

Analytics in Action

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Labatt Impact Lab Bootcamp
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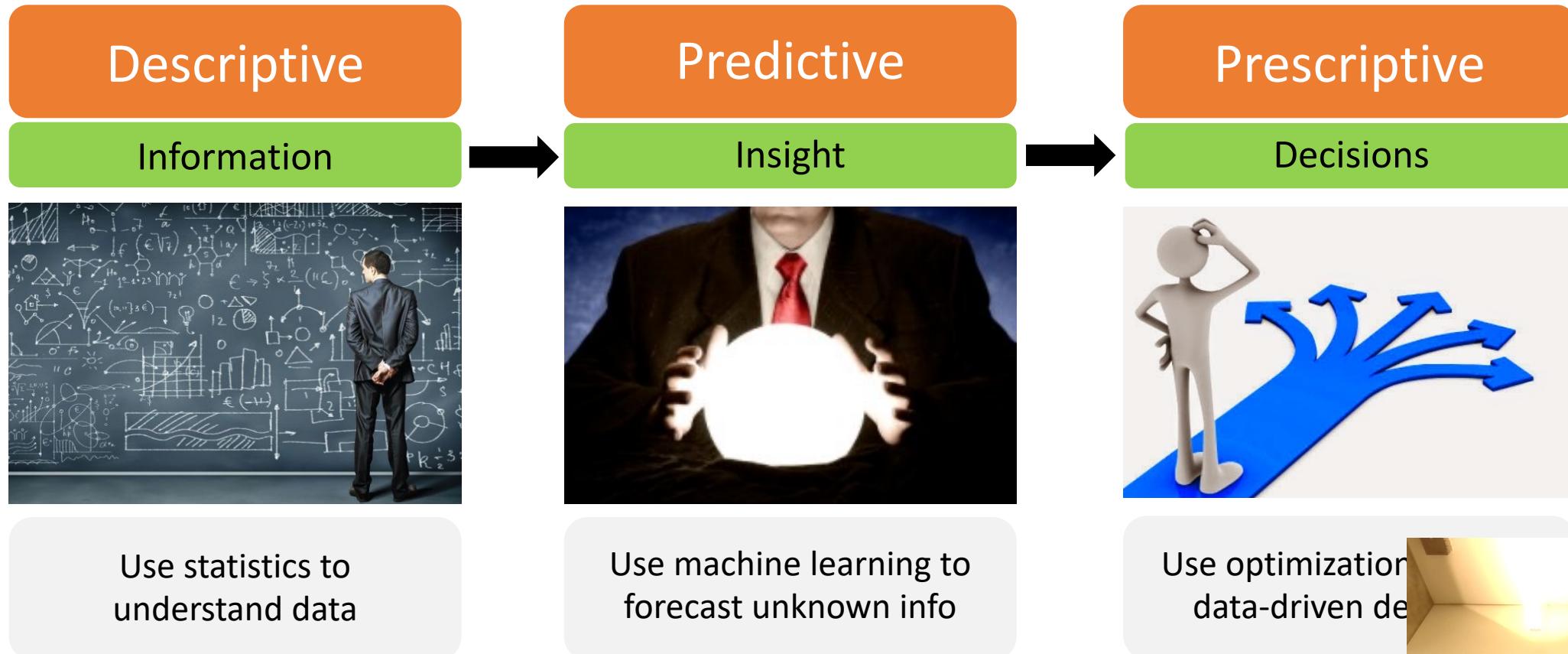


Overview

- Analytics overview
- Case studies of successful implementation
- Exciting advances in machine learning



A continuum of analytics



Let's look at sports analytics as a representative area

Forbes / SportsMoney

The Little Black Book of Billionaire Secrets

AUG 18, 2015 @ 03:08 PM

16,089 VIEWS

CHANGING THE GAME: The Rise of Sports Analytics

IBM Watson Teams With Toronto Raptors On Data-Driven Talent Analysis

Posted Feb 10, 2016 by Ron Miller (@ron_miller)

