Understanding the Impact of Social and Physical Environment Factors on Crime Using Urban Sensing and Machine-Learning

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Lydia Scott, Chicago Region Trees Initiative (CRTI)
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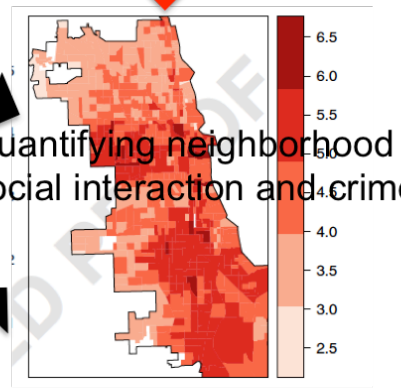
Project Overview

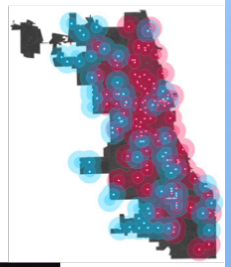
Community mapping and community input

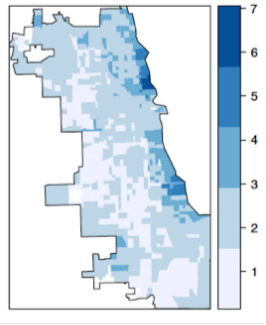
Social media and mobility data



Quantifying neighborhood social interaction and crime

Urban sensing





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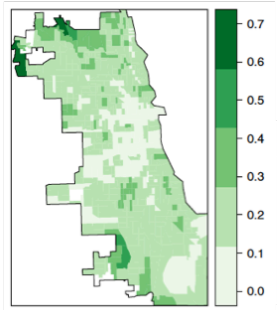
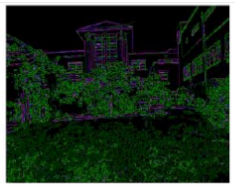
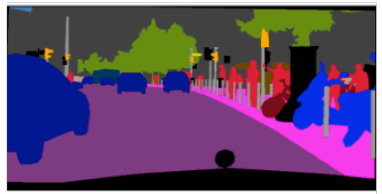
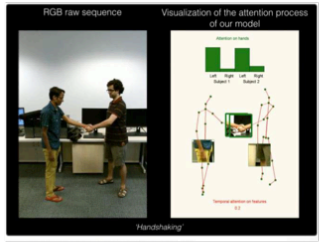


Greenspace and street quality



Edge computing & machine-learning





Project Vision

We seek to quantify the nature of social interactions in different neighborhoods based on community input, social media data, mobility data, greenspace, street quality and urban sensing data.

We plan to uncover the psychological, sociological and physical environmental factors that explain variance in social interactions. This will lead to proposed interventions to improve well-being and neighborhood social cohesion.

Project Overview

Use-Inspired Research

Here we aim to understand the social and physical environment factors that explain variability in social interactions and crime for different neighborhoods.

We will work with communities and our community partners about how incorporating greenspace and other physical environment features could be deployed into their neighborhoods and how communities feel about urban sensing technology and giving communities ownership over their own data.

Fundamental Research Contributions

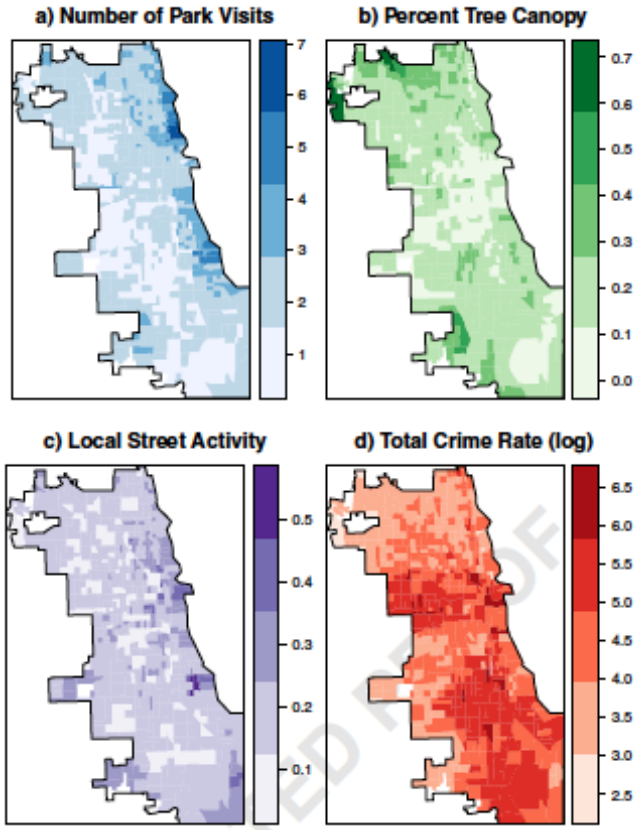
Quantifying elements of the physical environment (e.g., greenspace quality and disorder) on social interactions and crime.

