Machine Intelligence for Smart Cities: Participating in Civic Life as a Technologist

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AI Geeks
RBC FutureMakers

hi, I'm Helen!

- Data Scientist, Bell
- Sidewalk Toronto Fellow
- Toronto Women's Data Group
- Toronto Deep Learning Series
- Mathematics, coffee, poetry

Opinions expressed are solely my own and do not express the views or opinions of my employer or the Sidewalk Toronto Fellows.

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68%

of the world's population is projected to live in urban areas by 2050
(United Nations, 2018)

Smart city (n.)

an urban area that uses electronic data collection sensors to supply information which is used to manage assets and resources efficiently

https://assets.pcmag.com/media/images/533348-how-to-build-a-business-ready-internet-of-things.png

Internet of things (n.)

the network of physical devices, vehicles, home appliances … embedded with electronics, software, sensors ... and connectivity … to connect, collect and exchange data

data collected from citizens + devices is used to shape:

- traffic + transportation
- power plants
- water supply networks
- waste management
- law enforcement
- information systems
- schools
- libraries
- hospitals

Quayside by Sidewalk Toronto

Sidewalk Toronto is a joint effort by Waterfront Toronto and Alphabet's Sidewalk Labs to create a new kind of mixed-use, complete community on Toronto's Eastern Waterfront, beginning with the creation of Quayside.

Should you be...
optimistic?
skeptical?

my $0.02: both.

“cautiously optimistic”

why **cautious**?

“If you aren’t paying for the product, **you are the product.**”

- Richard Serra (1973)

In the smart city,
data is currency.

Data is going to power everything we do.

Who owns it?
Where does it live?

How do we maintain data pipelines to power innovation on an ongoing basis?

How do we futureproof?


¯_(ツ)_/¯

How does the role of a **technologist** change in this future city?

How can a **machine learning developer** use their skills for **social good** in a smart city?

How can you build + plan for a **future which you cannot yet see** or touch?

with caution.
(and excitement!)

Machine intelligence lends itself **naturally to the smart city** with its massive datasets.

Treepedia 2.0: Applying Deep Learning for Large-scale Quantification of Urban Tree Cover

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***Abstract*—Recent advances in deep learning have made it possible to quantify urban metrics at fine resolution, and over large extents using street-level images. Here, we focus on measuring urban tree cover using Google Street View (GSV) images. First, we provide a small-scale labelled validation dataset and propose standard metrics to compare the performance of automated estimations of street tree cover using GSV. We apply state-of-the-art deep learning models, and compare their performance to a previously established benchmark of an unsupervised method. Our training procedure for deep learning models is novel; we utilize the abundance of openly available and similarly labelled street-level image datasets to pre-train our model. We then perform additional training on a small training dataset consisting of GSV images. We find that deep learning models significantly outperform the unsupervised benchmark method. Our semantic segmentation model increased mean intersection-over-union (IoU) from**

test datasets and standard evaluation metrics to compare performance across different methods [2].

A. Traditional approaches to quantify urban tree cover

Urban greenery, and in particular trees, attract substantial interest in both academic research and urban planning since they provide wide-ranging services in cities such as carbon sequestration and oxygen production [3], and heat island effect mitigation [4]. Furthermore, the perception of urban greenery has a significant influence on the visual appeal of streets [5], such that urban greenery programs have generally received support from local residents [6].

Path Planning in Support of Smart Mobility Applications using Generative Adversarial Networks

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***Abstract*—This paper describes and evaluates the use of Generative Adversarial Networks (GANs) for path planning in support of smart mobility applications such as indoor and outdoor navigation applications, individualized wayfinding for people with disabilities (e.g., vision impairments, physical disabilities, etc.), path planning for evacuations, robotic navigations, and path planning for autonomous vehicles. We propose an architecture based on GANs to recommend accurate and reliable paths for navigation applications. The proposed system can use crowd-sourced data to learn the trajectories and infer new ones. The system provides users with generated paths that help them navigate from their local environment to reach a desired location. As a use case, we experimented with the proposed method in**

Smart mobility refers to the utilization of information and communications technologies (ICT) augmented with artificial intelligence for the optimization and efficient distribution of traffic flows and transportation services [5]. Smart Mobility is one of the prominent functionalities of a smart city as it can improve the quality of life of almost all the citizens. Path planning plays a significant role for many smart mobility applications. For example, path planning is a major component for emergency evacuation situations in a building or even a city scale. If evacuees have adequate information about the exit ways, smart mobility applications can prevent potential

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Re-Imagining Streetlight Infrastructure as a Digital Urban Platform

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ABSTRACT

Urban infrastructures have traditionally been mono-functional: water, sewage, and electricity are notable examples. Embedded with digital technologies, urban infrastructures have the potential to communicate with one another and become multi-functional platforms that integrate data gathering and actuation cycles. In this paper, we focus on public lighting infrastructures. Despite the technological development of lights, including LED technology, streetlights have been primarily treated as a mono-functional infrastructure. Based on case studies, we discuss the potential of reimagining streetlight infrastructure, and advance some initial

KEYWORDS

Streetlight; smart-lighting; urban infrastructure; digital technologies; internet of things

Designing for a city isn't like designing for the enterprise.

Algorithmic fairness (i.e explainable ML) is more important than ever.
Your applications will impact everyday lives.

Edge computing in the service of privacy by design.

