

出國報告（出國類別：出席國際會議）

參加「108年多倫多大數據及人工智慧年度 會議及展覽會」出國報告

服務機關：財政部財政資訊中心

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出國期間：108年6月10日至18日

報告日期：108年9月9日

摘要

隨著時代科技的進步，各種基礎技術日新月異，其中新科技結合不同領域資訊運用，往往創造出新的產業價值。近年來由於大數據(Big data)、人工智慧(AI)、物聯網(IOT)、無人機、機器人及3D列印等新興科技的產生，並運用在不同的領域，不僅改變了人們的生活，也改變了產業及經濟發展模式。智慧城市、智慧能源、智慧醫療、金融科技、新農業、開放商業模式及循環經濟等議題相繼出現，如何利用這些科技技術及創新思維去接軌國際拓展新的商機，進而促進國家經濟發展，提升政府服務效能，是當前政府最重要的課題。

加拿大多倫多市舉辦之大數據及人工智慧年會及展覽會，每年匯集世界各地之專家學者就大數據及人工智慧相關領域之技術、理論、策略及創新運用主題，分2天160多場在7個會議場地同時進行分享，藉由此次參加「108年多倫多大數據及人工智慧年度會議及展覽會」，我們發現各國在大數據及人工智慧方面，都投入相當的資源去發展，新的技術及各方面的運用，不斷推陳出新，產業或商業服務運用早已緊密結合了前述二者技術，而在政府服務運用方面，包含交通、農業、環保、氣象、醫療、金融科技及飛航安全等，亦都運用結合了大數據及人工智慧，甚或是機器人。這些都是值得我們政府機關參考學習的地方。

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壹、緣起與目的

近年來由於大數據(Big data)、人工智慧(AI)及機器人等新興科技的產生，並運用在不同的領域，不僅改變了人們的生活創造出新的價值，也改變了國家產業與經濟發展並改變政府服務運用模式。

財政部財政資訊中心（本中心）為中央政府中唯一的三級資訊機關，掌管全國所有人民財產所得及賦稅資料，加以近幾年政府極力推動電子發票，所以本中心亦掌管有數以億計的電子發票資料（全國人民的消費資料），擁有這麼多種且又龐大又重要的資料，如何利用上述這些科技及創新思維去提升本中心的服務效能，並推陳民眾有感服務，自是本中心當前重要的工作和使命。

加拿大多倫多市舉辦之大數據及人工智慧年會及展覽會，每年匯集世界各地之專家學者就大數據及人工智慧相關領域進行分享，為瞭解世界各國大數據及人工智慧運用狀況，尤其是各國政府部門，應用這些新興科技創新服務民眾情形為何？因此派員參加此次會議，期望能藉由各國這方面的創新運用，作為本中心未來施政之借鏡。

貳、會議過程



本次「多倫多市舉辦之大數據及人工智慧年會及展覽會」會議日期及時間，是在多倫多當地時間6月12至13日共2日，在多倫多市捷運中心大樓會議中心舉行，每日上午8:30至下午17:30，共有來自世界各國大數據及人工智慧領域的150多位演講者，以及超過3000人來自各國各行各業的與會者，參加此盛會。

Our Speakers

June 12-13 2019

Speakers include: Ashish Gupta, Alysia Harvey Dawson, Monica Halaba, Brian Ho, Travis Aitinger, Rajar Singh Kohli, Eric Lee, Xiaoping Liu, Laura Mannes, Saheli Gupta, Ranson Hawley, Steve Hauer, Peter Hauer, Yifan Chen, Sacha Davis Mohapatra, Jean-François Lessard, David Lloyd, Darin Murray, Nehal Shah, Saeed Akbari Kocak, Steven Astorino, Christopher Berry, Ying Chen, Dan Dulan, Matt Gordon, Alex Goff, Dr. Weidong, Andrea Karim de Andrade, Deborah Joo, James Bask, Matthew Olshe, Rob Davidson, Madven Patel, Dr. Steve Frey, Robert W. (Bob) Gordon, Sam Ahmad, Zach Argeus, Helene Brauchstein, Rosario Caragna, Solway Collap, Dan Demers, Kevin Ferreira, Koen Gungorther, Madine Gutter, Rahaan Ahmed, Nuts Arnet, James Bergstra, Robert G. Chason, Greta Coudance, Jeff Dennis, Dominic Fortin, Inmar Golan, Rob Gunning, A. O'Brien, Danielsson, Benjamen, Alan Shalit, Sara Soldova, ryan Taylor, John Tullis, Waldner, Gull Ye, Salar Nazari, Scott Pinsky, Nilo Ravaei, Mirza Shah, Alex Shihler, Sarah Sun, Alexander Terato, Yegoruy Valis, Christian Weidbrook, Susanna Zagar, Symyala Pranga, Michael Roberts, Sita Shahabadi, Patrick Scouth, Patrick Surry, Dr. Stephen W. Thomas, Angela Van Damme, Eugene Wen, Irene Zhang.

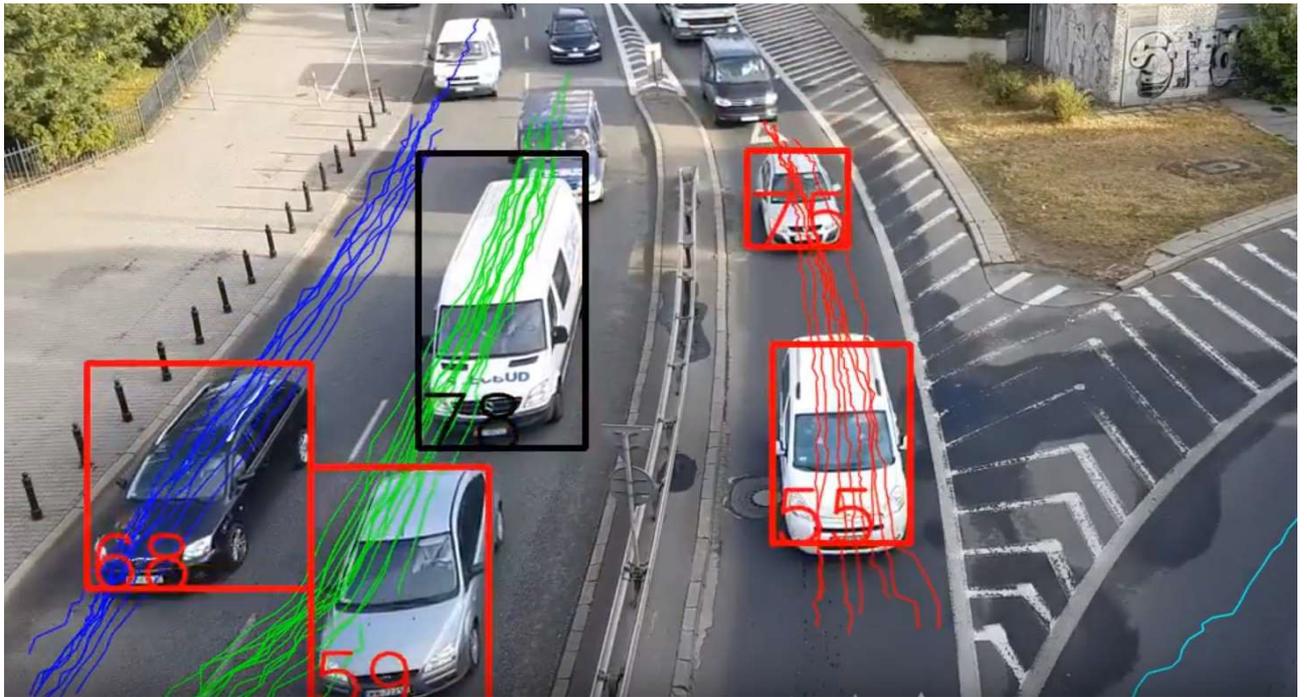
由於此次會議主題係以大數據及AI人工智慧相關策略、技術、應用服務及e政府應用方面，採分場地同時進行分享，故職只能就政府及財政相關運用主題與會。有關政府應用主題部分：多倫多市政府派員分享多倫多市政府各部門在大數據及AI人工智慧運用狀況；而其他運用主題部分：如飛行安全、票價預測、超市賣場行銷及金錢支付...等，將逐一分述如下：