NHL | TRAVIS YOST

Feb 9

For the teams paying attention, analytics continue to add real value

Maple Leafs creating analytics department

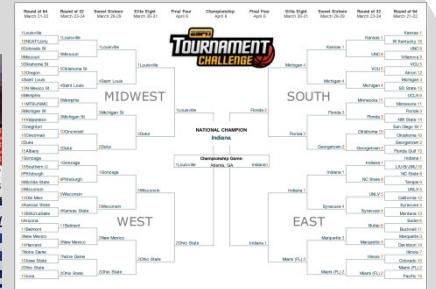
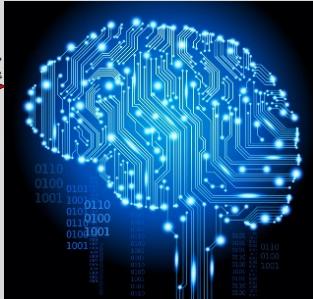
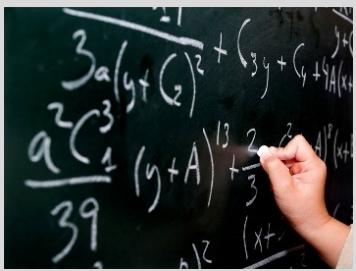
New hires to include head of ExtraSkater.com blog

CBC Sports Posted: Aug 19, 2014 2:08 PM ET | Last Updated: Aug 19, 2014 3:56 PM ET



What is analytics?

- Analytics is about using models and data to make better decisions



Sports analytics timeline



Case studies

- ① Predictive policing
- ② Scheduling / HR redeployment
- ③ Emergency response and logistics



1 Predictive policing



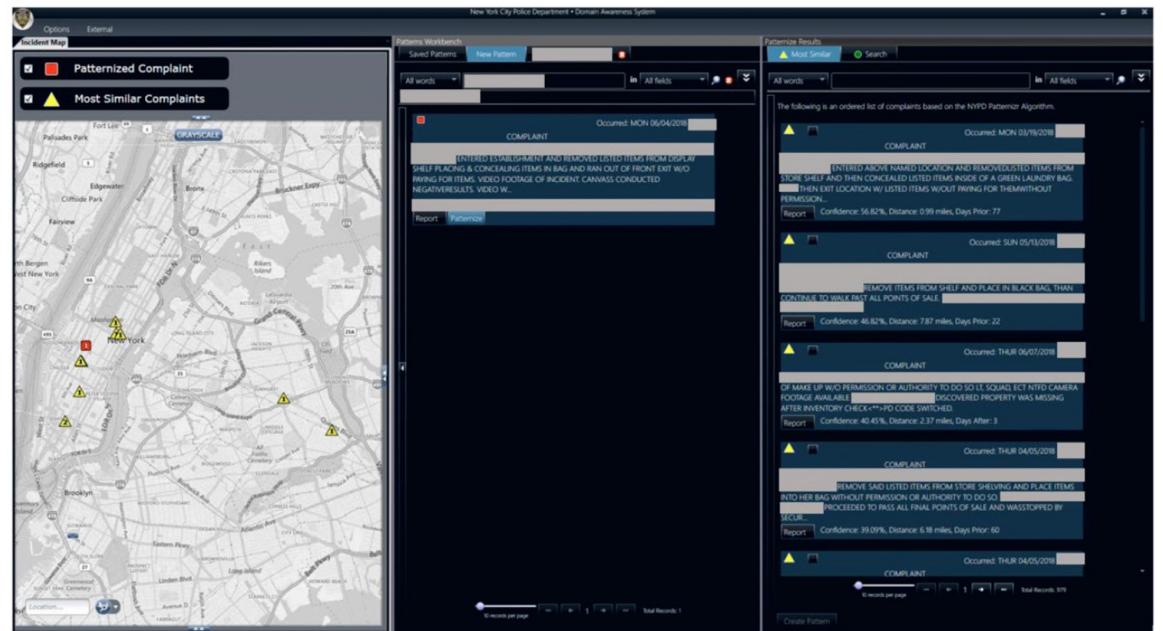
“The application of analytical techniques—particularly quantitative techniques—to identify likely targets for police intervention and prevent crime or solve past crime by making statistical predictions.” - Perry et al., 2013



