

# Accelerating the Adoption of AI in the Government of Canada

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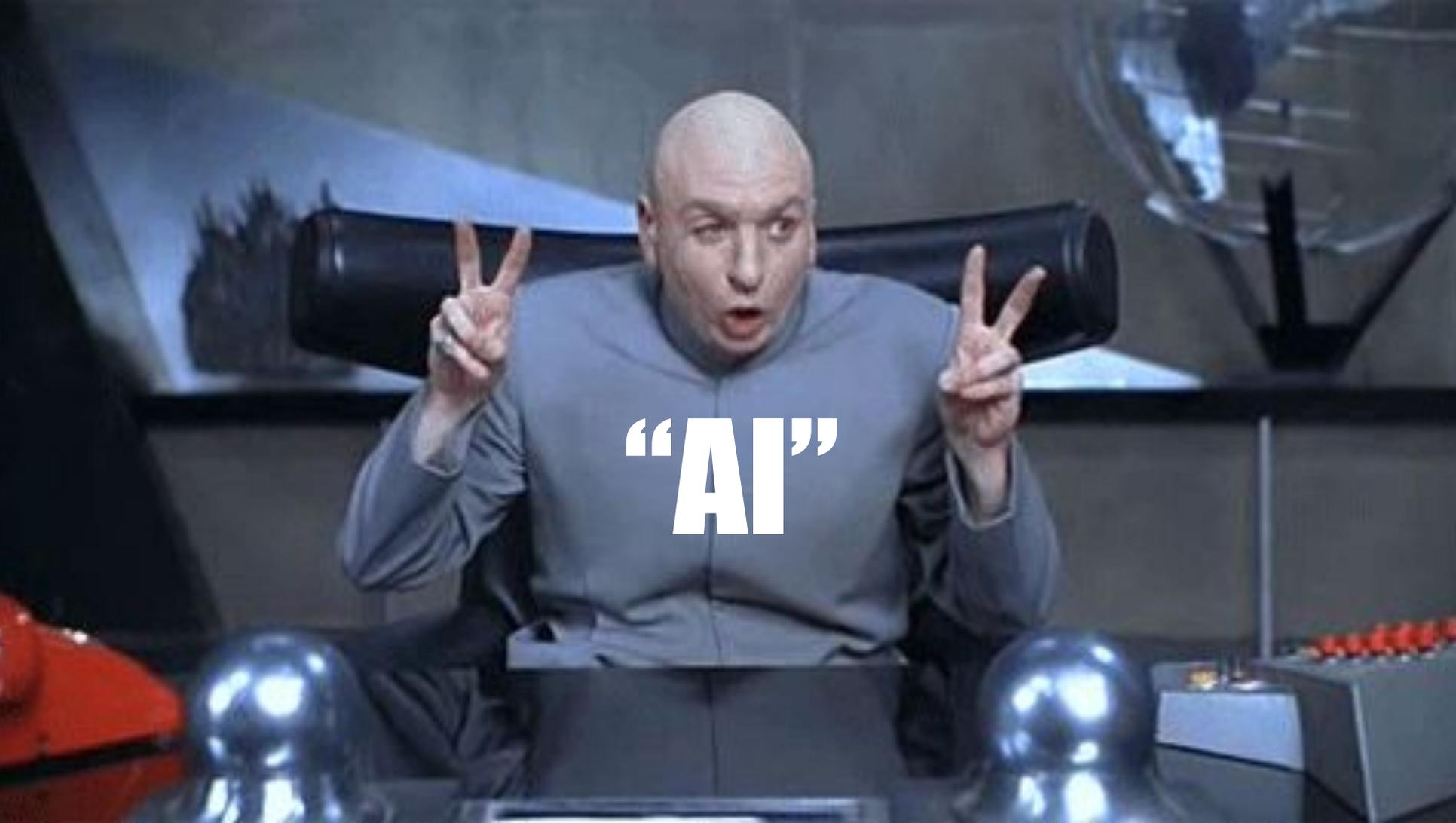
# Outline



**GC context for AI  
Challenges  
The NRC and the AI Accelerator  
Lessons learned & examples of projects**



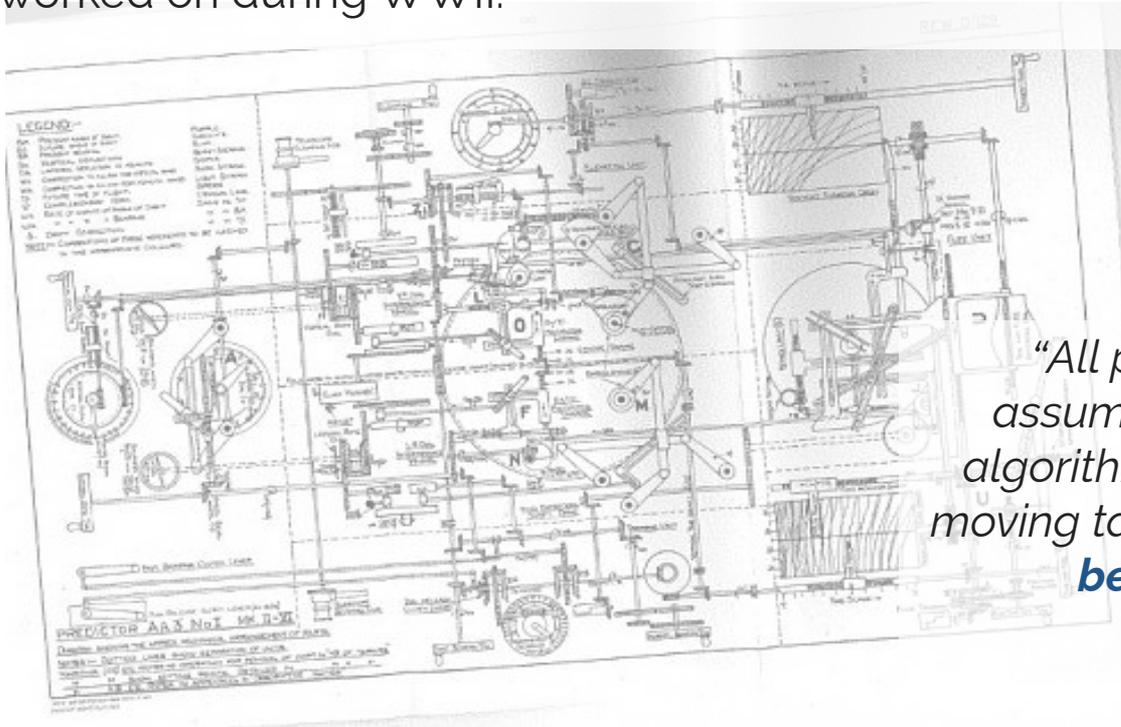
**Questions / discussion**

A still from the movie "Dr. Strangelove or: How I Learned to Stop Worrying and Love the Bomb" showing the character Dr. Strangelove. He is bald, has a wide-eyed, crazed expression, and is wearing a grey military uniform. He is holding a large black cylindrical object (a nuclear missile) on his shoulders and making peace signs with both hands. The background is a control room with various dials and equipment.