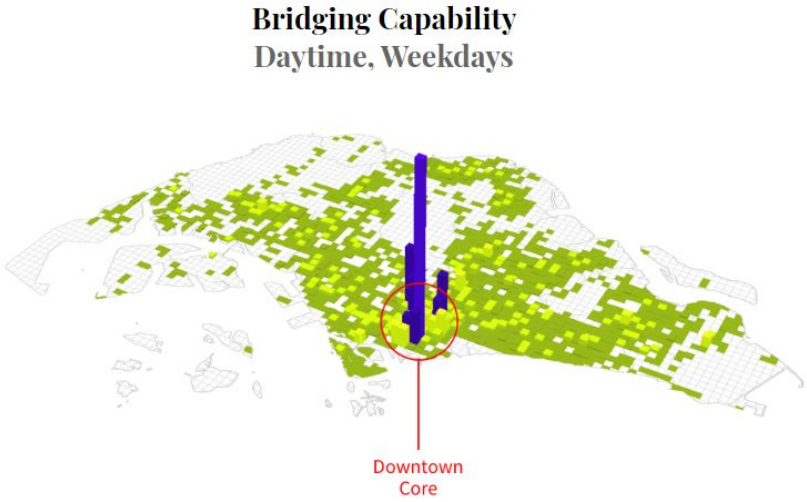
Does your model run in real time within sensor memory?

The timescales are in years, not quarters.
Decisions affect the city for years to come.
Taking the time to get them right is worthwhile.

Data visualization for non-technical audiences from all walks of life will be critical.

Your visualization needs to speak to those whose day-to-day doesn't require any quantitative background at all.

Bridging capability, on the other hand, describes the average chance that two randomly selected people tend to co-locate at a given place. A place with a high value indicates that it tends to facilitate chance encounters among strangers.



Places with a high level of bridging capability are mainly concentrated in Downtown Core, the financial hub of Singapore where numerous corporations and government agencies locate.

Source: MIT, http://senseable.mit.edu/friendly-cities/

The “**technologist - urbanist divide**” is real.

the problems with technologists + urbanism

“political insensitivities, a reflexive dismissal of existing regulations, and a reluctance to balance profit motives with civic benefits and systems”

the problems with urbanists + technology

“vested interests, risk-averse bureaucracy, private-sector suspicion, and legitimate public safety concerns”

- Dan Doctoroff

Source: https://medium.com/sidewalk-talk/it-s-time-for-urbanists-and-technologists-to-start-talking-df1b57abfbd1

problem:
citizens are afraid of faceless technologists working on their personal data.

this one's fixable.

two things.

1. **Get involved with educating your community about code + data.**

   Data literacy is critical to the success of the smart city.

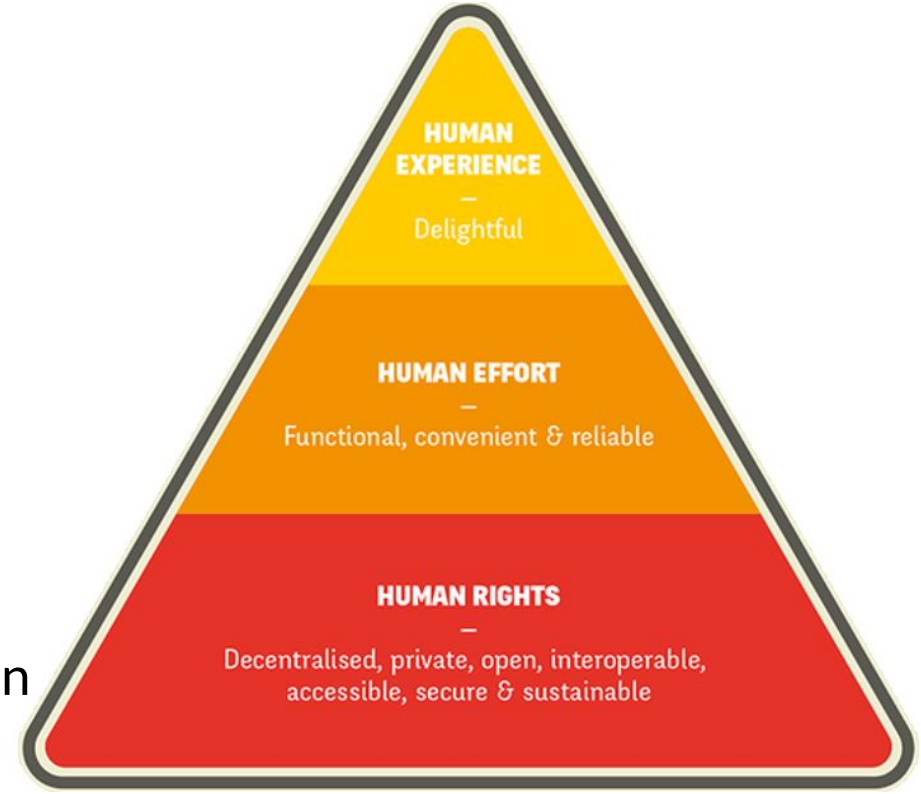
   Code doesn't have to be scary, and data collection can be used to power change for good.

2. Prove that you are a developer community which will champion using data solely for good.

This one’s going to take time.

Trust isn’t built overnight.

Build ethical, intersectional design principles into your products.



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dear Toronto tech:
this is a call to action.

you're passionate about using **data for good.**

the world is watching.
~~don't fuck it up.~~
give them a reason to be hopeful.

Toronto is home.
get invested in
building its future.

Thank you!