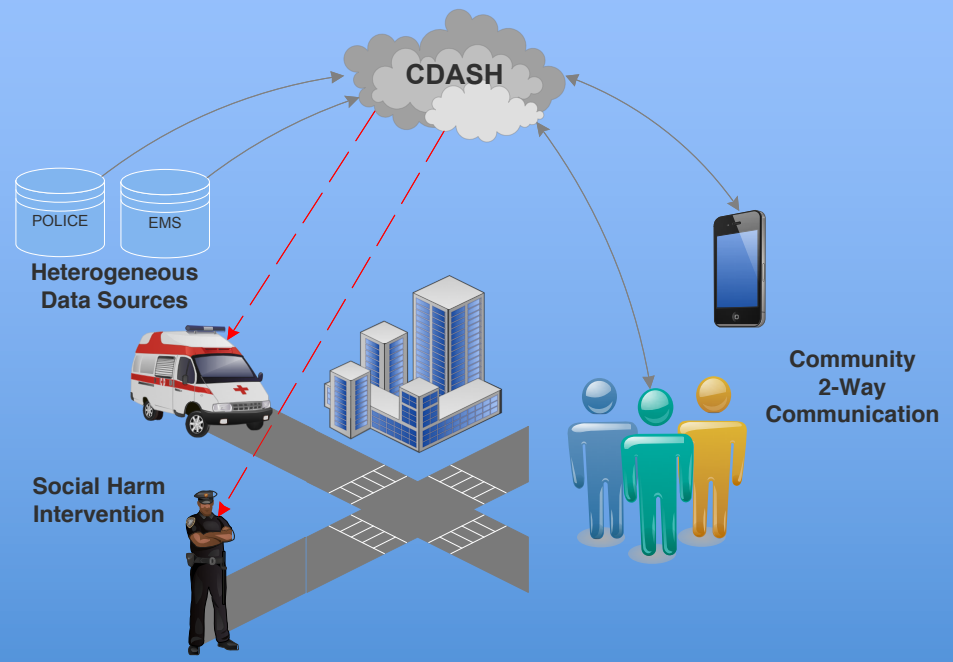
Project Overview

Community Data Analytics for Social Harm Prevention



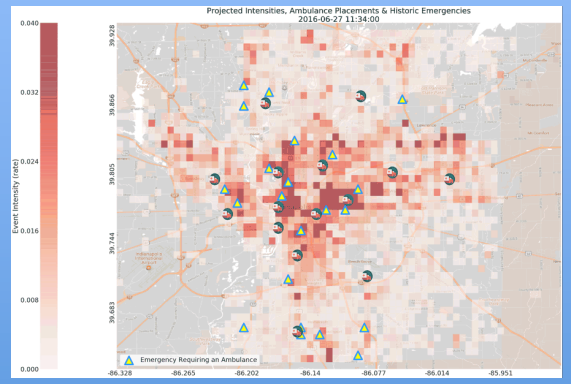
Project Vision

- cross-agency social harm data integration from heterogeneous sources
- real-time predictive modeling and optimal control of social harm risk (e.g. traffic crashes, crime, medical emergencies, overdoses)
- mobile application for targeted interventions
- multi-disciplinary team: computer science, criminal justice and public policy, police and emergency medical services

Project Overview

Use-Inspired Research

50% of crime occurs in **4%** of the city
50% of opioid deaths in **5%** of the city