**“AI”**

# AI in the Government of Canada... Not a new thing!

Dr. George Lindsey's recollections on **predictors** (automated anti-aircraft fire-control systems) that he worked on during WWII.



*“All predictors had to be provided with an assumption (which would now be called an algorithm) regarding the future motion of the moving target [...] **Today such problems would be classified as artificial intelligence.**”*

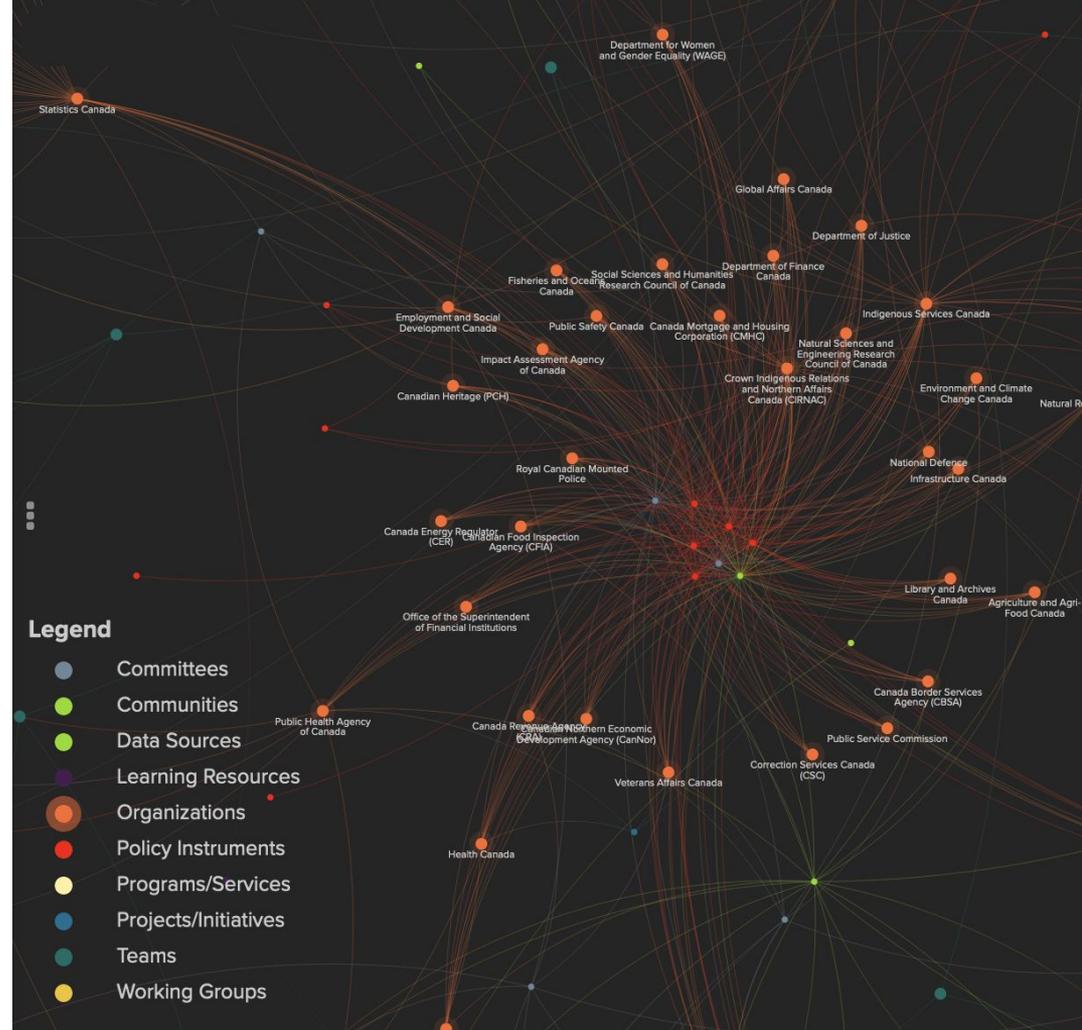
G. Lindsey, Canadian Military History, Volume 4, Issue 2, 2012

# The Government of Canada is in the midst of an ambitious digital transformation

- Several strategic objectives set in:
  - [Digital Government Strategy \(2021\)](#)
  - [Digital Operations Strategic Plan \(2021\)](#)
  - [Policy on Service & Digital \(2020\)](#)
  - [Data Strategy Roadmap \(2018\)](#)
- This transformation means changing traditional business models and will require **new expertise**
- It will also require new ways of exploiting an exponentially-growing amount of data using **analytics and AI**

# The GC data ecosystem is growing rapidly

- Several new data-centric organisations established over the last few years.
- Also created: new communities of practice, programs, policy instruments, working groups, etc.



Source: GC Data Community, Interactive beta version available at <https://kumu.io/GCDataTeam/gc-data-ecosystem-project-fall-2021-r2>

# Some challenges...

- **Pace of digital transformation** very asymmetric
- **Data maturity** (governance, quality, literacy, etc.) varying widely from one department to another
- **Talent** recruitment & retention
- **Moving from data strategies to data operations**

# NATIONAL RESEARCH COUNCIL

## WHAT WE DO

**WE ADVANCE  
SCIENTIFIC  
AND TECHNICAL  
KNOWLEDGE**

**WE DELIVER  
SOLUTIONS FOR  
GOVERNMENT**

**WE SUPPORT  
BUSINESS  
INNOVATION**

# NRC Digital Technologies



We make digital technologies smarter and more intuitive by exploring innovative uses of data to solve real problems



100+  
SPECIALISTS

30+  
YEARS OF EXPERIENCE IN AI



Wide network of world-class experts from top universities and leading institutes

# NRC recent support to GC

## Helping organisations enter the data space

- Measuring data literacy – *DND*
- Data strategy – *Translation Bureau*
- Defining and adopting a data culture – *CTA*
- Automated AI tool assessment – *DND*

## Improving situational awareness

- Virus outbreak detection – *PHAC*
- Illicit drug outbreak detection – *HC*
- Diplomacy insight situational awareness platform – *GAC*
- Intelligence on animal, plant & human hazards – *CFIA*
- Early warning of emerging technologies – *DND*
- Machine learning for nuclear forensics – *CNSC*

## Using AI and IoT for maintenance

- Machine learning and causal inference for Frigate maintenance – *DND*
- Ride quality modelling – *Via Rail*
- Legacy equipment digitization – *NRC*

## Augmenting internal service delivery

- Machine-assisted treaty annotation – *PCH*
- Improved routing of visa applications – *IRCC*
- Security clearance aftercare – *PSPC*
- Capital project portfolio optimization – *DND*

## Better managing human capital

- Causal analysis of the Public Service Employee Survey results – *Multiple depts*
- Data analytics of diversity and inclusion in hiring – *NRC*
- Analytics of HR cases in ASSYST – *NRC*

## Translating and processing text

- Computed-assisted translation – *Multiple depts*
- Language comprehension tool – *Translation Bureau*

... and many more!

