Lessons from data science in Healthcare & their potential applications for insurers

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When will AI replace actuaries?

Robots will take most jobs, predicts Bill Gates

- Bill Gates has warned it is inevitable that smart machines, powered by artificial intelligence, will replace most human work.
- The Microsoft founder said it was only a matter of time before robots replaced humans in a substantial number of jobs.
- “Work won’t be the central, almost religious activity it is today. That’s an inevitability. Then you’ll have all sorts of philosophical questions about purpose.”

Source: The Sunday Times, April 15 2018
Lessons from data science in Healthcare

Rebecca Pope
What does the NHS & actuarial science have in common?
Data, data, data”
Artificial Intelligence in the NHS

- Reduce costs
- Reduce inefficiencies
- Improve patient care & quality
Machine learning has been recognized to offer transformative value within the health service
Critical hurdles to overcome for the benefits of AI to be realized

- Trust of the public, clinicians and policy makers
- ‘Silos’ of data
- Infrastructure for collecting data
- Issues around consent
Augmenting diagnostic ‘vision’ with AI

10 million images
200,000 skin lesions
100,000 specimens
Diabetic-related eye disease
Clinical decision making: Sepsis

The Artificial Intelligence Clinician learns optimal treatment strategies for sepsis in intensive care

Matthieu Komorowski, Leo A. Celli, Omar Badawi, Anthony C. Gordon & A. Aldo Faisal

- Main cause of mortality in hospitals
- 3rd cause of death worldwide
- How to optimally treat patients?
- Sequential decision-making problem
78 y.o. man with h/o CHF, AFib, depressed LV systolic function, who presented to the ER with increased weakness.

John Doe
78 years old

I48.0 Atrial fibrillation
I50.2 Congestive heart failure
R53.1 Weakness

148.0 150.2
R53.1 150.1

150.1 Left ventricular systolic dysfunction
Impact on stroke care?

18 mins

7 minute reduction

11 mins

Ambulance Victoria

C.A.R.E
Welcome to the 4th industrial revolution
Diffusion
Legal & regulatory issues
Public polling

Respondents are more likely to share their personal data with the NHS than any other organisation, followed by banks and the police.

Which, if any, of these organisations would you be willing to share your personal data with if it meant an improved service or capabilities?

<table>
<thead>
<tr>
<th>Organisation</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>The NHS</td>
<td>56%</td>
</tr>
<tr>
<td>Banks</td>
<td>47%</td>
</tr>
<tr>
<td>The police</td>
<td>33%</td>
</tr>
<tr>
<td>None of the above</td>
<td>24%</td>
</tr>
<tr>
<td>Government</td>
<td>22%</td>
</tr>
<tr>
<td>Pharmaceutical companies</td>
<td>15%</td>
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<tr>
<td>Charities</td>
<td>11%</td>
</tr>
<tr>
<td>Internet companies</td>
<td>8%</td>
</tr>
<tr>
<td>Media companies</td>
<td>8%</td>
</tr>
<tr>
<td>Political organisations</td>
<td>7%</td>
</tr>
</tbody>
</table>
Lessons learned

Data is never ‘ready’ for AI

Augmented intelligence (not replacement!)

Bias in the machine…

Invest & upskill your workforce
Lessons for actuaries

Ian Carey
When will AI replace actuaries?

• 4 Waves of AI (term coined in 1956)
  – Internet AI (think tailored ads based on what you do online)
  – Business AI (e.g. what Rebecca was talking about)
  – Perception AI (upgraded for eyes, ears and a myriad of other senses)
  – Autonomous AI – (ability to sense and react to the world around them and to make decisions independently)

https://www.youtube.com/watch?v=JVHbetNYyhc
  – Nobody knows!
  – Data scientists will be automated first as regulatory requirements for actuaries to sign things off preserve us!
When will AI replace actuaries?