Target Community: Indianapolis, Indiana
Partner Agencies: IMPD, IEMS

Community engagement at the neighborhood level across Indianapolis

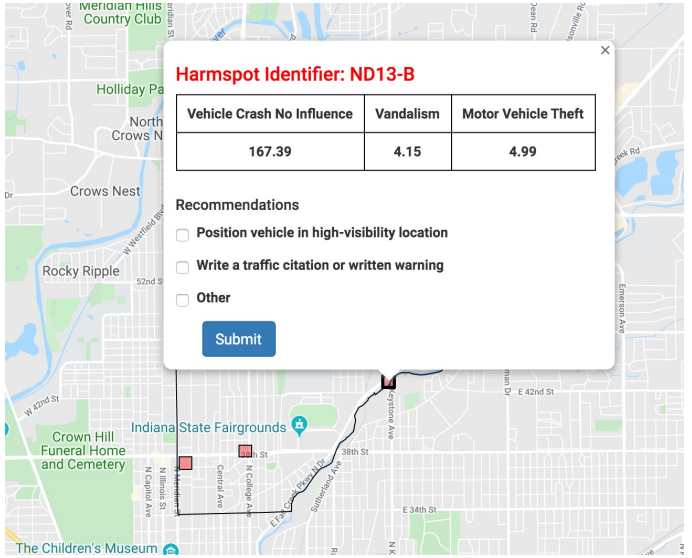
Fundamental Research Contributions

- Developed state of the art machine learning models to forecast dynamic social harm risk (tied for 1st in 2017 NIJ Crime Forecasting Competition)
- Built software application that was tested in a 3 month randomized controlled trial in Indianapolis for social harm prevention
- Researched bias and fairness of algorithms used in spatial crime forecasting and designed methods to mitigate bias
- Analysis of the impact of Covid-19 on crime and drug overdoses in Indianapolis

Project Update

Indianapolis harmspot policing experiment (June to Sept 2019)

- Block randomize patrol beats
- A/B test “harmspot” vs. crime hotspot interventions
- Over 6000 proactive activities in crime, traffic crash, overdose hotspots
- Pre/post community survey



proactive activity	treatment	control	total	avg. dur.
vehicle patrol	337	2764	3101	10.2 min
foot patrol	–	215	215	10.7 min
foot patrol/explain data-driven policing handout to citizen/business	499	–	499	10.8 min
position vehicle in high-visibility location for traffic crash prevention	2227	–	2227	10.7 min
write a traffic citation or written warning	39	–	39	12.2 min
distribute information flyer on drug treatment centers	918	–	918	–

Evaluating Project Impact on Communities

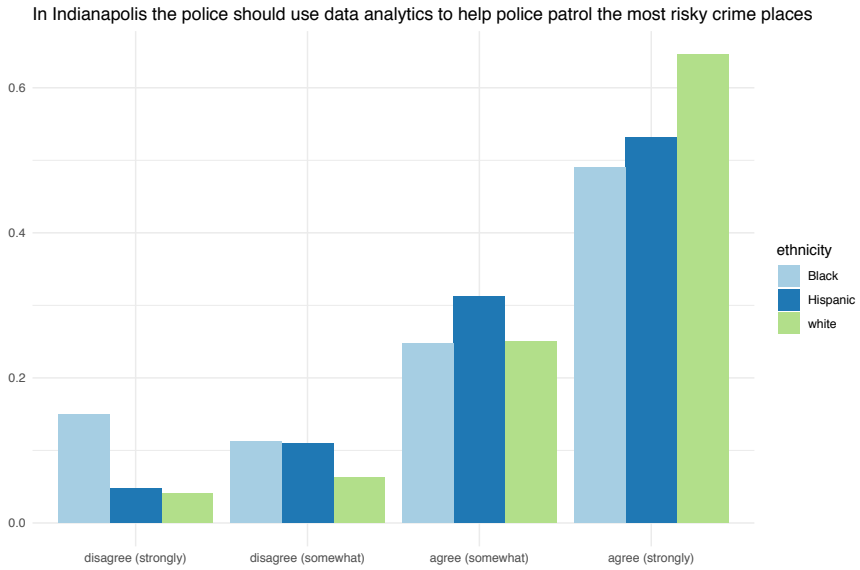
variable	coefficient	sd. error	t value	$Pr(>\|t\|)$
intercept	$s_0 = 74.13722$	6.05914	12.236	<2e-16
n_p (proactive activity)	$\beta = 50.2706$	30.28699	1.66	0.097
χ_t (treatment)	$\gamma = 18.0128$	7.72283	2.332	0.0197
s_{pre} (avg. cost pre-experiment)	$\alpha = 0.59954$	0.01145	52.382	<2e-16
$n_p\chi_t$ (treatment proactive activity)	$\delta = -88.85779$	40.81517	-2.177	0.0295