BIGDATA Corp AITORONTO Corp June 12, 2019 - Morning						
Main Stage	Big Data Theatre	AI Theatre	Big Data Strategy (\$)	Big Data Technical (\$)	AI Strategy (\$)	AI Technical (\$)
Accelerate the Future	Innovations & Solutions	Innovations & Solutions	Internal Transformation	Big Data Analytics	Research in Practice	Cybersecurity
Keynote: Track The Future						
BIGDATA Corp AITORONTO Corp June 13, 2019 - Morning						
Main Stage	Big Data Theatre	AI Theatre	Big Data Strategy (\$)	Big Data Technical (\$)	AI Strategy (\$)	AI Technical (\$)
Canadian Innovation	Innovations & Solutions	Innovations & Solutions	Big Data Leadership	Tools & Platforms	International Opportunities	Models & Methods
Opening Keynote: The Future of Data Science						
Panel: Connected Ecosystem	Keynote: The Future of BI isn't a BI Tool	Industry Session led by V-Soft Labs		MASTERCLASS led by Hadoop Data Spark for Data Science		
Keynote: Blockchain Applied	Industry Session led by Segment	Industry Session to be announced soon	Track Keynote: Change Management	Track Keynote: Augmented Analytics and Its Role in Democratizing Data Science	Track Keynote: Global AI Market Analysis	Using Distributed Computing to Do ML, Inference in the Home Edge
Keynote: Taking the Next Steps in E-Governance	Industry Session led by Astra Software - Accelerating Data Warehousing with Centigrade Data Integrator	Industry Session to be announced soon	Industry Session led by CAPS Group	NextGen Big Data Platforms	International Case Study	Consumer Airfare Prediction and Other Big Data Challenges at Hopper
Keynote: Hyper Focused Customer Journey	Industry Session led by Segment	Industry Session to be announced soon	Industry Session led by CAPS Group	Industry Session	International AI Panel	Industry Session
Networking Lunch	Networking Lunch	Networking Lunch	Networking Lunch	Networking Lunch	Networking Lunch	Networking Lunch

BIGDATA Corp AITORONTO Corp June 12, 2019 - Afternoon						
Main Stage	Big Data Theatre	AI Theatre	Big Data Strategy (\$)	Big Data Technical (\$)	AI Strategy (\$)	AI Technical (\$)
Accelerate the Future	Innovations & Solutions	Innovations & Solutions	Internal Transformation	Big Data Analytics	Research in Practice	Cybersecurity
Keynote: The Art of the Future	Industry Session led by Verica	Industry Session led by Adasta	Industry Session led by Proxify	Panel: Intelligent Decision Making	International Case Study	Panel: Shifting Towards a Purpose-Driven Environment
Keynote: Data for Good	Industry Session led by Verica	Industry Session led by Adasta	Industry Session led by Proxify	Panel: Intelligent Decision Making	International Case Study	Panel: Shifting Towards a Purpose-Driven Environment
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Keynote: Data for Good	Industry Session led by Verica	Industry Session led by Adasta	Industry Session led by Proxify	Panel: Intelligent Decision Making	International Case Study	Panel: Shifting Towards a Purpose-Driven Environment

一、政府服務運用：

多倫多市政府在大數據及AI人工智慧運用方面相當廣泛：包含
交通方面：在公路上偵測前後車輛的速度及前後車的距離，將這些數據傳回後端演算經和大數據比對，可精確預測每個車道交通流量狀況，以及預測稍後可能產生的交通瓶頸，據此可以事先採取導流或其他交通管制措施。

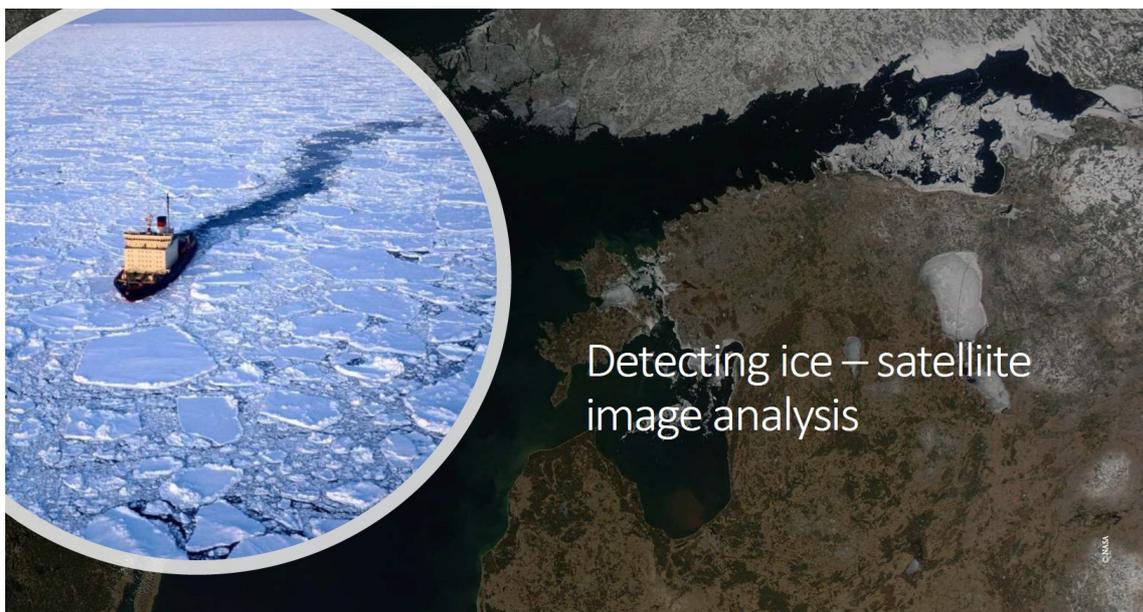


在環境保護方面：首先由志工或環保工作人員於前端做資料蒐集之工作，在湖邊或海邊的沙灘上將各種不同的垃圾，分別予以照相採樣，再將這些相片匯入大數據資料庫，經由大數據的分析，對各種垃圾產生相對應特徵數據，並利用大數據資料庫及AI人工智慧，結合裝設於機器人上，最後派遣這些機器人至湖邊或海邊的沙灘上清理垃圾，很驚訝的是！從影片中可看到機器人透過眼睛看到沙灘上任何大小物品，經由機器人本身的AI人工智慧系統及資料庫，可以很精確的判斷是不是圾垃，並將垃圾撿拾。利用機器人清理沙灘，不僅快速且節省很多人力，這對幅員遼濶的多倫多湖邊清理是一項很大幫助和效益。