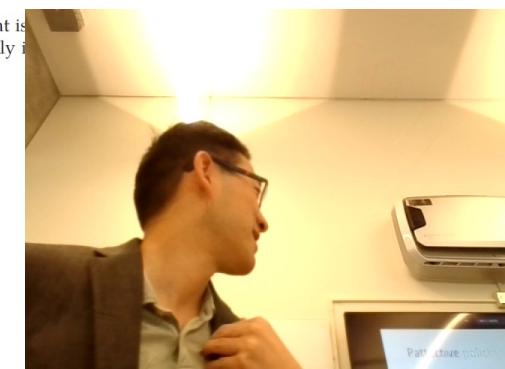
Patternizr

- Decision support tool for identifying crime patterns used by NYPD since 2018
- Uses predictive analytics (machine learning) to identify other crimes that may be part of the same pattern given a “seed” complaint

Figure 6. (Color online) Screenshot of Patternizr in the NYPD Domain Awareness System



Notes. The map of the seed and most similar complaints is in the left panel, the seed complaint is in the middle panel, and the most similar complaints are in the right panel. Grey boxes obscure law enforcement sensitive and personally identifiable information.



Impact

- Perpetrator shoplifting power drills and attacked employee with hypodermic needle when confronted
- Analyst ran complaint through Patternizr and discovered similar case in distant precinct
 - Same robbery subtype (shoplifting), several matching words in narrative (drill, needle)
- Combined these two complaints into pattern, along with two other larcenies by the same person
- Passed to detective squad, conducted an investigation, and arrested the perpetrator who later pled guilty to larceny and felony as



Testimonial

- “Patternizr dramatically improves efficiency compared to traditional methods, and it still allows the analysts that work for me to apply their own thinking and analysis. The science doesn’t overwhelm the art.” – Debra Piehl, NYPD Senior Crime Analyst