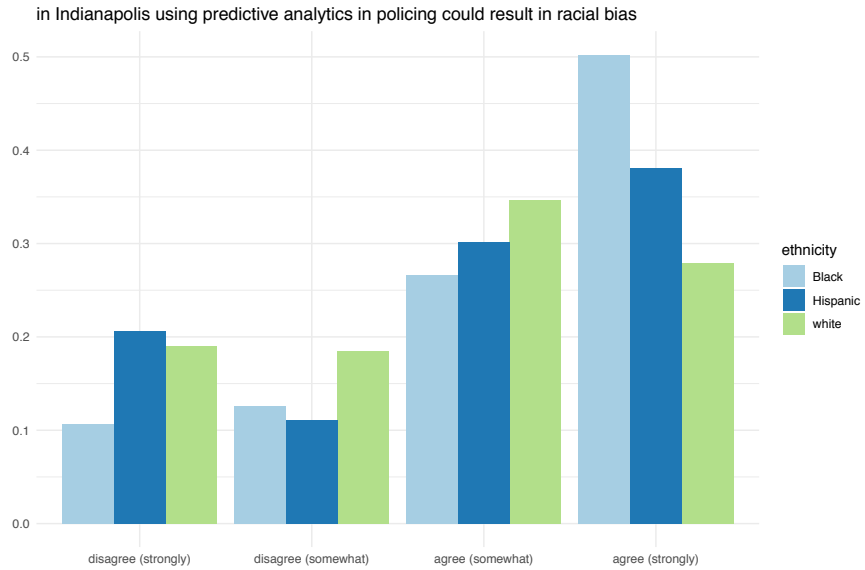
Table 3: Regression of aggregated social harm cost vs. number of proactive activities in 3 hour window and indicator for treatment vs. control.

Social harm cost reduction of ~$40 per every 10 minutes of proactive activity

No significant change in use of force incidents

Community in favor of use of data analytics, though concerned about potential bias





Project Evolution

Non law-enforcement solutions to harm

GRYD FOUNDATION

The GRYD Foundation works in Los Angeles communities that historically have been marginalized due to racial and social injustices. They collaborate with residents, local agencies and philanthropic partners to break cycles of poverty, trauma and inequity, and to equip Los Angeles youth for success at home, at school and in the workforce.

Reducing use of force and misconduct

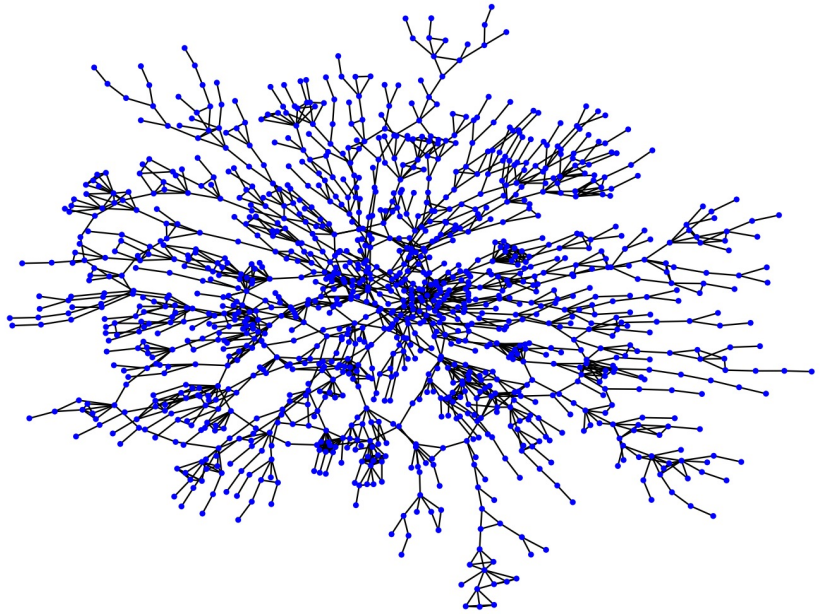


Fig. 1: Network where links between officers with more than 1 common complaint are shown.

Anticipated outcomes & success measures for next year

- **Publish results of Indianapolis harmspot policing experiment (in review at Journal of Criminal Justice)**
- **Project analyzing the impact of law enforcement drug seizures on drug overdose**
- **IU Racial Justice Research Fund Seed Grant, High-stakes pairing systems for mitigating police bias and misconduct. Joint w/ Jeremy Carter and James Hill**
- **Graduate student embedded with IMPD to collect data on officer academy records, field training officer pairings and post training outcomes**

Publications www.georgemohler.com

Algorithmic and software engineering advances

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Analysis of drug overdose patterns

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12. Mohler, George and Brantingham, P. Jeffrey. "Privacy Preserving, Crowd Sourced Crime Hawkes Processes," *2018 International Workshop on Social Sensing (SocialSens)*, 2018.
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