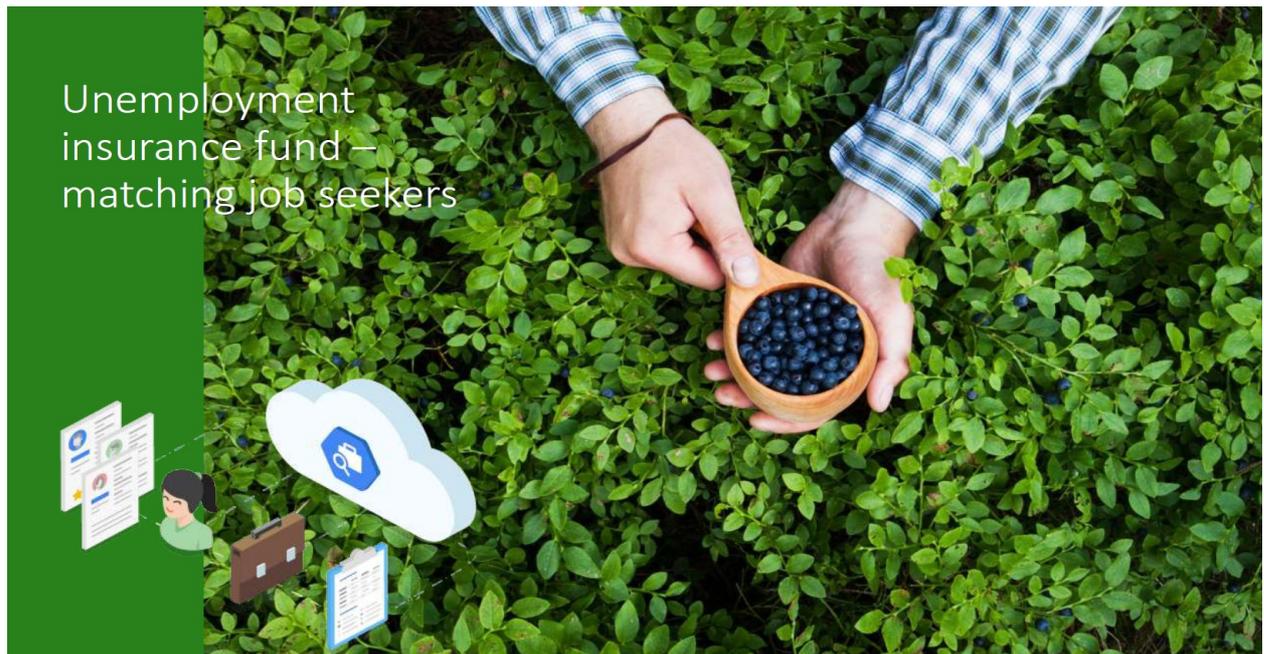
On-going: Garbage detection



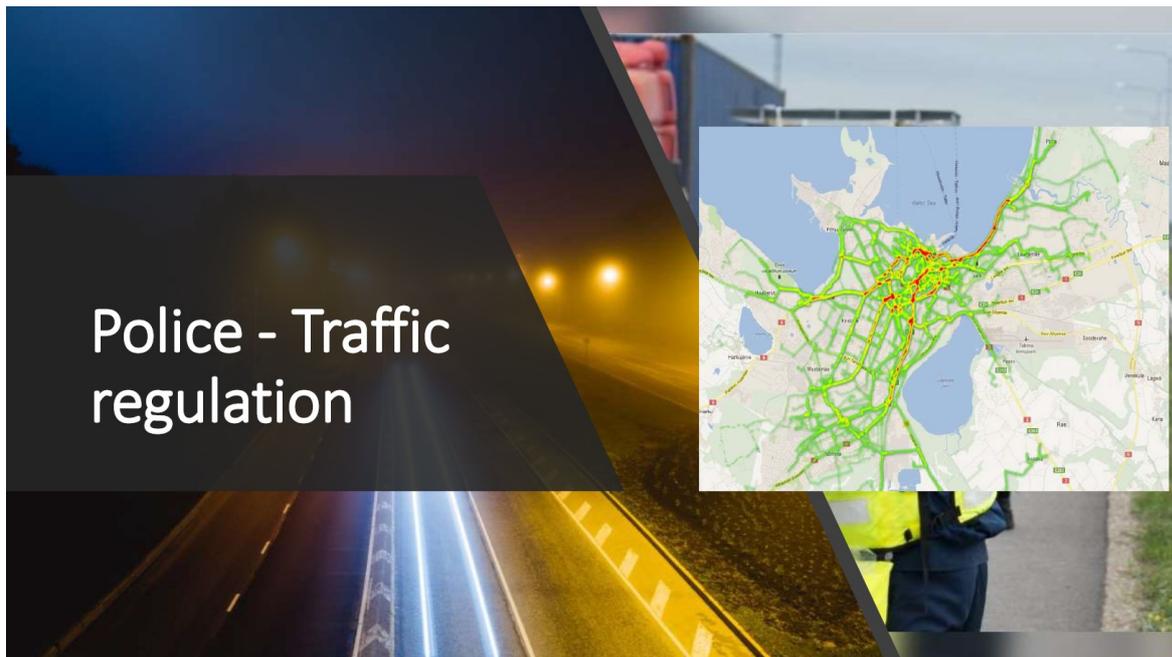
冰河偵測：對於地球暖化影響北極冰河融化問題，加拿大政府收集衛星影像資料，利用大數據比對分析這些冰河前後時間的影像及各種暖化數值，即可瞭解冰河融化的程度和速度，並預測冰河融化的趨勢，做為政府決策參考。



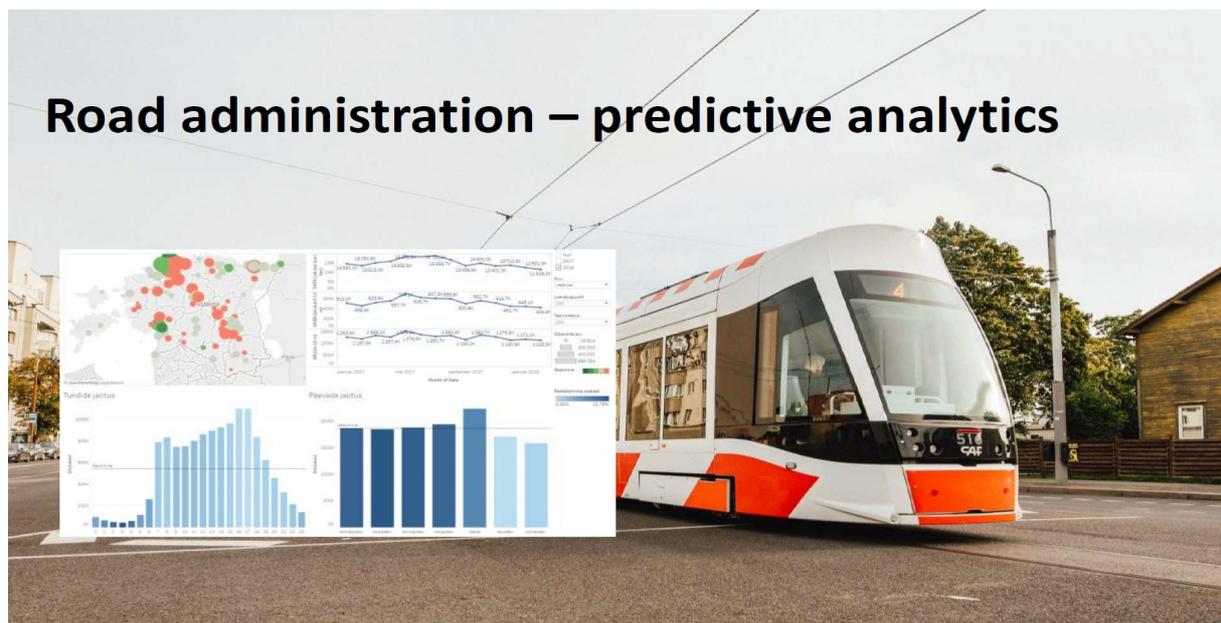
農業應用：利用大數據來收集並分析農作物每個生長時段，所需的溫溼度、陽光及各種會影響它生長之環境因素，再結合AI人工智慧來控制提供這些農作物所需的參數，增加農作物的收成和品質。除此也利用大數據及AI人工智慧結合機器人，用在農作物的採收方面，由簡報的影片中，可以發現機器人在採收農作物時，能精準的分辨出成熟的農作物，並予以採收，值得一提是在大數據的分析下，機器人的採收力道也是精準無誤不傷及農作物表皮。



警察交通流量規劃：隨著城市經濟的發展，城市交通需求量急劇增長，城市交通問題日趨嚴重，為了解決城市交通問題，多倫多交通警察亦利用大數據及AI人工智慧來做交通的規劃管理。藉由每條路及路口的交通流量，做長時段的收集和分析，就可以瞭解那個路口那個時段會塞車，再利AI人工智慧規劃出分散交通流量的最佳路線，作為多倫多整體交通路線規劃。除此並透過物聯網及車速大數據分析，動態調整控制路口之交通號誌，隨時調整車流量，達到管制交通目的。