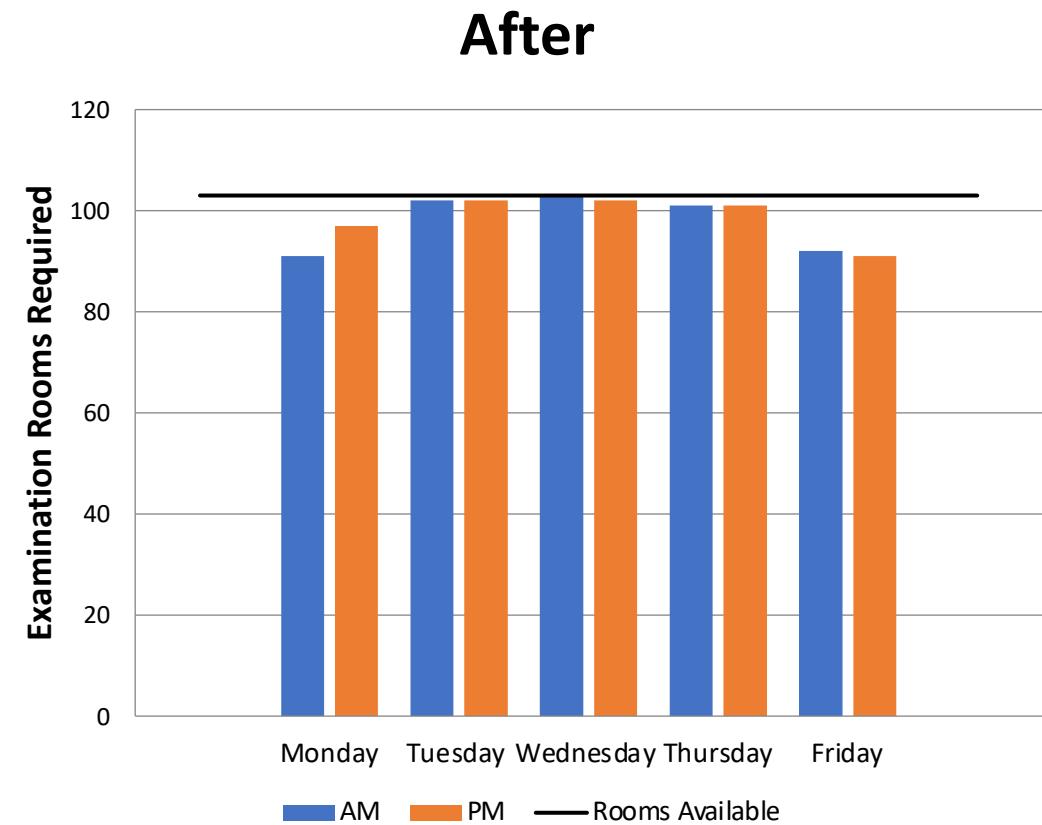
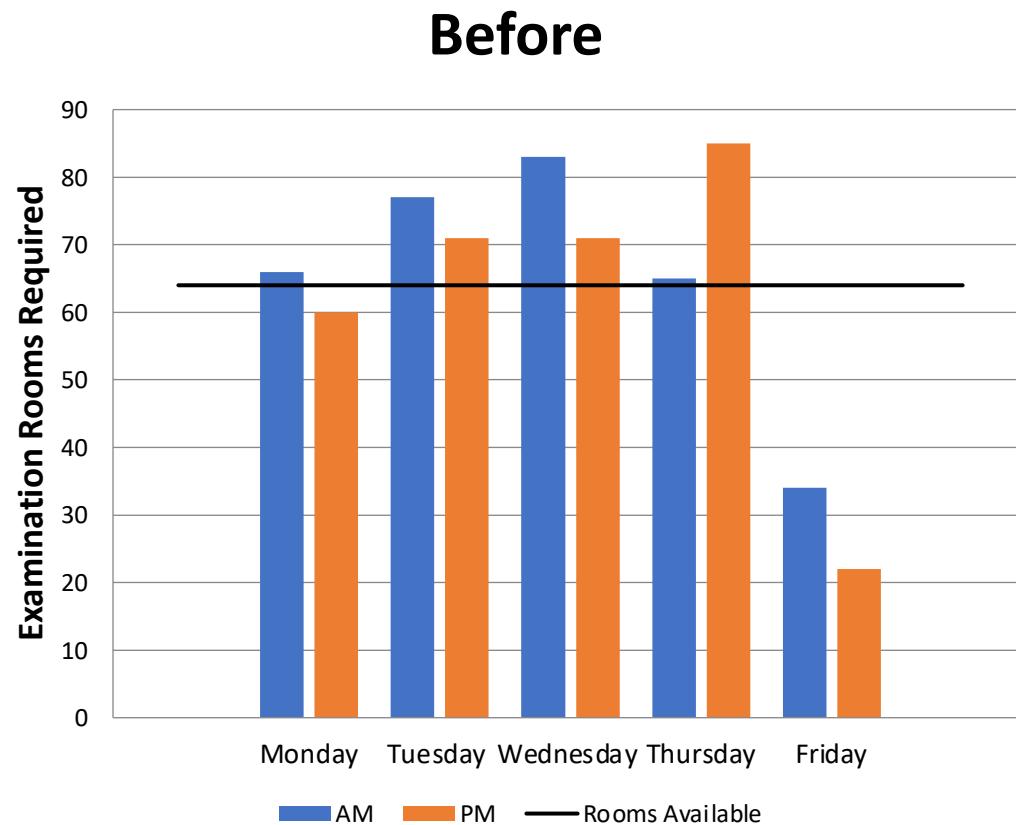


② Scheduling / HR redeployment

- Women's College Hospital opened new hospital in 2016
- Required moving 300+ weekly clinics from old space into new shared space, necessitating new schedule for thousands of individuals
- Prescriptive analytics (optimization) used to redesign schedule from scratch



