Data science – optimising the actuarial toolkit

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Introduction

Allan is a principal at Barnett Waddingham, he advises companies on how to succeed in the data rich economy, through the effective use of data and science to deliver commercial and operational value. Allan has significant expertise in decision science and gives executives the courage to act through data led analytics and insights.

Amit is a senior consulting actuary at Barnett Waddingham. Amit's background is providing advice and support to life insurance clients with their actuarial and risk management needs, including the use of technology to improve and automate valuation processes and produce risk monitoring MI.

Wan is a principal at Barnett Waddingham. He has a wide set of experiences across non-life insurance in reserving, pricing and capital modelling and specialises in the use of technology in actuarial processes, from small scale automation to end-to-end transformation of actuarial processes.

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Agenda

- Why use data science tools?
- Case studies
- Lessons from the world of data science
- Building high performance analytics teams

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Why use data science tools

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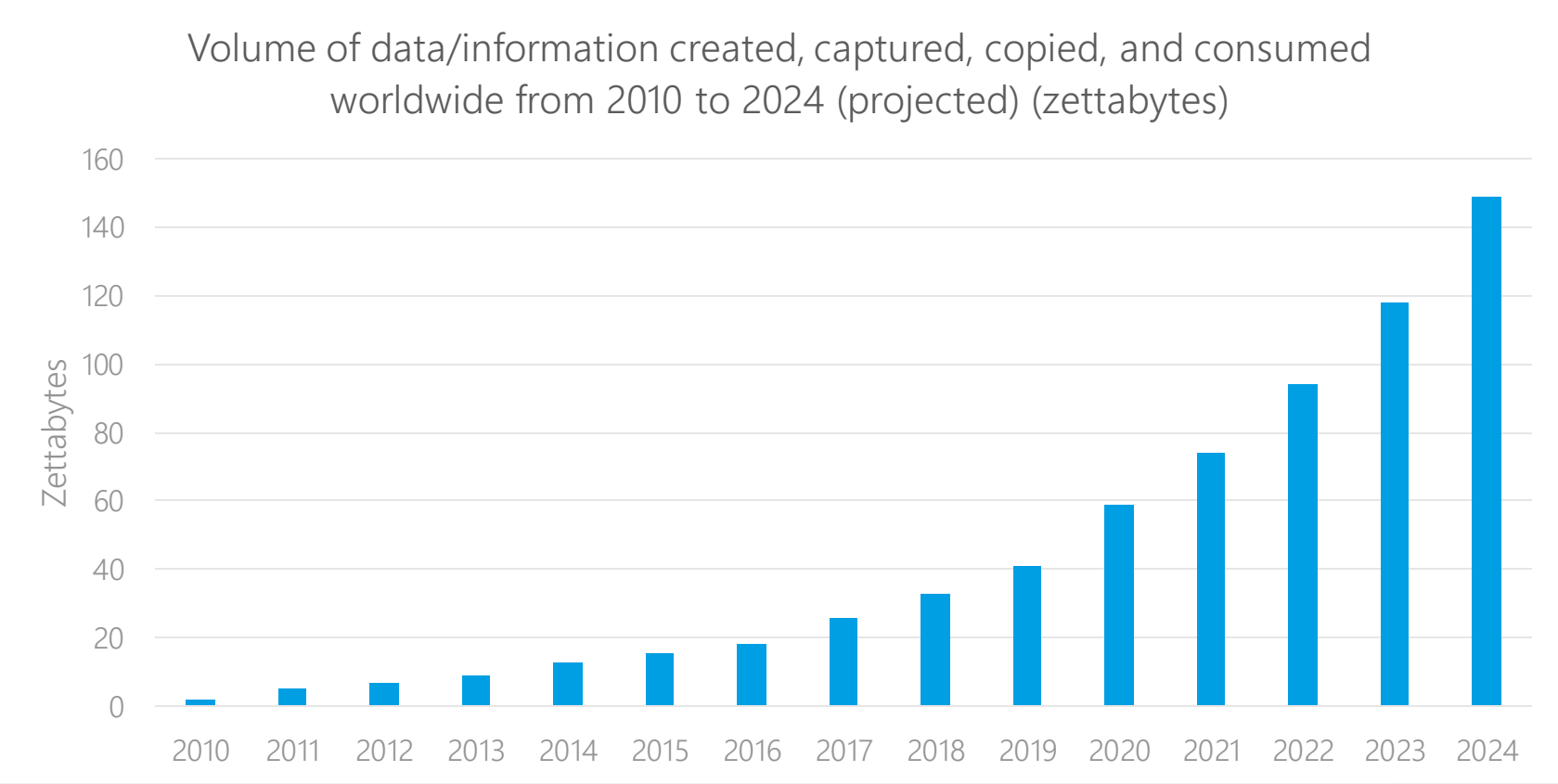
What are data science tools?