道路管理預測分析：多倫多市政府透過大數據及AI人工智慧，結合交通與氣候資料庫，對每個道路車流狀況做資料收集分析，以瞭解每個道路每個時段流量的變化，並依據這些變化去預測未來道路車流量的變化，除此並結合路段氣候狀況，對於大雨或危害行車安全路段，會在交通路線圖上示警行車人注意，並機動更改建議新的行車路線。



在醫療方面：運用大數據及AI人工智慧，對各種病狀做分析，如對心臟驟停原因分析，並探究其影響因素及相關參數，以做為相關病患預先示警或治療之參考。

Ongoing project – Cardiac arrest



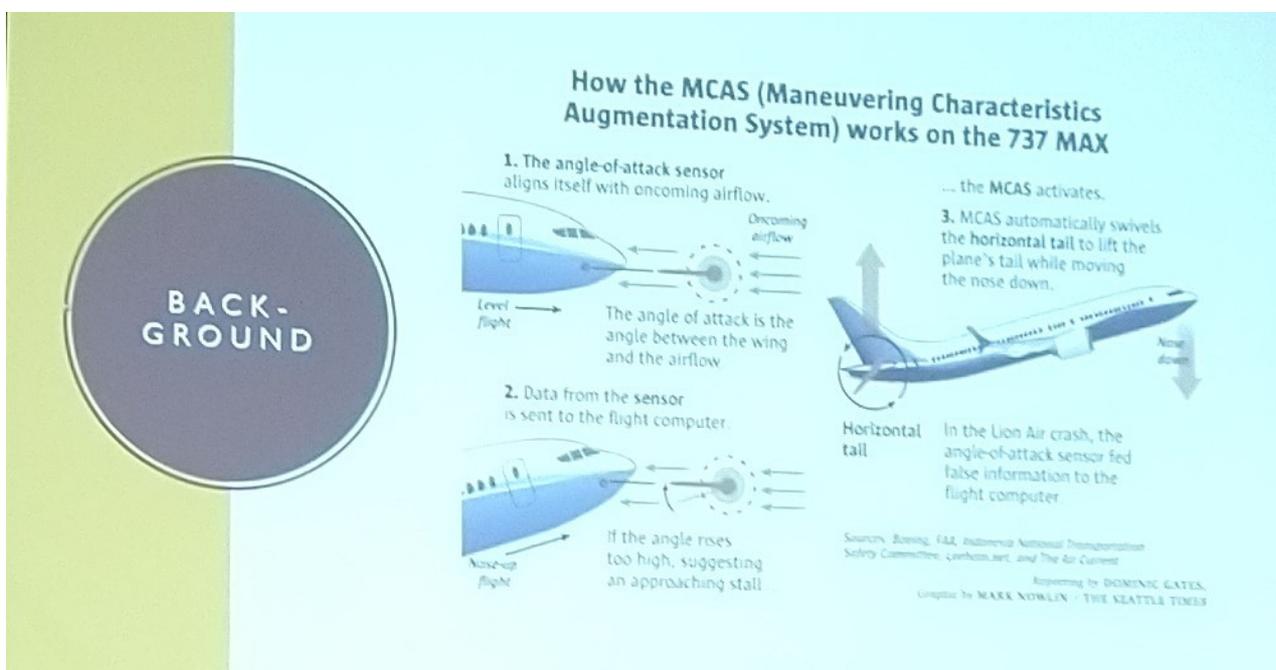
犯罪預防：大數據及AI人工智慧也常被政府警察單位用來預防犯罪或是罪犯的追蹤，例如利用犯罪案件及贓車資料庫，經由大數據和AI人工智慧分析找尋可疑的人、車以預防犯罪的發生。或是事件發生時，利用各街頭攝影機的影像資料庫，追蹤嫌疑犯的去向。