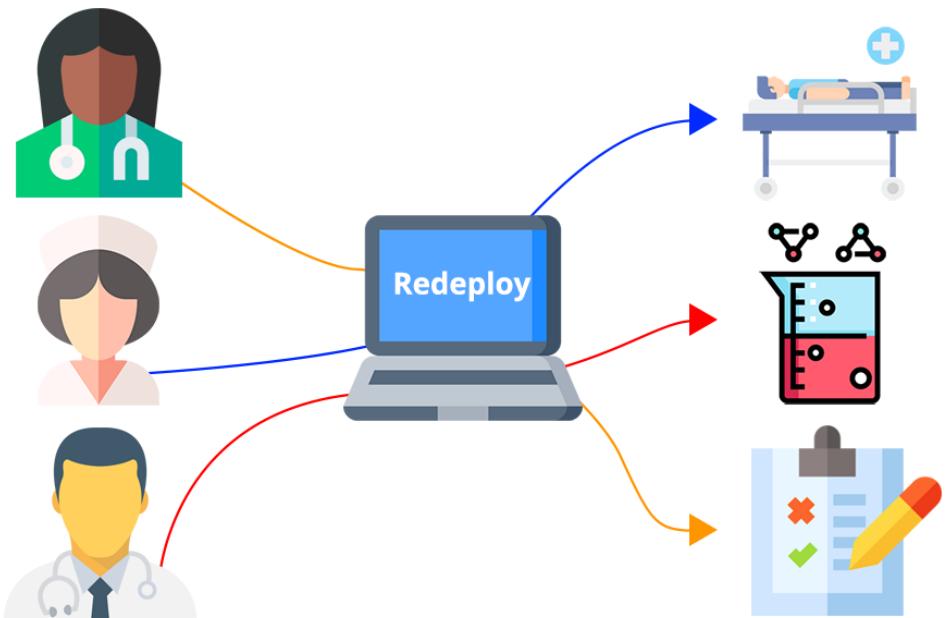
Results



Impact

- Centralized control of schedule, including optimality, fairness, transparency
- Better resource utilization and space sharing
 - Exam space decreased by over 20% but managed to fit all clinics in new space with 97% utilization
- Proactive planning, new clinics accommodated more easily
- “The model developed by the team provided data-driven decision-making guidance that otherwise would not be possible through a manually designed schedule.” – Heather McPherson, EVP WCH