## COLLABORATION CENTRES

Colocating researchers and equipment with university, industry, and other government organization partners to support research excellence in areas in which Canada can excel.

### Examples of interest:

- NRC Waterloo  
Collaboration on AI, IoT, and Cybersecurity
- CIC-NRC Cybersecurity  
Collaboration Consortium:  
Fredericton

# SUPPORT TO CANADA'S INNOVATION SUPERCLUSTERS

## Examples of interest:

- AI for Logistics Program (support to Scale AI supercluster)
- Collaboration Program to support Digital Technology supercluster

## CHALLENGE PROGRAMS

Partnering with private and public sector, academic and other research organizations to advance transformative, **high-risk, high-reward research** that address Canadian priorities.

### Examples of interest:

- High-Throughput and Secure Networks
- Artificial Intelligence for Design
- Aging in Place
- Internet of Things: Quantum Sensors

# AI ACCELERATOR

Delivering **impactful, innovative, and responsible AI solutions** and advice supporting the Government of Canada's digital transformation

# The accelerator's operating model



## 1. INITIAL DISCUSSION

**Talk to us!**

**When:** Anytime!



## 2. EXPLORATION

**We scope the problem with the client and explore the data**

**Duration:** Typically up to 5 days

**Cost:** free!

**Result(s):** use case identification, feasibility assessment, recommendations



## 3. SOLUTION

**We develop a user-centric solution with the client**

**Duration:** Typically 3-6 months

**Cost:** recovered

**Result(s):** model, prototype, MVP, technical report, strategy, algorithmic bias assessment

# A few lessons from the trenches...



# Lesson #1: Adopting AI in government is hard

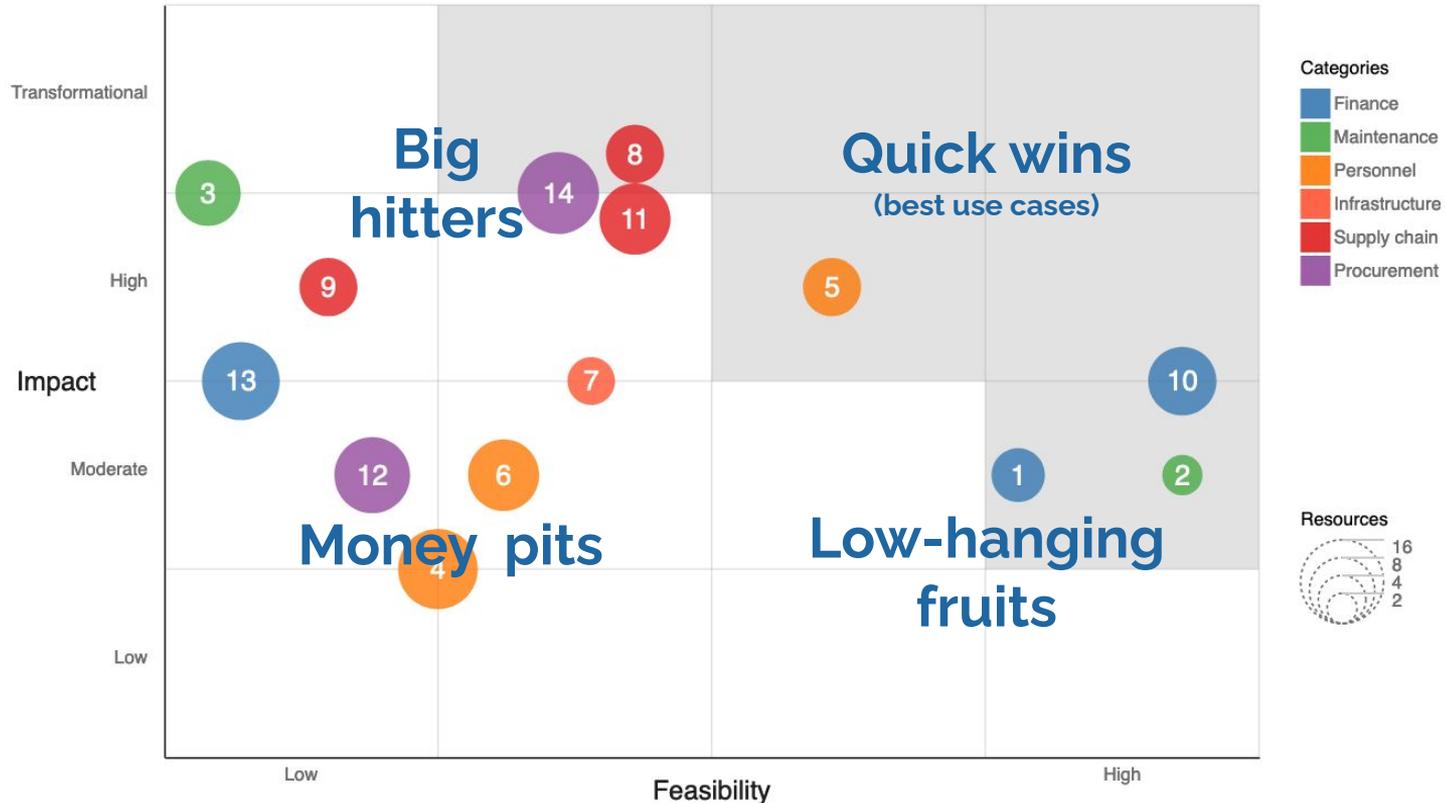
- The first rule of machine learning is... **do not start with machine learning!**
- **Starting small** helps to define requirements (for data, IT, talent, processes, governance, etc.)
- **Simpler approaches more likely to succeed** initially