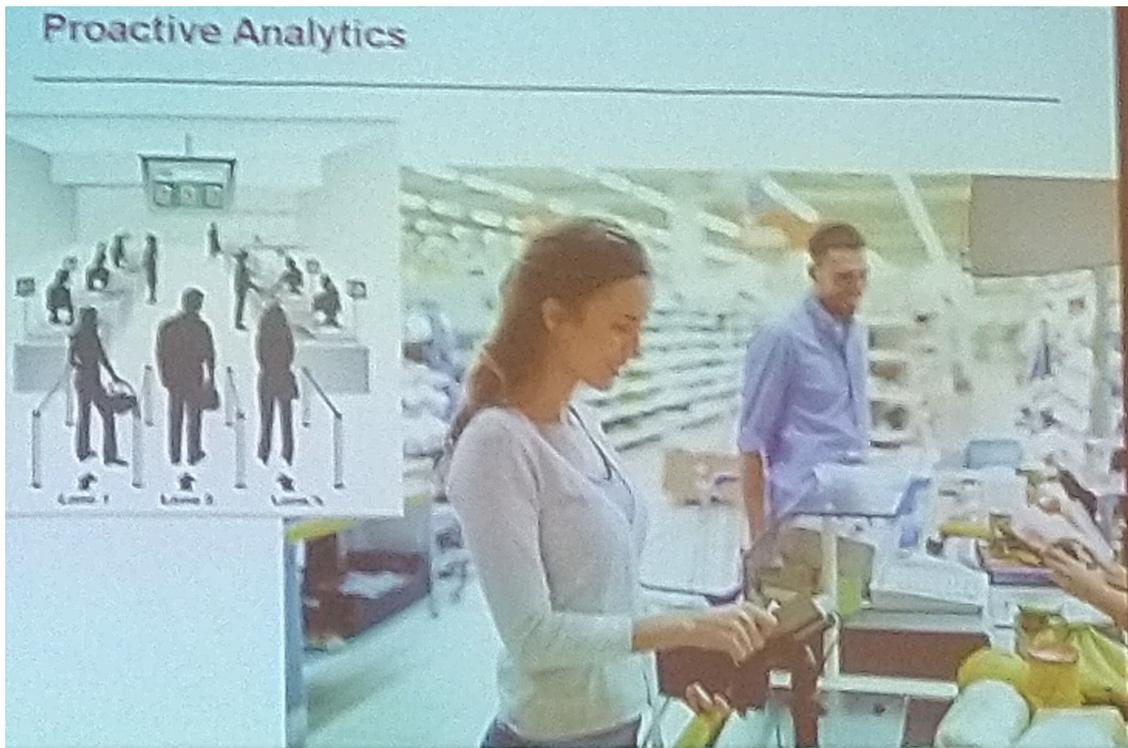
二、其他產業服務運用：

大數據及AI人工智慧除在政府各項服務廣泛運用外，在其他產業或民間服務也被大量的使用

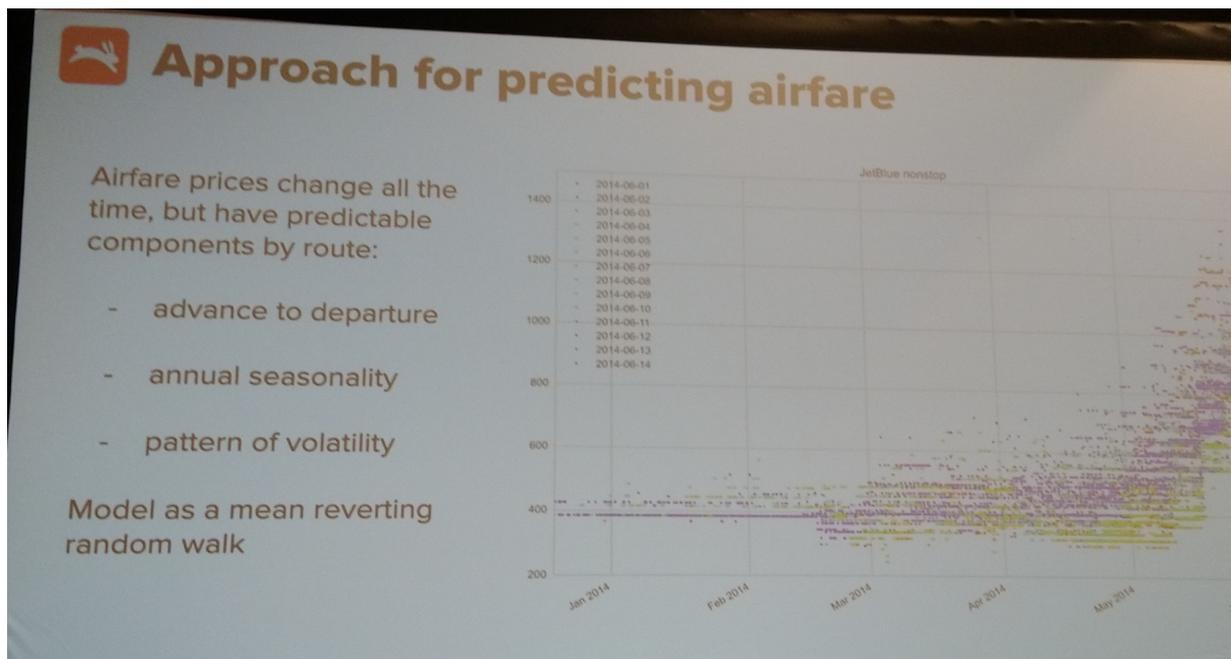
增強飛航安全運用：例如在波音737的機動性增強系統MCAS（Maneuvering Characteristics Augmentation System）即利用大數據及AI人工智慧來分析防止飛機在起飛爬升、襟翼縮回或低速飛行等特定狀況時引發失速。MCAS使用單一攻角感測器數據，搭配空速、飛行高度等數據來判斷飛機是否即將進入失速狀態，然後通過調整機尾安定面配平強制將機頭下壓。



在超市和賣場的運用：利用人臉辨識系統，辨識進入消費之消費者後，利用大數據及A I人工智慧分析該消費者以往的消費喜好，並以手機簡訊直接引導他（她）到有興趣的商品區予以促銷。而有些無人商店更以人臉辨識及大數據分析連結支付系統，在確認消費者身份後直接支付款項。



機票票價預測系統：它是收集之前各年度，該國國內各航空公司，飛往各目的地城市，每天顧客所買的飛機票價，組成一資料庫，然後以大數據及AI人工智慧去分析每天的票價的走向是漲是跌，並預測未來機票的漲跌，讓顧客可以在最佳的時點買到最便宜的機票。





機票購票預測系統，是參加此次會議中，另一個讓自己印象最為深刻的地方，目前在台灣並沒有看到這樣的系統，它是收集之前各年度，該國國內各航空公司，飛往各目的地城市，每天顧客所買的飛機票價，變成一個資料庫，然後利用大數據去分析每天票價漲跌走向趨勢，並預測每天機票的漲跌，讓顧客可以在最佳的時點買到最便宜的機票。這個情形讓人聯想到股票系統，係依買賣當時買家的多寡來決定股價，並影響股票的走向趨勢，也讓人明白，機票並非越早買越好，而是適當的時機。另機票票價預測系統，是依據每一筆顧客的實際購買票價，所建立而成的資料庫系統，這讓我想到我們財政資訊中心的電子發票系統，也是消費者一筆筆真實交易所構成，未來是否可以仿效機票預測系統，利用大數據分析每項產品或原物料，其價格的變動及購買人數變化情形，去預測每項商品及原物料（尤其是重要的民生用品）的漲跌及走向，以作為決策者調節供需或政策介入之參考。

而從這次會議分享的大數據和AI人工智慧應用案例來看，我們也發現，大數據要能發揮其最大的效用與價值，僅靠單一領域的資料庫是不夠的，需跨領

域結合不同的資料庫，才能發揮其最大的創新效益，為人類生活服務品值或政府服務帶來更高的創新價值！所以在未來，財政資訊中心電子發票資料庫，要能發揮其創新價值，一定需結合不同的資料庫，如現在衛福部的食品雲，環保署的化學雲，農委會的農業資料庫，甚或警政署的人臉辨識系統，氣象局的氣象資料，健保署的健保資料，則無論是在協助食品安全的追蹤、國家新農業的發展、國人健康和消費行為的分析、流行疾病的預防，甚或協助犯罪的追查，必能發揮其創新的價值！

而在稅務資料的運用上，如能結合大數據和AI人工智慧，並結合行動支付的金流及消費資訊的電子發票等不同資料庫，則無論在稅務的查審運用效能上、稅務服務品質上以及擴展稅務財源上（將地下經濟台面化）將會有其創新的突破和價值。

而在這次會議上大數據和AI人工智慧資安的議題上，因會議場次分場衝突及時間關係，對於資料應用的資安議題並沒有太多分享，而自己所參與大數據資安議題場次部分，其資安防護仍著重在大數據底層的資料庫或演算法則上，是參加這次會議稍嫌不足的地方，惟各國在創新及資安問題上，面臨同樣的問題，就是這些大數據、AI人工智慧、金融科技及物聯網…等創新運用和資安議題的平衡點，究竟為何？各國仍未有共同的結論與標準，這是各國在推展大數據和AI人工智慧時，所必須注意的問題！

肆、附錄

Competition Bureau Canada / Bureau de la concurrence Canada

Canada

Big Data and Antitrust

Anthony Durocher
Big Data Toronto – June 13, 2019



Competition Matters

Drives Innovation and Productivity



Competition Bureau

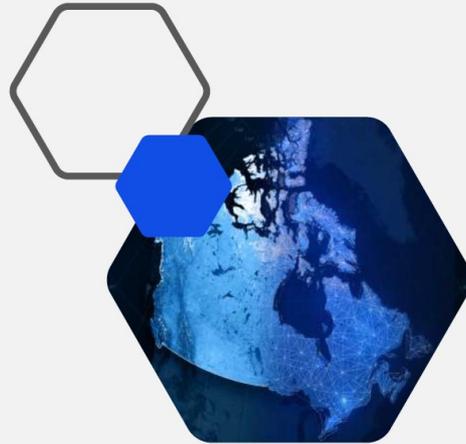
Independent Law Enforcement Agency

Advocacy

- Targeting government regulations or policies that create barriers to competition

Enforcement

- Merger review
- Abuse of dominance
- Cartels
- Deceptive marketing practices



3

Government Regulation

Identifying Barriers to Competition



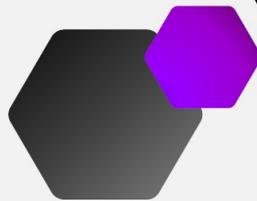
4

Toronto Real Estate Board Case

Enabling Data-driven Innovation in Real Estate

“Today’s ruling is a decisive victory for competition, innovation and for consumers. By removing TREB’s anti-competitive restrictions, home buyers and sellers in the GTA will now have greater access to information and innovative real estate services when making one of the most significant financial decisions of their lives.”

Matthew Boswell
Commissioner of Competition



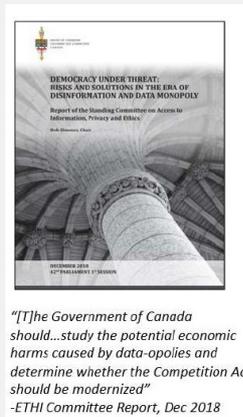
5

Antitrust in the Digital Era

The Public Discourse



“The world’s most valuable resource is no longer oil, but data...The data economy demands a new approach to antitrust rules”
- The Economist, May 2017



“[T]he Government of Canada should...study the potential economic harms caused by data-opolies and determine whether the Competition Act should be modernized”
-ETHI Committee Report, Dec 2018

As tech giants grow ever more powerful, Canada and others are under pressure to act

As tech companies grow ever more powerful, countries such as Canada must decide how to protect the public without turning away economic benefits

NEWS Feb 23, 2019 by Michael Lewis Toronto Star

Bank of Canada warns of dangers of leaving ‘superstar’ tech giants unchecked

Carolyn Wilkins is warning about the risks related to the growing dominance of a handful of big firms, especially their monopoly over user data.