• **With enough data, Google thinks it can predict when a patient will die with up to 95 per cent accuracy.**

• In May, Google scientists published the account of a woman who came to hospital with late stage breast cancer and fluid building in her lungs.

• Hospital predicted 9.3% chance of dying during stay based on their records and vital sign testing etc.

• Google’s neural network, was fed **175,639 data points** on the woman including past health records and her current vital signs. It delivered a decidedly more grim prediction, calculating the woman had a 19.9% chance of dying during her stay. She unfortunately died within a week.

• Where the system was able to add value was its ability to incorporate data not easily analysed by traditional systems such as clinical notes buried in PDFs or scribbled on old charts, while disregarding redundant data.

• Google analysed more than **46 billion data points** for this tool.

Source: www.news.com.au, June 20 2018 (also Bloomberg and Nature)
Data, data, data!

- According to a 2018 US survey, actuaries spend significant time on data manipulation…
  - more than 50% spend at least half of their time
  - more than 75% spend at least 25% of their time
- Is this a good use of the actuarial skillet?

Source: PWC actuarial modernisation survey, q2 2018
Example (very simple) Alteryx workflow

- You can see that annotations have been added to each stage of the workflow, so that the data preparation process is well-documented.

- When source data changes, you only need to hit ‘play’ to run the Alteryx workflow, and the output will be updated to include those changes.
Below are some examples only – not an exhaustive list!

- Data preparation: alteryx, apache hadoop
- Robotic process automation: blueprism, automation anywhere
- Visualization: tableau, qlik, power bi
- Coding / machine learning: R, python, sas

**Computing power has increased significantly over time**

We have seen a 1 trillion-fold increase in computer processing capabilities over the past 60 years\(^1\)

Today’s smartphone has more computing power than the Apollo 11 Guidance Computer

Source: \(^1\)Experts Exchange, “Processing Power Compared”
Source: \(^2\)Frost & Sullivan, “Addressing Mobile Cybersecurity”
Upskilling is fun!...

- **Datacamp** leaderboard for e-learning coding training (R and Python)
- **Alteryx** workflows look so much nicer than Excel and are auditable, applicable to large data sets, reusable and reproducible
- **Hackathons** for Coding and Data Visualisation tools
- **Drag and drop functionality** in tools makes building dashboards easy for non-coders
- **Interactivity** of dashboards (e.g. drill-down) means being able to answer questions from the Board on the spot vs at the next Board meeting in 1-2 months time!
- If we don’t upskill we will struggle to attract new talent and risk becoming stuck as “champions of regulatory requirements”
...and allows actuaries to focus on providing insights to add value

Embracing data science, there will be more time to focus on insight generation to drive value creation, positioning the function in the center of the business and enabling actuaries to shift towards being more commercially valuable.

Six defining characteristics of high performing actuaries:

- **The Strategist**: Drives the actuarial function to optimize global business strategy.
- **The Predictive Analyst**: Turns the regulatory environment into a competitive advantage.
- **The Operationalist**: Stays ahead of technology and masters the complexities of data analytics.
- **The Talent Champion**: Has a deep knowledge of the business and its customers.
- **The Talent Champion**: Finds the right model for the actuarial function.
- **The Talent Champion**: Invests in and motivates talent, promotes key skills and collaborates.

Actuarial as an Insight Organization

Data Science helps actuarial teams become high performing
Actuaries - doing data science since the 1600’s

• “An important advance came in 1662 from a London draper named John Graunt, who showed that there were predictable patterns of longevity and death in a group, or cohort, of people of the same age, despite the uncertainty of the date of death of any one individual. This study became the basis for the original life table.

• The first person to demonstrate publicly how this could be done was Edmond Halley (of Halley’s comet fame). Halley constructed his own life table, and showed how it could be used to calculate the premium amount someone of a given age should pay to purchase a life annuity (Halley 1693).”

• https://en.wikipedia.org/wiki/Actuarial_science
Actuaries today?

“No thanks!
We are too busy
>Data science tools!”
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