## Lesson #2: Carefully select your AI projects



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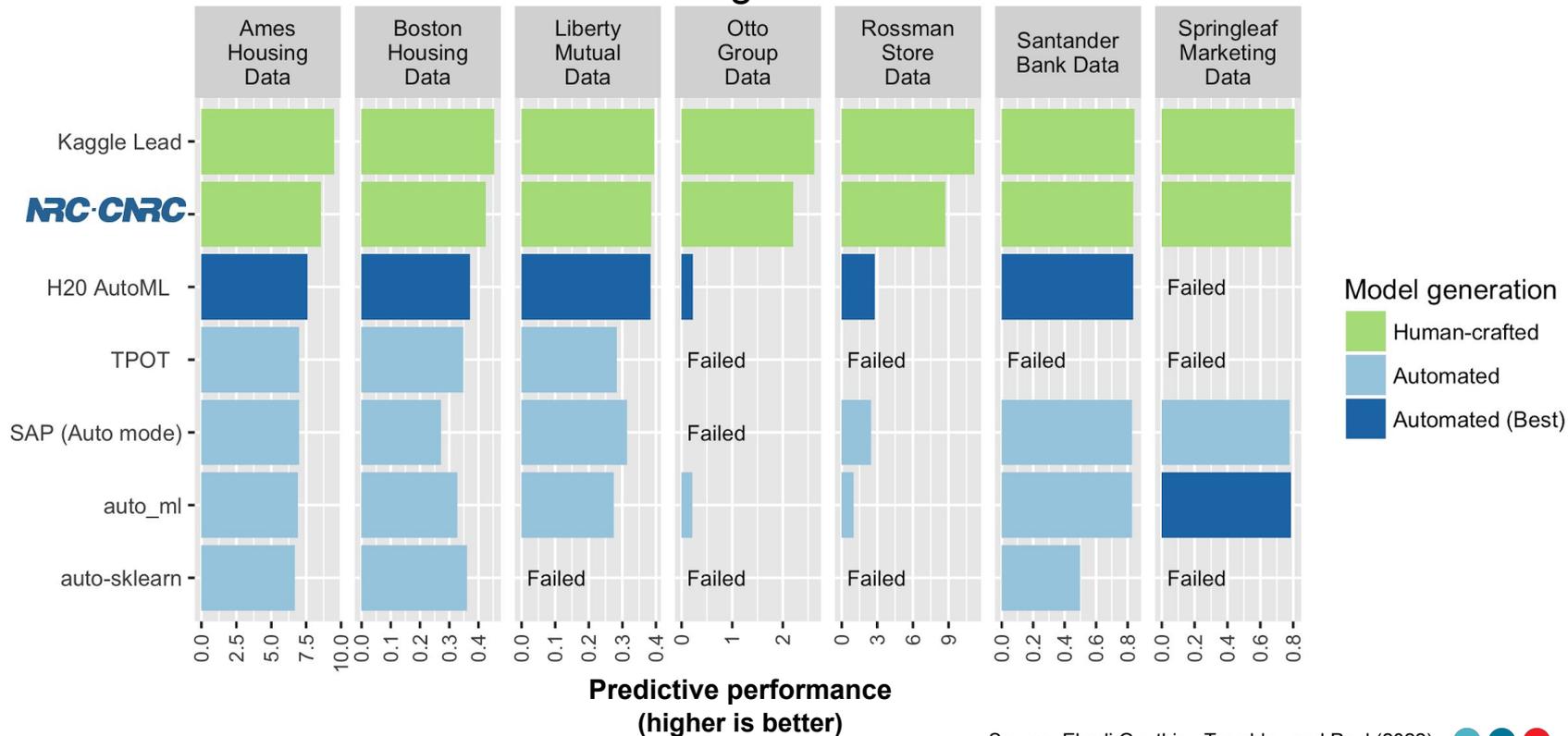