FINANCIAL POST

“[Wilkins] lays out several possible solutions like modernizing anti-trust and competition policy as well as exploring data-ownership rules, such as giving users control over their own data.” -The Financial Post, Feb 2018

6

The Rise of the Tech Giant

Network-driven platforms

Digital Platforms

- Serve as an intermediary between different groups of users

Network effects

- Users of a platform benefit more as others increase their consumption

“70% of value in tech is driven by network effects”

- NFX, Silicon Valley venture capital firm



Canada's Digital Charter

Principle #6: A Level Playing Field

“The Government of Canada will ensure fair competition in the online marketplace to facilitate the growth of Canadian businesses and affirm Canada's leadership on digital and data innovation, while protecting Canadian consumers from market abuses.”



enter e-Estonia
the coolest digital society

Taking the next step in e-governance

Ott Velsberg

Chief Data Officer of Estonian Government

Ott.Velsberg@mkm.ee

„AI taskforce“

- **Period:** August 2018 – May 2019
- **Proposals** for policy measures
- **Substantial** changes not required
- **Areas:**
 - public sector
 - private sector
 - legal
 - education

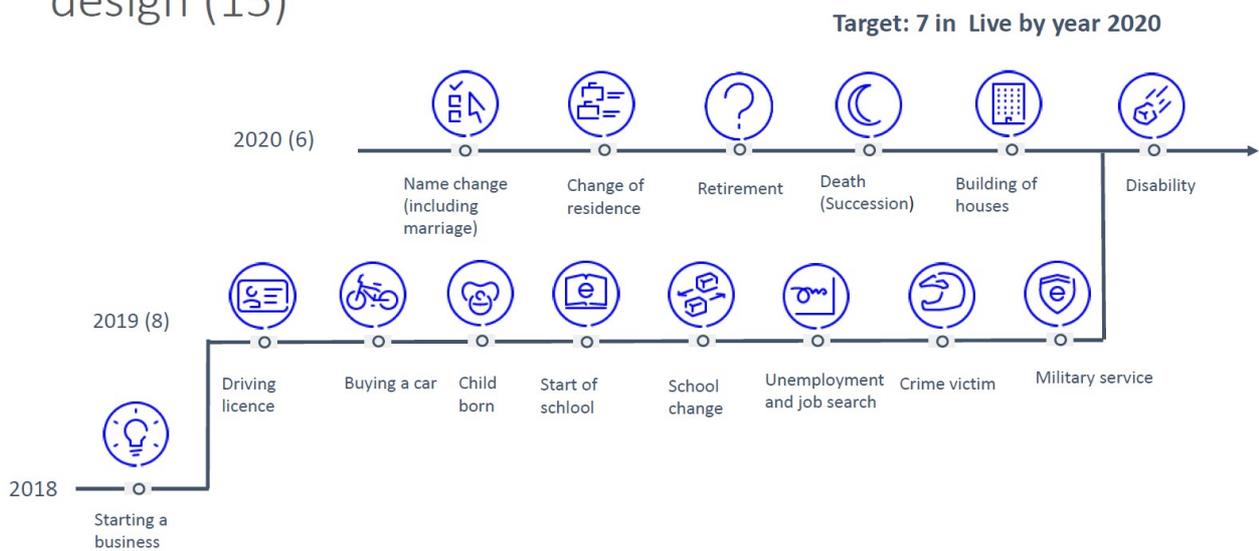


Why AI?

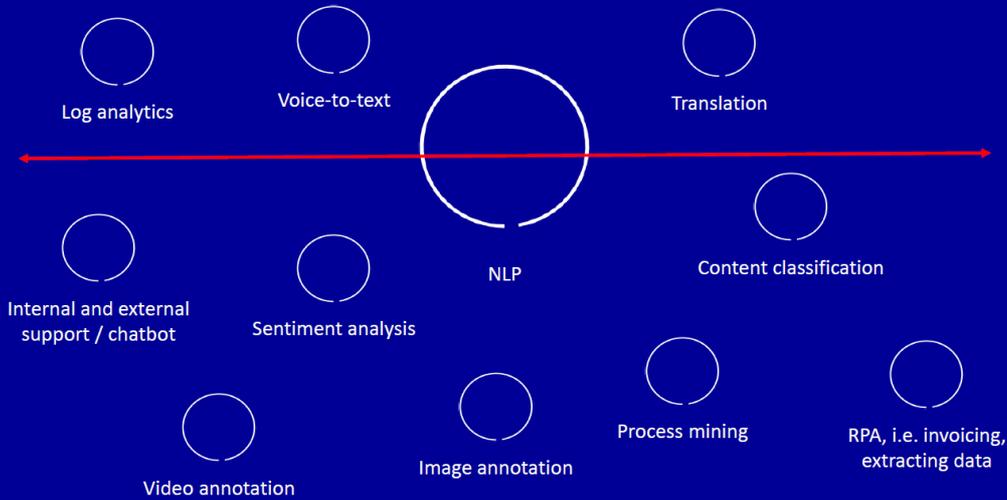
- + Proactive government
- + Invisible personalized services
- + Challenge of the Estonian economy: declining population

© Piret Mägi

Action plan for life-event service design (15)



Centrally provided components



Current AI projects: 16 live

TARGET:
50 LIVE BY YEAR 2020

On-going projects: 14

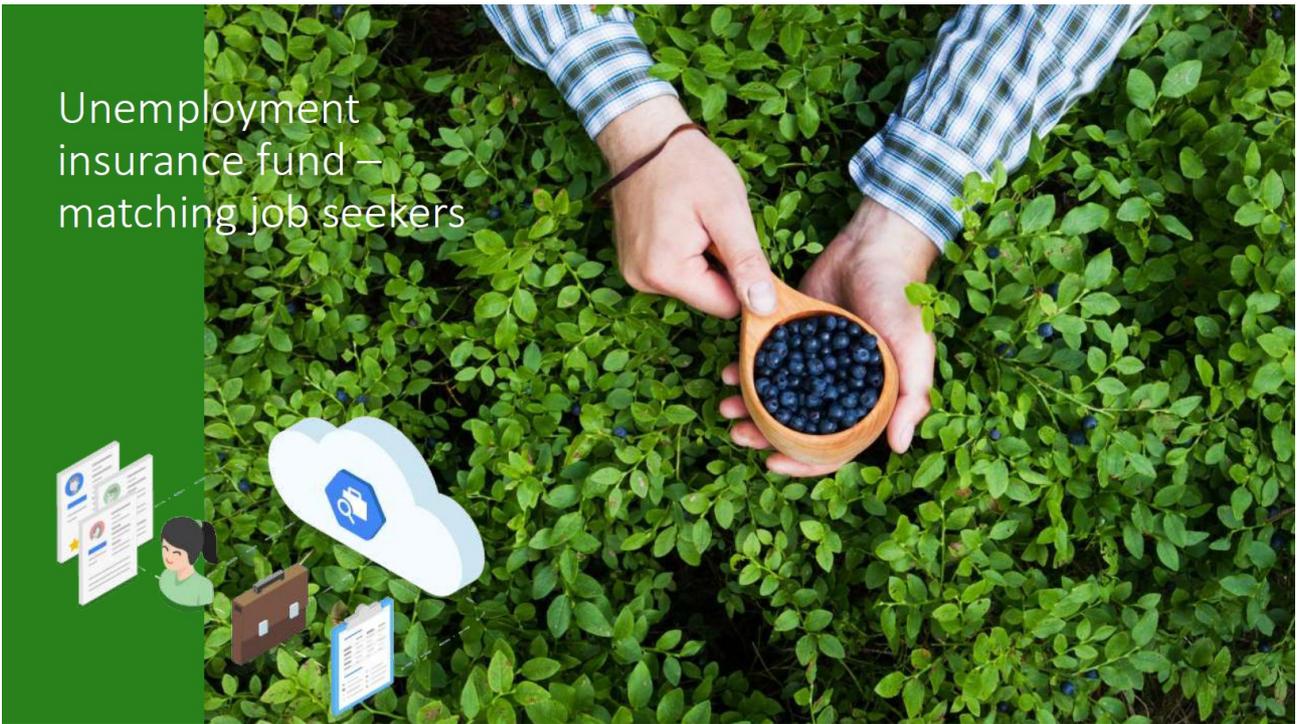


Cross sectoral approach

Examples:

	Transportation	Security	Human resources	Agriculture	Customer support	Healthcare	Justice
Live projects	Traffic violations	Cyber incidents	Job matching	Mowing detection	Chatbot	Risk-stratification	Speech-to-text
On-going projects	Route optimization	National security	Employee planning	Species composition map	Cardiac arrest	Speech-to-text triage	Legal proceedings

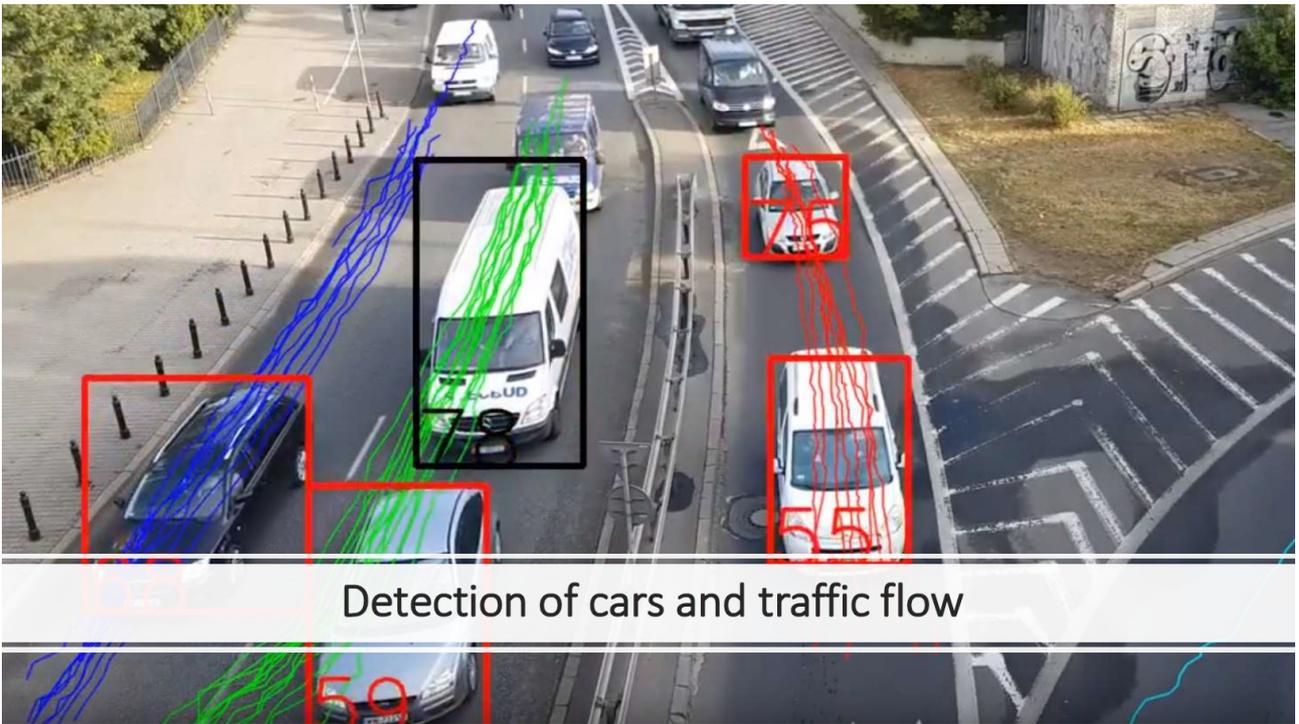
Unemployment insurance fund – matching job seekers



Agriculture – satellite image analysis

- Detection of cutting hay
- No need for on-site inspections





Predicting anomalies from x-road



Now incidents

Constraints

clientMemberClass equal GOV [Add constraint](#)

[Clear constraints](#) [Update](#)

[Mark all as incidents](#) [Mark all as viewed](#) [Mark all as normal](#) [Unmark all](#) [Save changes](#)