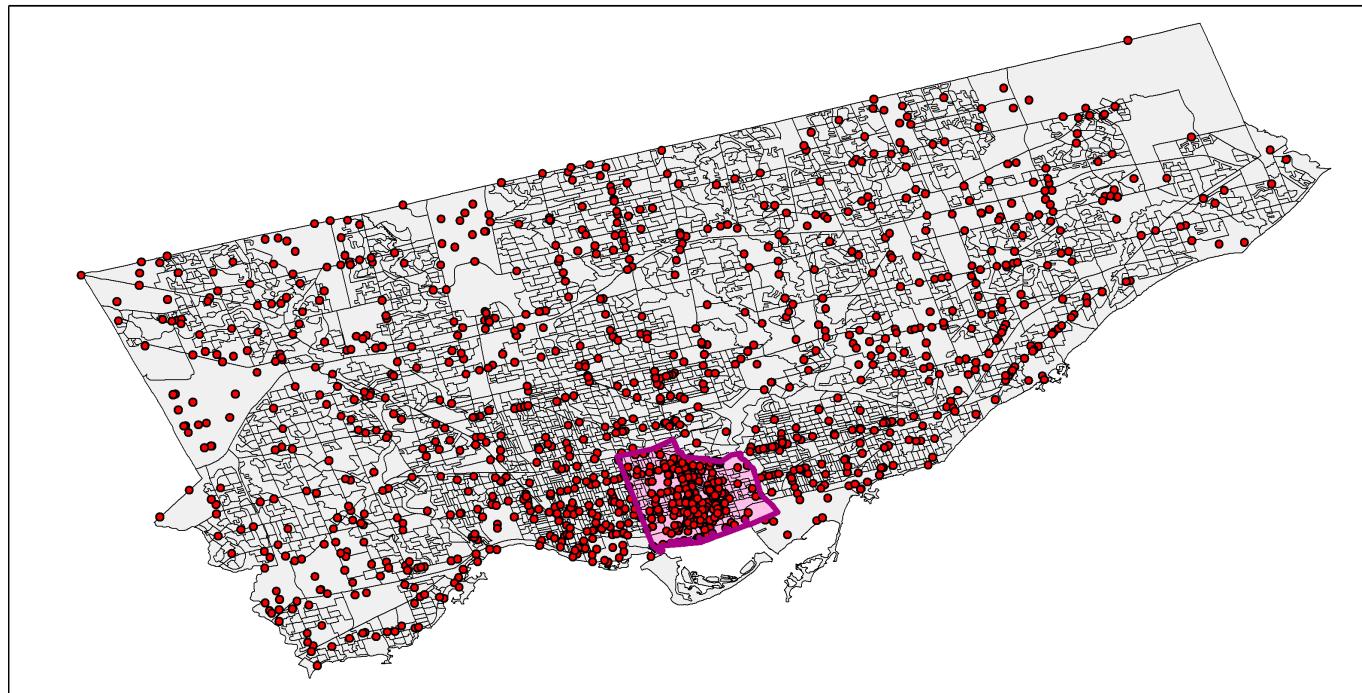
② Scheduling / HR redeployment



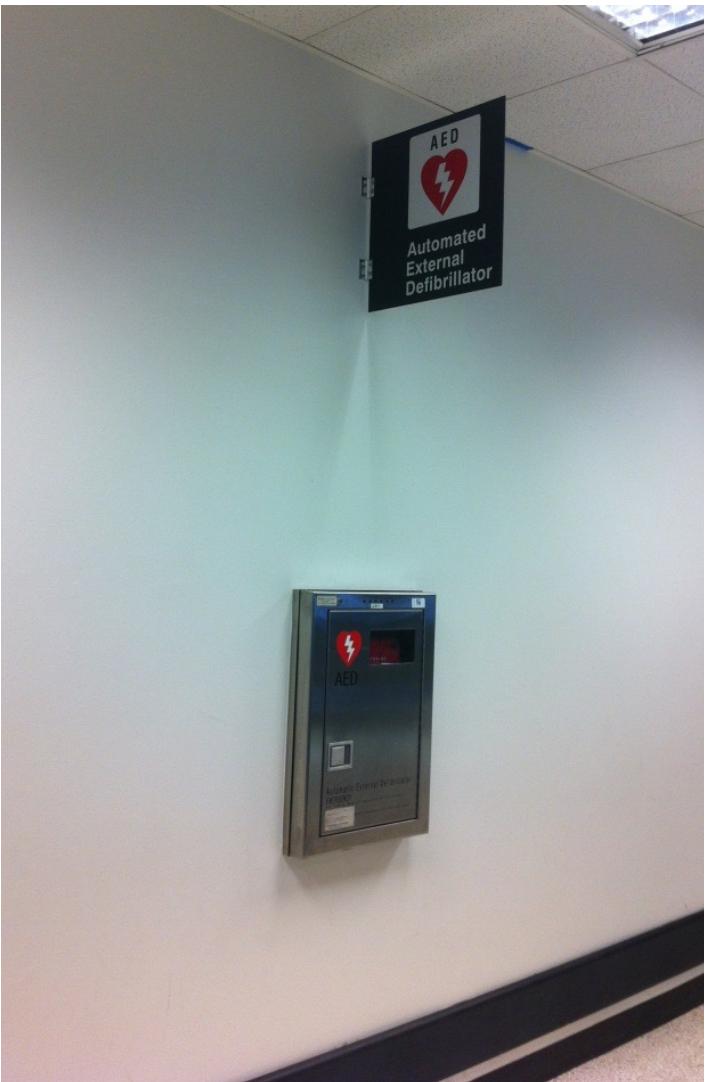
- Hospitals were redeploying hundreds of hospital staff during first wave of COVID-19
- Prescriptive analytics (optimization) tool developed to help automate this process
- <https://redeploy.ca>