# Lesson #3: Beware the hype



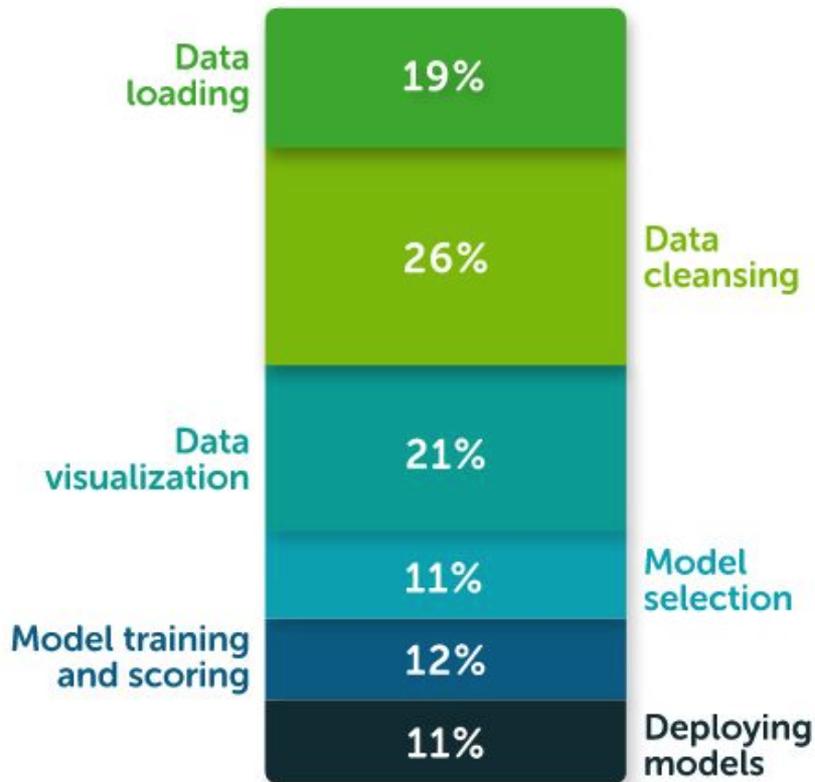
# Lesson #3: Beware the hype

## Automated Machine Learning vs. Human-Crafted Models



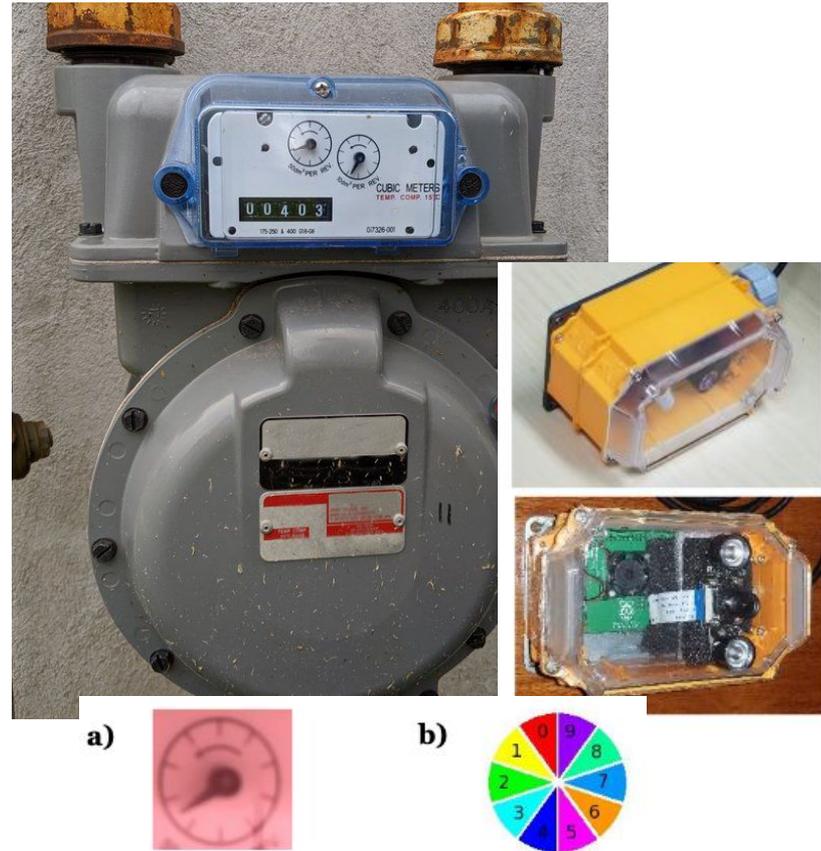
# Lesson #4: It's the data, stupid!

How much of data scientists' time is spent in each of the following tasks?



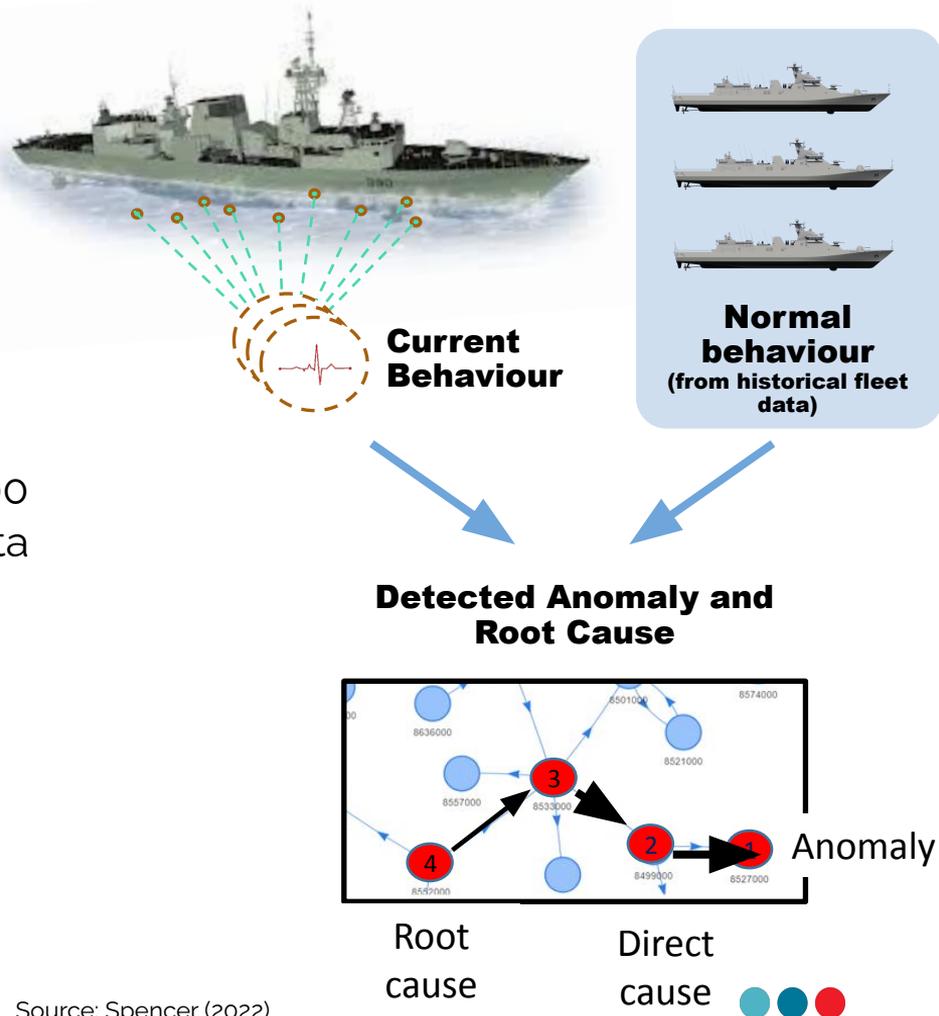
# Lesson #5: AI can help you get the data you need (and teach old equipment new tricks)

- Some analog equipment is prohibitively expensive to replace
- AI coupled with machine vision can automate labor-intensive (and error-prone) meter reading tasks
- NRC-GAMMA: Novel Large Gas Meter Image Dataset



# Lesson #6: Inferring causes is often more important than making predictions

- Example: Navy Frigates have over 2,000 sensors reading equipment health data every half second
- AI can infer the causes and effects that occur between vessel components and trace any anomaly back to its root cause(s)
- Data can also be exploited for predictive maintenance



# Public Service Employee Survey

We can **estimate** which responses influence other responses, and by how much, using causal inference