Advancing machine learning (ML) algorithms to quantify the nature of social interactions.

Determine if these ML algorithms can be applied at scale to low-cost edge computing devices.

The application of cutting-edge causal models to large-scale sociological and psychological data.

Project Updates



Relationship between park visits, greenspace, steet activity and crime
Schertz et al., (in press) *NPJ Urban Sustainability*

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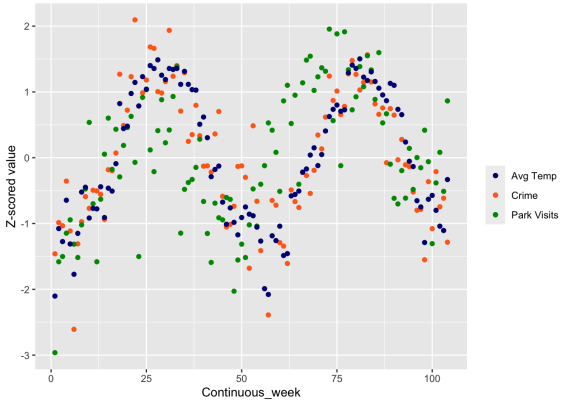
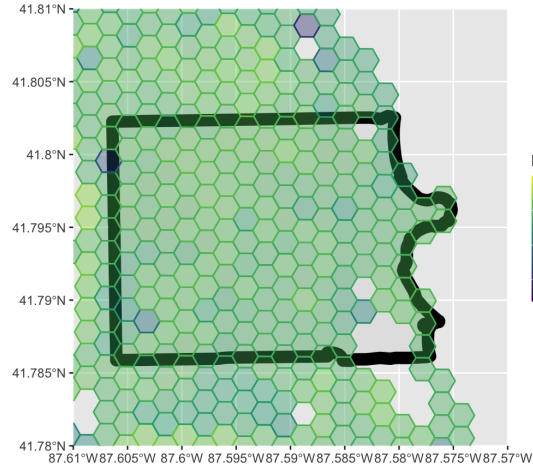
Replication with Safegraph data



Causal modeling with time series data



Airbeam air quality sensor

Kestrel temp and humidity sensor

Air quality measurement + Heat mapping + subjective measurements of neighborhood cohesion

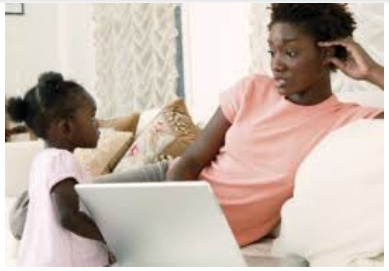
ENVIRONMENTAL LAW & POLICY CENTER

Air Quality Chicago

MAPSCORPS

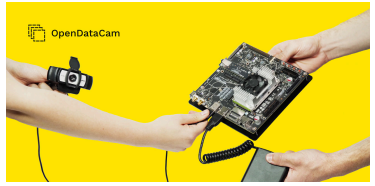
Conducted preliminary focus groups on neighborhood issues and thoughts of urban sensing technology