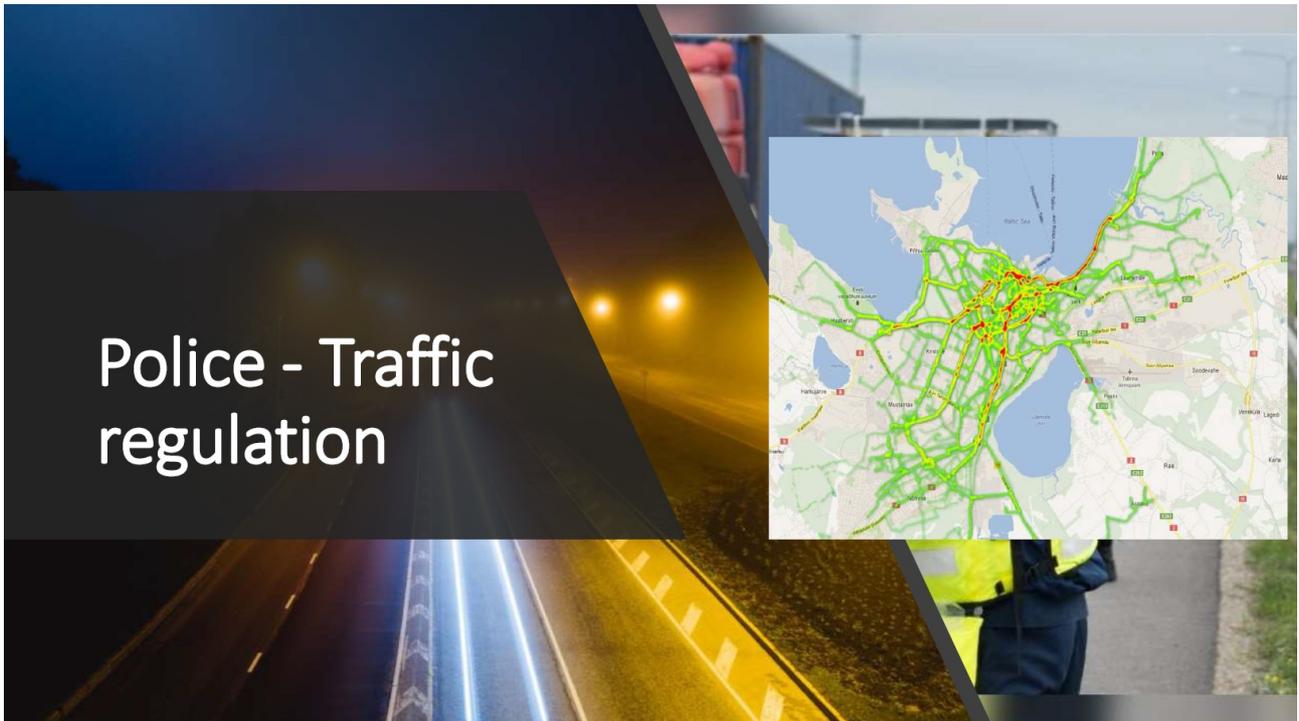
Expand/collapse service call

Show 10 entries

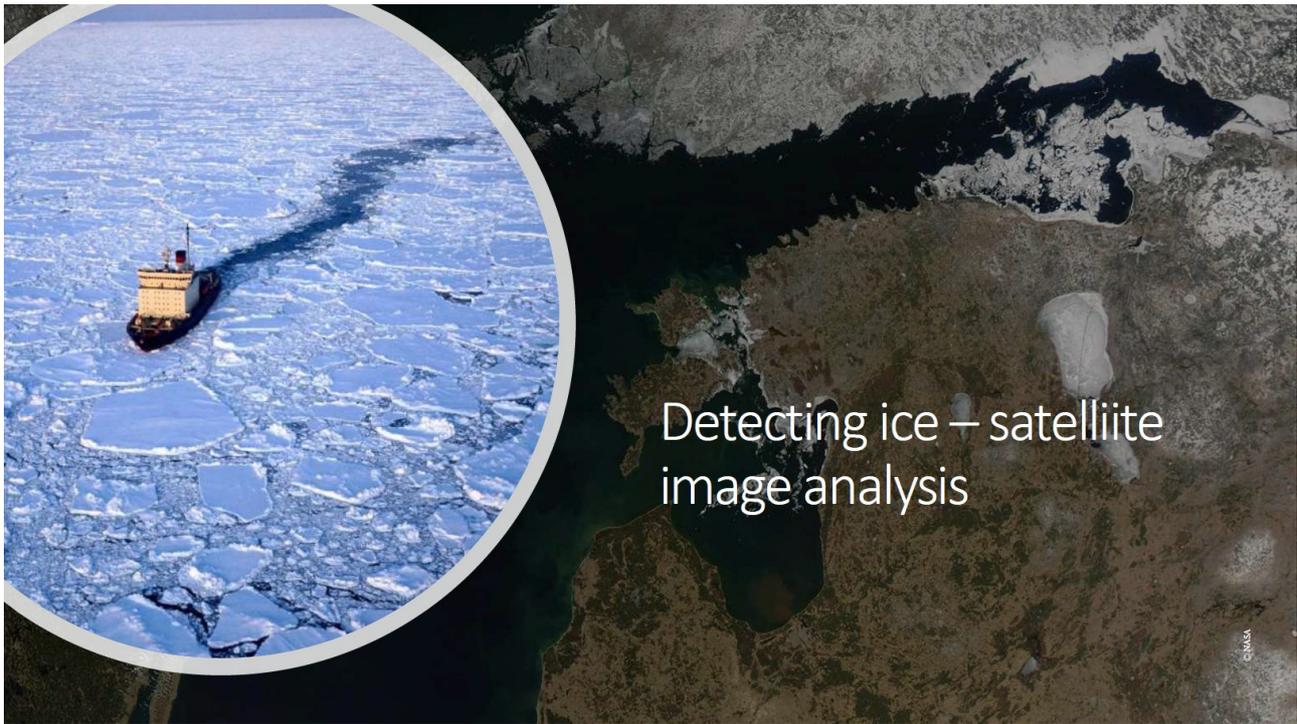
Service call	anomalous metric	anomaly confidence	period start time	aggregation timeunit	monitored metric value	difference from normal	request count	description	incident status	incident update timestamp	Actions	Mark as
COM 11338578 ee-dev testClient-01 esirabo_v1 v1 GOV 70000310 ee-dev aiiereg	mean_response_size	0.97	Sat 2017-07-08 00:00	day	2644.25	765.0	31569	Average mean_response_size per day on Saturdays is 1858.45, but observed mean_response_size was 2644.25.	normal	Fri 2017-09-29 12:22	See examples Filter similar	Incident Viewed Normal

Showing 1 to 1 of 1 entries

Previous 1 Next [Save changes](#)



Police - Traffic regulation



Detecting ice – satellite image analysis

Chatbot for customer service




CUSTOMER
SUPPORT
AUTOMATION


INFORMATION
EXTRACTION


DMS AUDIT


DOCUMENT
RECOMMENDATION

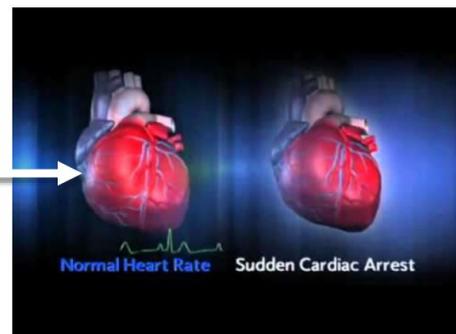
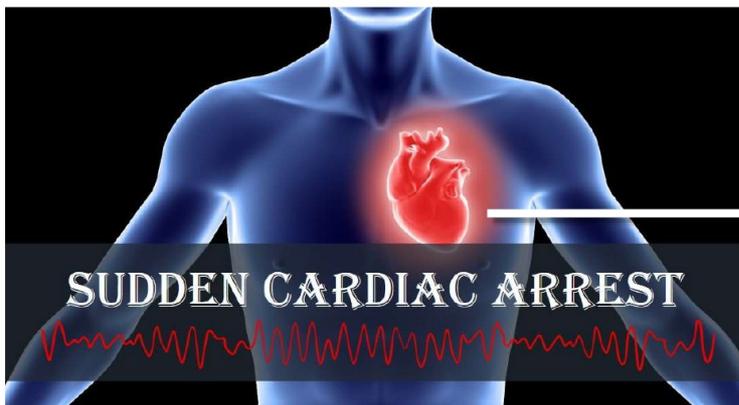

DETECT TEXT
FROM IMAGES


DOCUMENT
CLASSIFICATION


SENTIMENT
ANALYSIS


DATA
VISUALIZATION

Ongoing project – Cardiac arrest





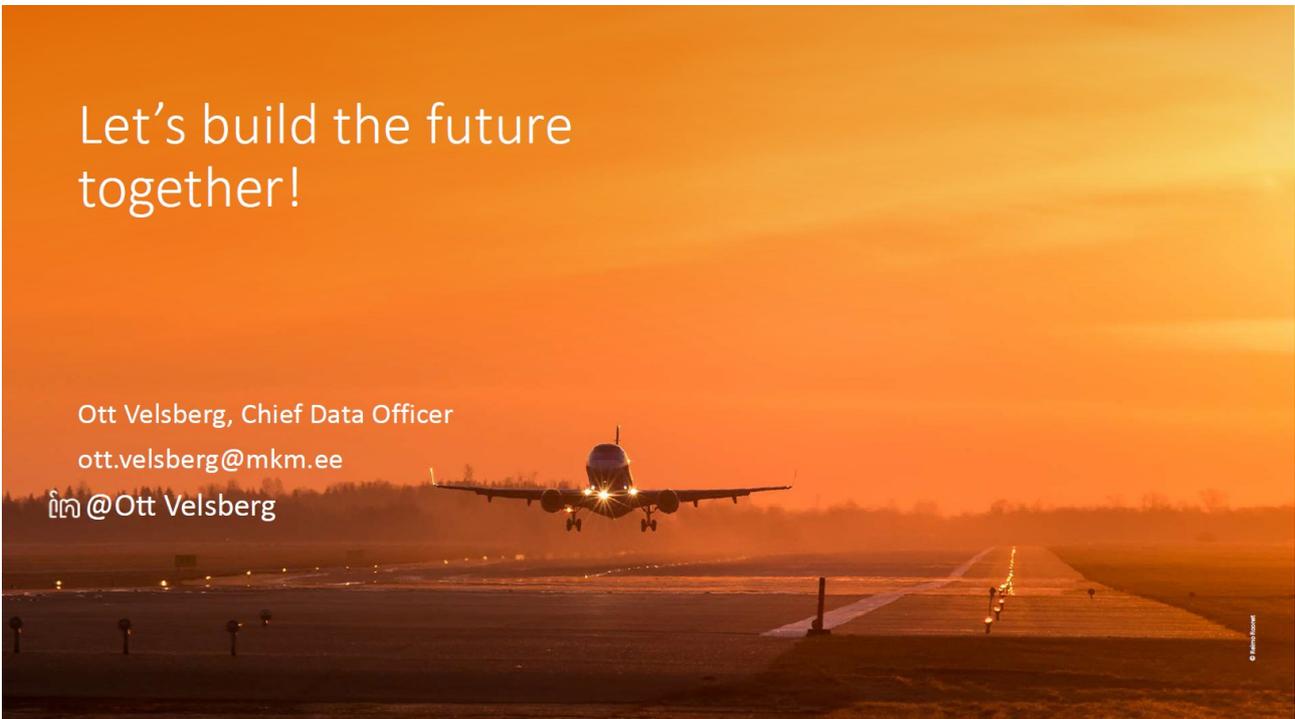
Ongoing project – Speaker identification system



Ongoing project – Crime prevention



Ongoing project - Robot judge



Let's build the future
together!

Ott Velsberg, Chief Data Officer

ott.velsberg@mkm.ee

[LinkedIn](#) @Ott Velsberg