EXAMPLE

Responses to

**Q66** – My workplace is **psychologically healthy**

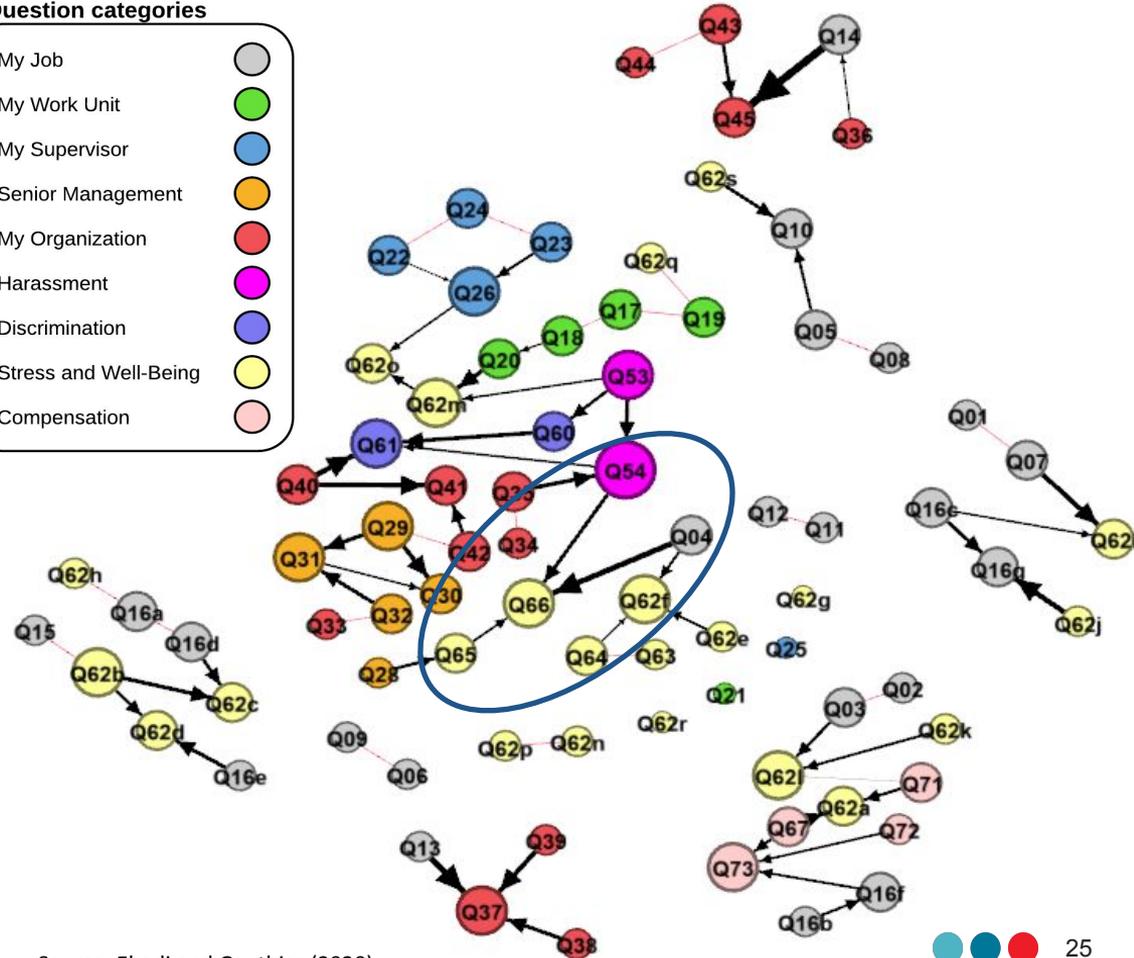
are influenced by responses to:

**Q65** – My department does a good job of raising **awareness** of **mental health** in the workplace

**Q04** – I have support at work to **balance** my work and personal life

**Q54** – My department works hard to create a workplace that prevents **harassment**

## Question categories



**Lesson #7:**  
Open data is  
valuable... yet  
remains  
under-exploited

# Lesson #8: Eat your own dog food...

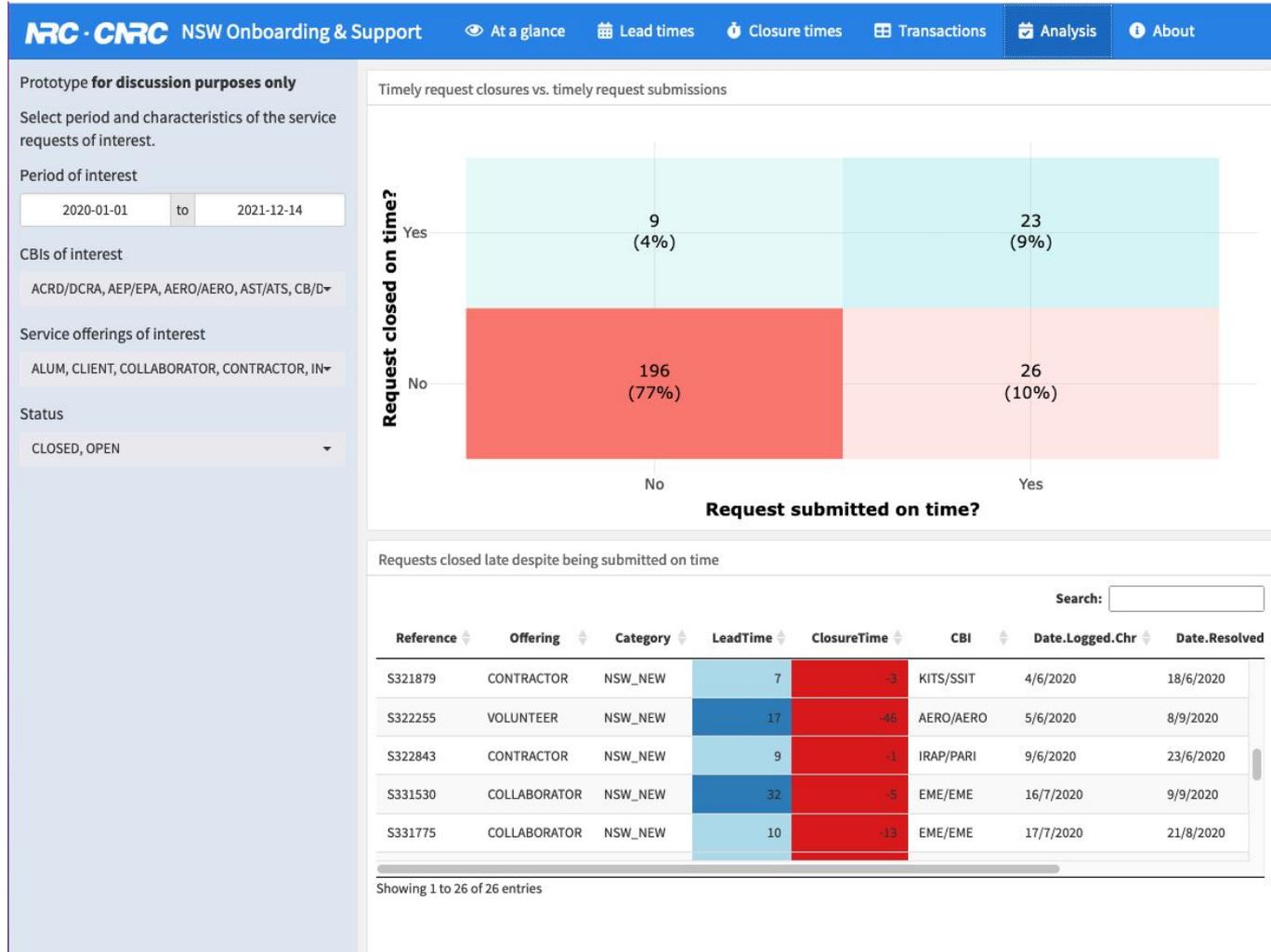
- **We apply some of our own solutions and expertise to ourselves** at NRC
- **High potential for solution transfer** between departments (e.g., in HR, finance, infrastructure, etc.)