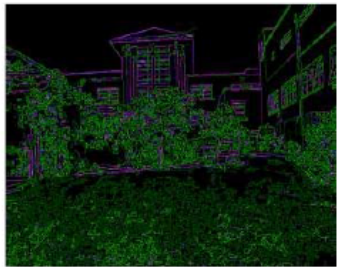
thirty million words



Quantifying the nature of social interactions In dyads

Open data cam and Pedestrian counting





Creating disorder maps of Chicago using Google Streetview

Code can now be run on AoT nodes

Project Evolution

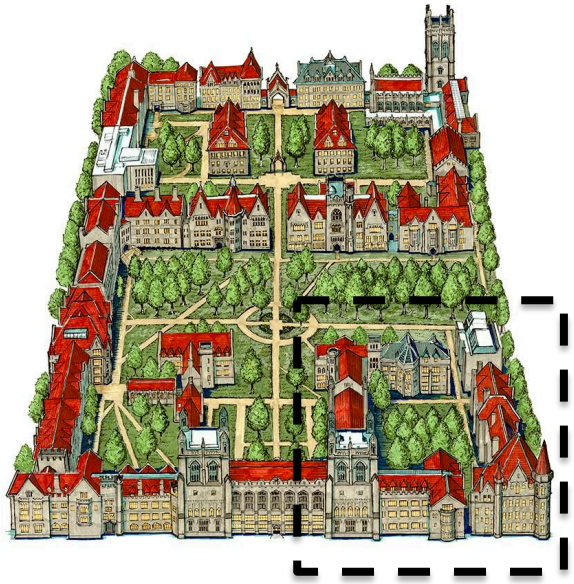
From some of our preliminary focus groups with community members and partners there is interest in air quality measurements, heat mapping and assessing the quality of parks and greenspaces. With Mapscorps, the Environmental Law and Policy Center and Air Quality Chicago we will conduct these measurements this summer. We have also been looking at some of the existing air quality data from past mapping.

We decided to start with looking at social interactions indoors using two datasets. One comes from the 30 Million Words project (PI: Dana Suskind) and the other comes from the Language Development Project (PI: Susan Goldin-Meadow). Both projects have video and audio data from hundreds of parent child dyads. The data have been transcribed and some labeling has been done to characterize aspects of the interactions. The data also come from participants from varied SES backgrounds. We will begin with posture modeling and acoustic modeling (e.g., sound envelopes) and using that information to predict the nature of social interactions.

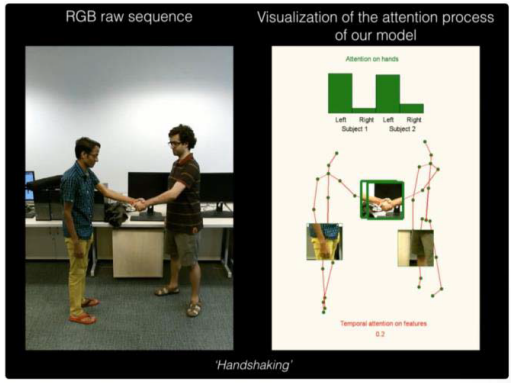
Using open data cam, we will feed their pedestrian counting algorithm thousands of hours of video to do pedestrian counts. Accuracy will be compared to computationally intensive pedestrian counters to test accuracy. We will also explore evidence of bias in the pedestrian counting algorithms. Uncovered biases here could inform potential biases for more complex computations such as determining how positive or negative social interactions are.

Anticipated outcomes & success measures for next year

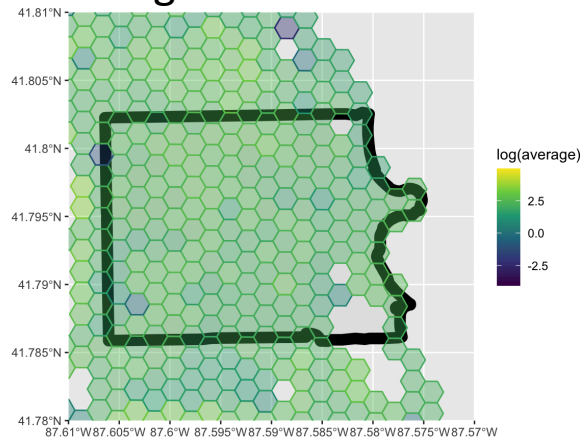
Creating an on-campus outdoor sensor lab

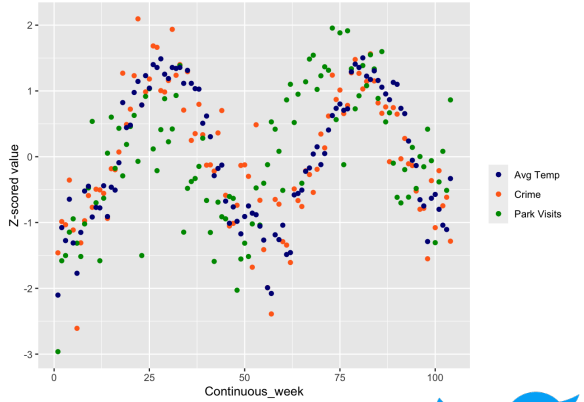


Posture and acoustic models to quantify social interaction



Combining Data and Causal Modeling





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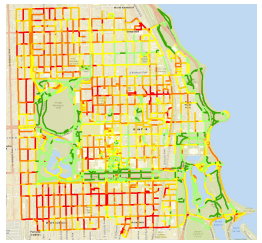

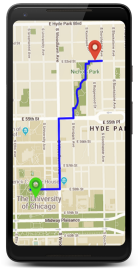

Development of our ReTUNE app to route residents on walking routes that maximize greenspace exposure