③ Emergency response and logistics

- Out-of-hospital cardiac arrest kills 400K in North America annually
- 5-10% survival; survival drops 10% per minute delay
- CPR and defibrillation can increase survival dramatically



Public defibrillators

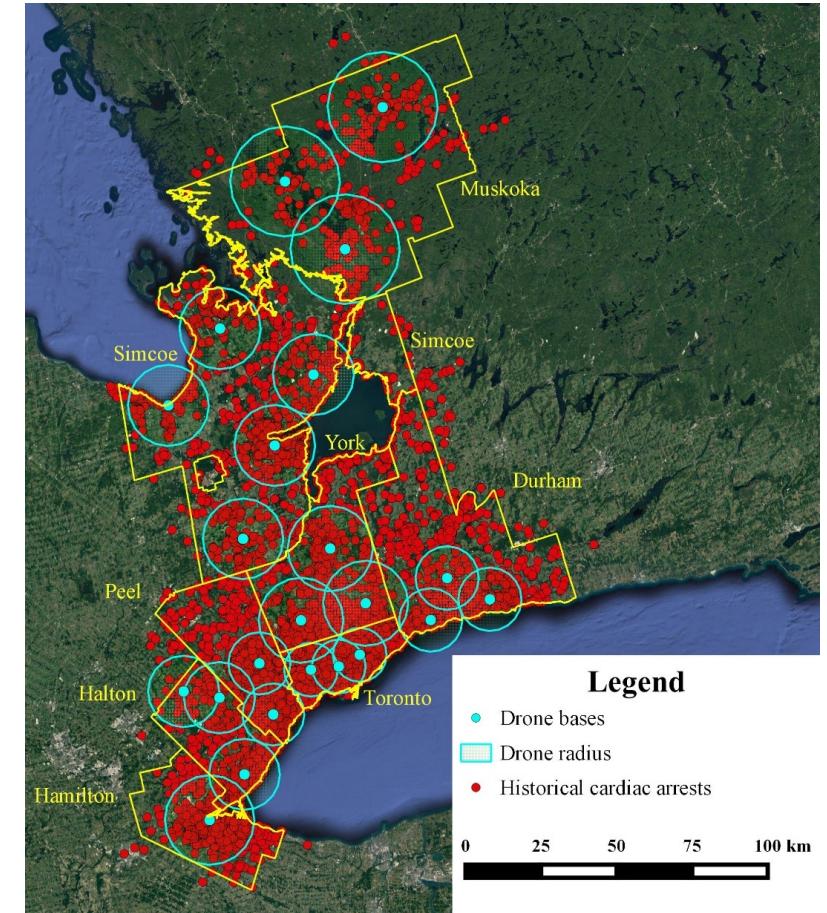


Defibrillator, delivered



Peel pilot project tests drone delivery of defibrillators to help cardiac arrest victims