# Example:

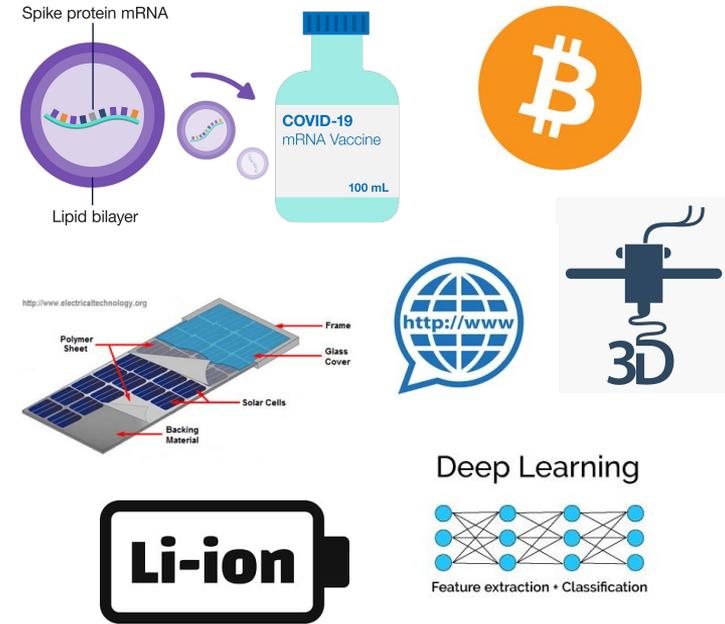
Supporting our Client Support Centre with:

- automated ASSYST reports and analysis
- AI-based ticket triage (starting)



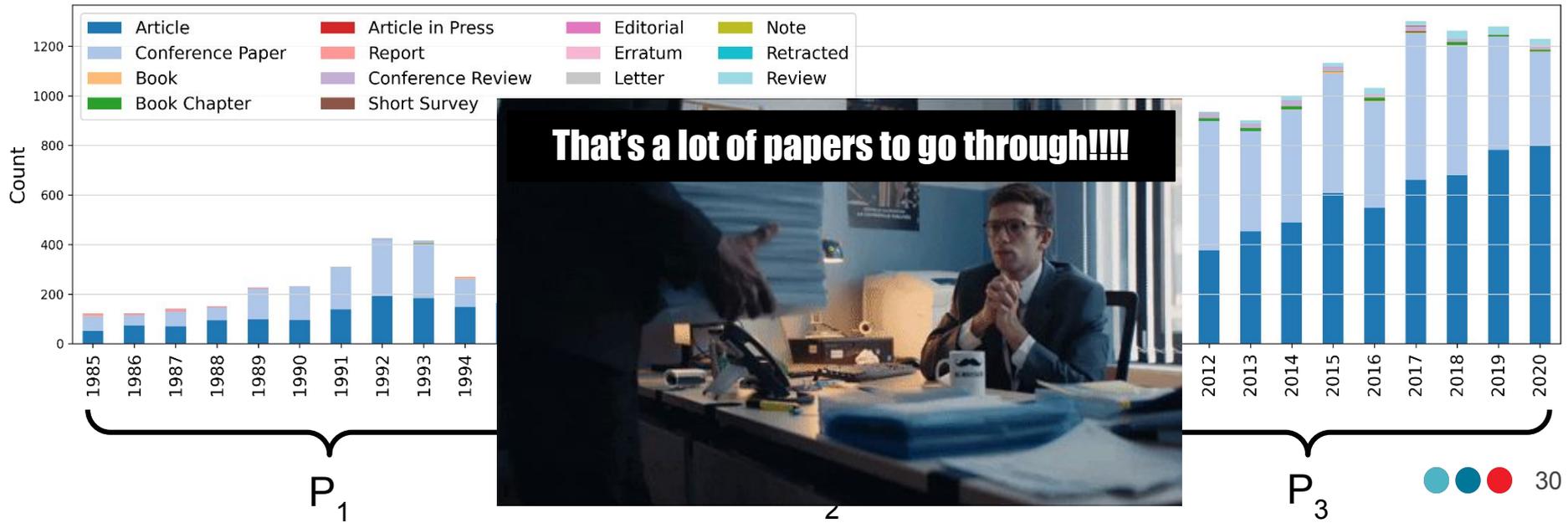
# Another example: early detection of emerging technologies in the literature

- New technologies can change the landscape of entire industries
- Recent examples: mRNA vaccines, lithium-ion batteries, cryptocurrencies, deep learning, 3D printing, solar cells, etc.
- Major economic and social impacts
- Implications for national security and strategic stability



# Another example: early detection of emerging technologies in the literature

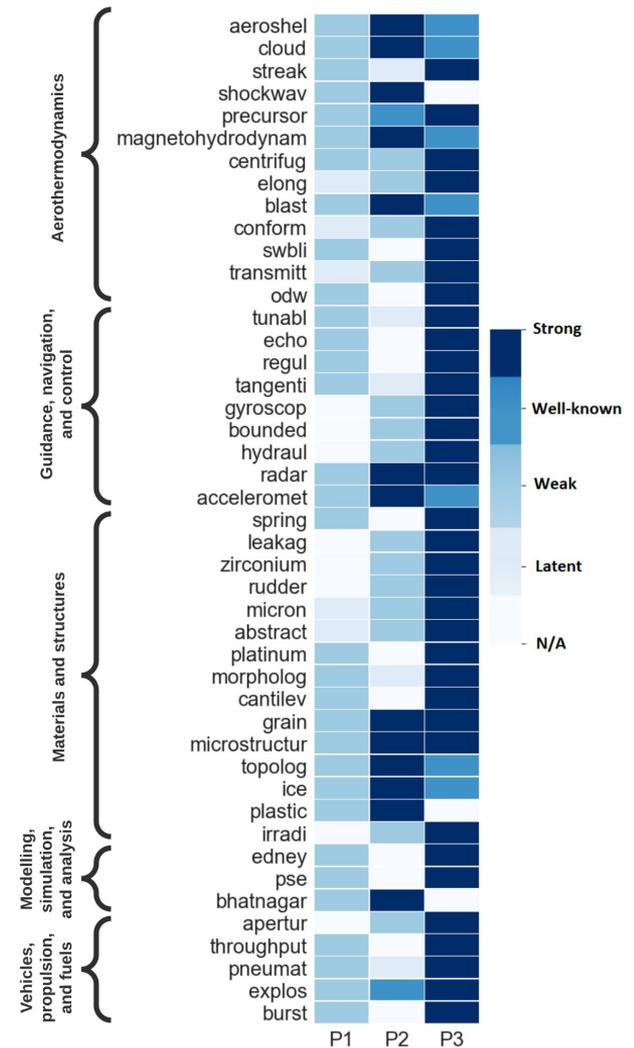
- 21,590 research papers on hypersonics published between 1985 and 2020
- Separated into 3 periods ( $P_1$ ,  $P_2$ ,  $P_3$ )



# Weak signals becoming strong

- We use Google AI's **BERT** to extract keywords
- Found stems of **weak signal terms in  $P_1$  or  $P_2$  that converted into a strong signal** later on.
- Many terms are related to significant advancements in hypersonics over the last 30 years

Source: Ebadi, Auger and Gauthier (2022)  
<https://arxiv.org/abs/2205.05449>

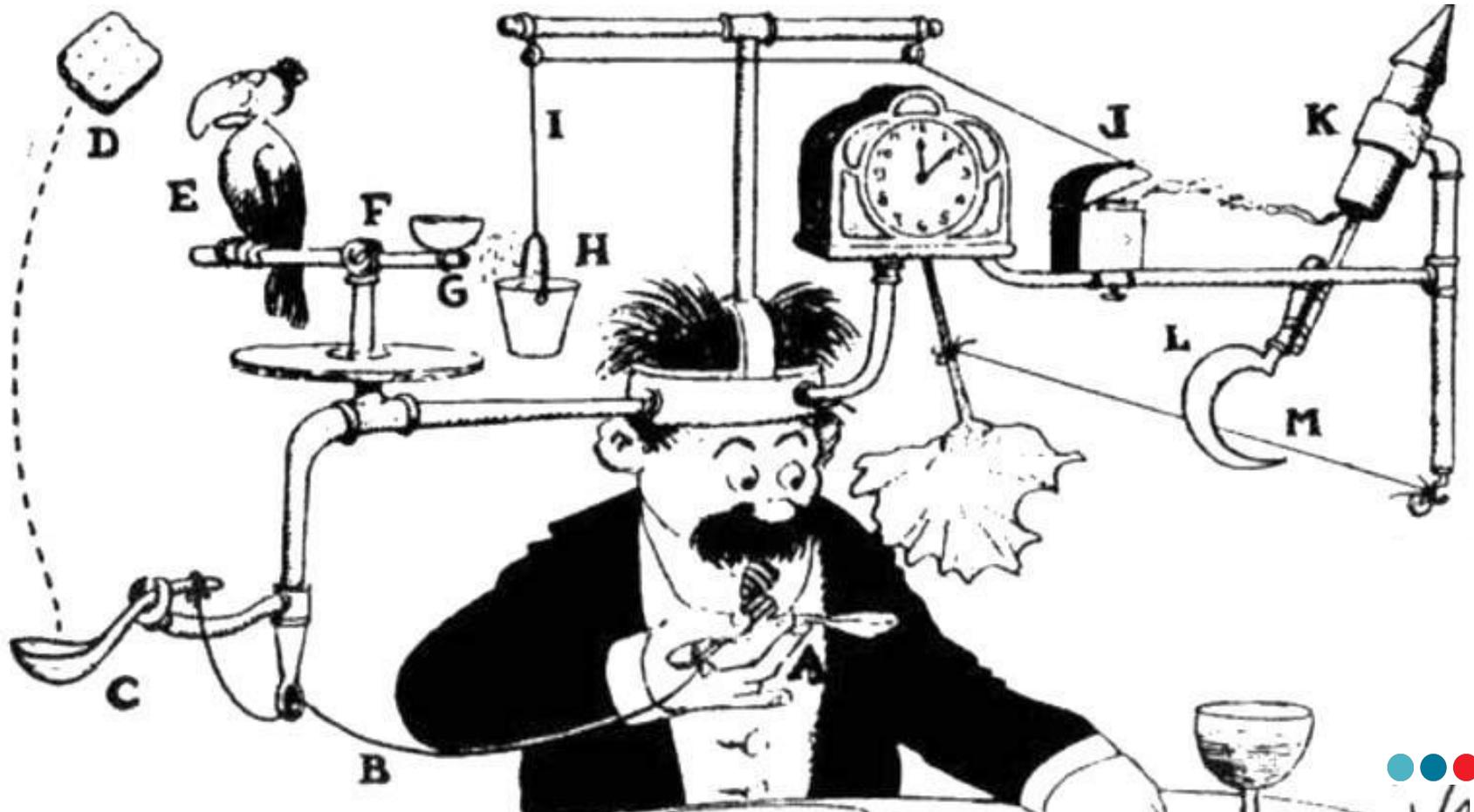


# Lesson #9: Understand AI risks

- 1) Fairness:** Are there outcome differences in model decisions across groups?
- 2) Privacy:** Is your model complying with relevant privacy regulations?
- 3) Security:** Have you incorporated applicable security standards in you model?
- 4) Agency:** Is your AI system making decisions on behalf of your organization?
- 5) Negligence:** How are you ensuring your AI is safe and reliable?
- 6) Transparency:** Can you explain how your model arrives at a decision?
- 7) Third Parties:** Does your AI system depend on third-party tools, services, or personnel?

Adapted from [Oreilly \(2021\)](#)

# Lesson #10: Don't focus too much on process



## Lesson #10: Don't focus too much on process

*“When it comes to Data Science, we're all winging it. Even the experts. Especially the experts; we're dealing with cutting edge problems and there's no playbook. This is applied R&D.*

*[...] Forget all about policies, memos, directives, standards, reference architectures. The office building you work in is already wallpapered with those artifacts, and nobody is paying any attention to them. Don't add to the wallpaper.  
**Lead by example instead.**”*

Michael Conlin  
Former CDO, US DoD

Our AI journey is  
just beginning!

**MERCI! THANK YOU!**

**QUESTIONS?**

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