By Marta Marychuk Mississauga News
Tues., April 2, 2019 | 2 min. read



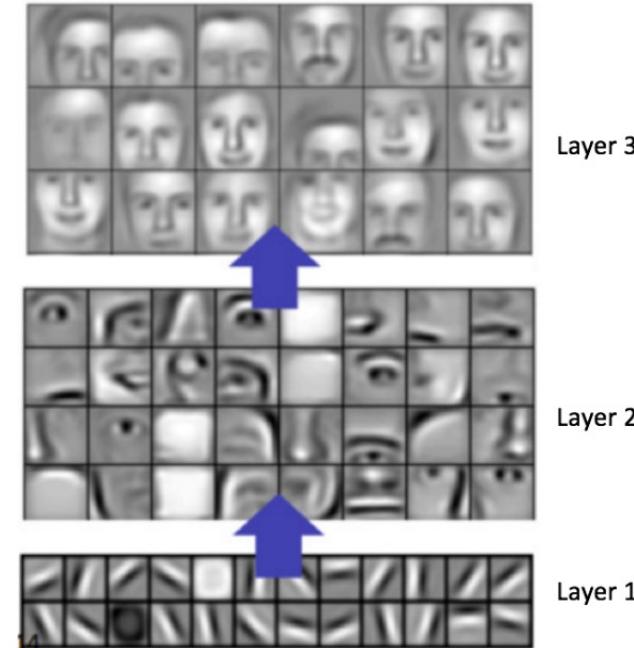
Case studies → Generalizable ideas

- ① Predictive policing → finding similarity in patterns
- ② Scheduling / HR redeployment → optimizing task assignment
- ③ Emergency response and logistics → facility location

Exciting ML advances

Exciting ML advance: image data

- One of the earliest success stories in deep learning
- Faster computers + better machine learning techniques (pioneered at UofT) allowed for the success of Convolutional Neural Networks (CNNs)
- Each layer recognizes ‘features’ of an image that are successively more complex



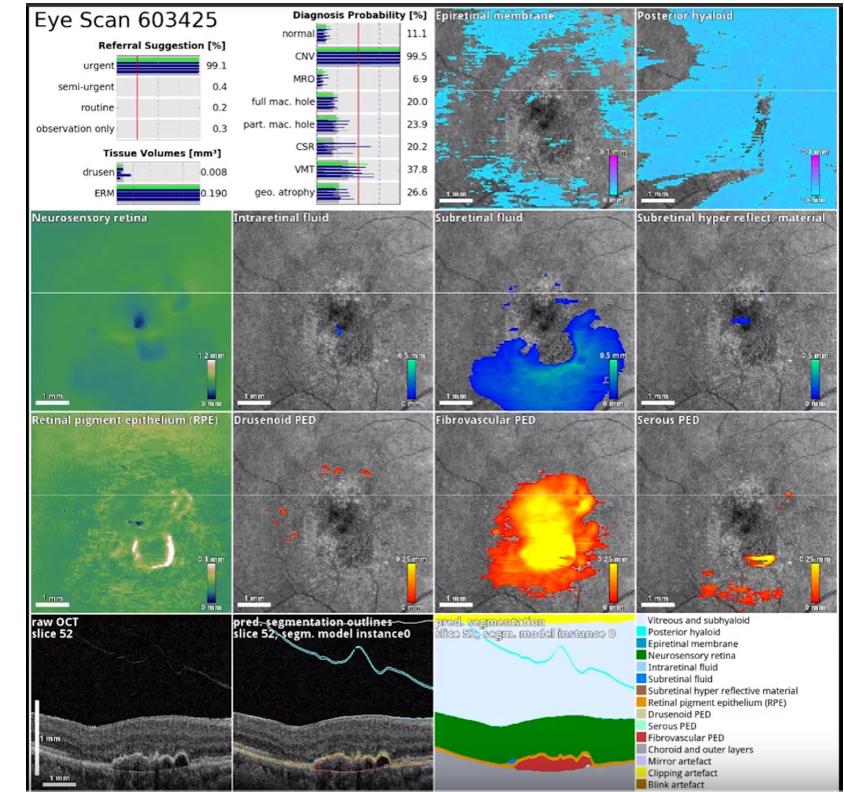
Exciting ML advance: image data

- An early application of this technology: automatically reading handwritten addresses and bank cheques
- Pre-CNN this required hand designing features to be recognized
- Today, handwriting can be read with an accuracy of 99.83% - using almost the same core technology as in 1998



Exciting ML advance: image data

- Hugely beneficial in medical applications
- Retinal disease identification: 95% accuracy (better than humans!), while saving doctors time
- CNNs are also widely used in drug discovery, identifying promising compounds



[Clinically applicable deep learning for diagnosis and referral in retinal disease](#)

Exciting ML advance: image data

- Facebook automatically captions images for people who can't see them
- Generating realistic images: powerful applications for film, television and video games