Data is growing exponentially – better tools are needed



1 zettabyte = 10^{21} bytes = 3,000,000 times the size of Netflix's entire catalogue

Source: https://www.statista.com/statistics/871513/worldwide-data-created/

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Why use R?

Deal with larger data volumes	Leverage the work and knowledge of others	Growing knowledge in the actuarial community	Quick deployment of applications
Ability to control and reproduce work in a structured manner	Longer term career development	Sometimes faster than conventional tools	Engaging visuals
Maximise spend	Documentation of human intervention	Flexible integration	Extensive capability

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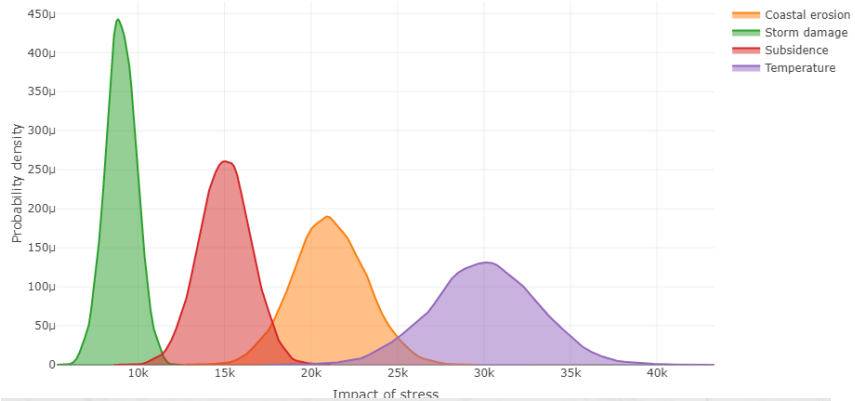
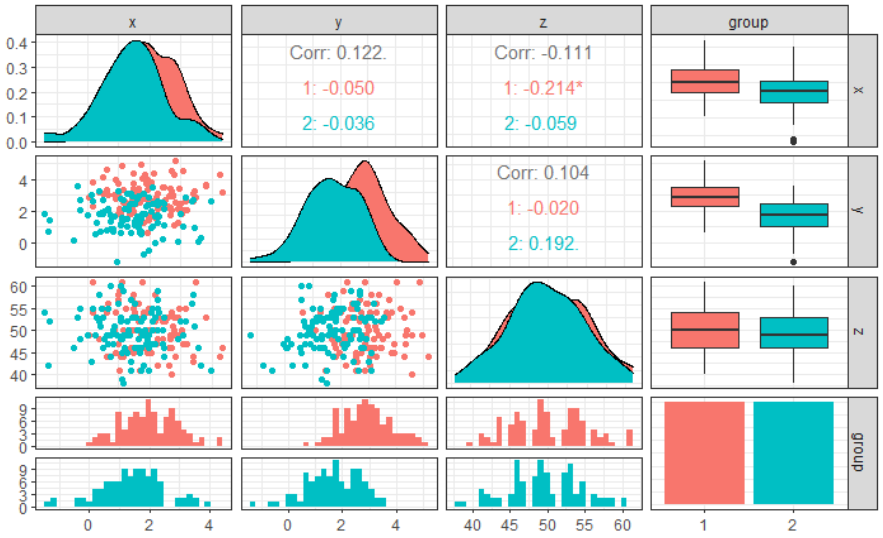
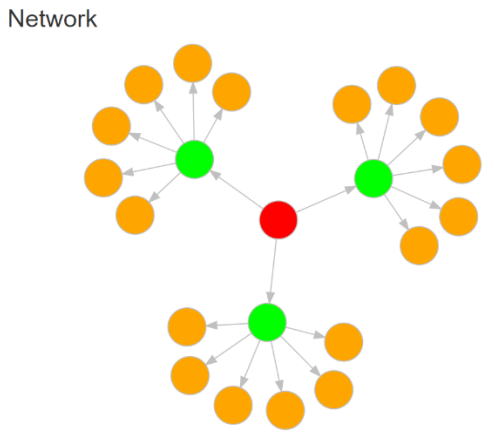
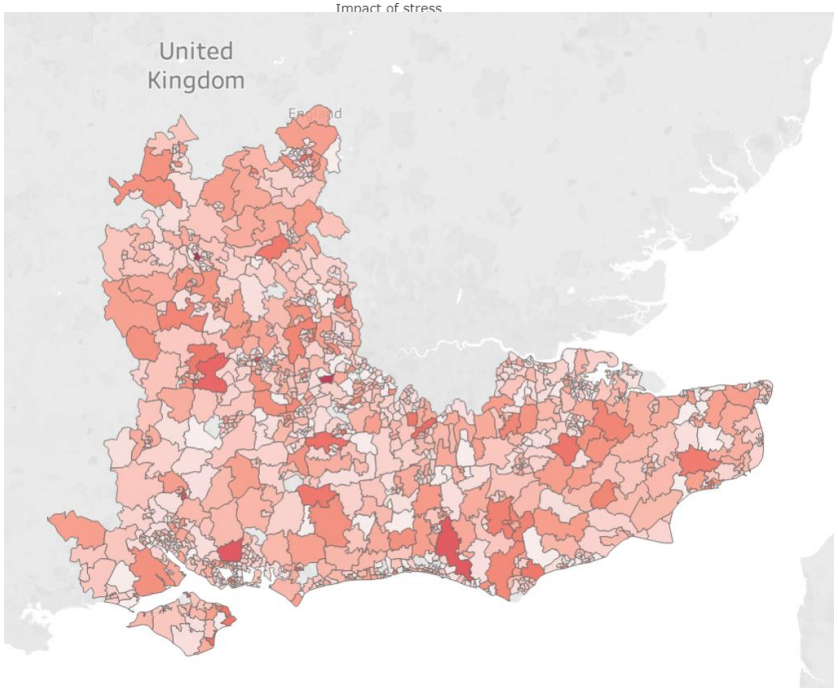
Data visualisation

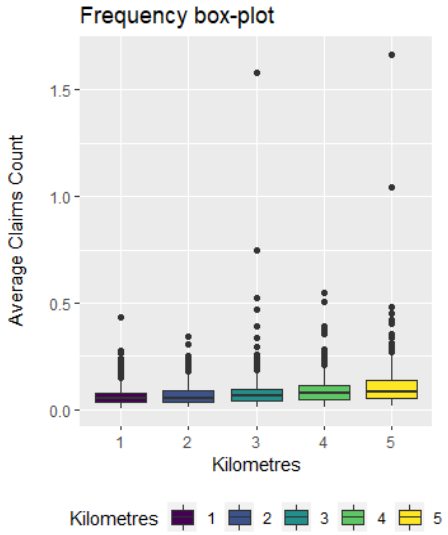
R is used as a powerful visualisation tool

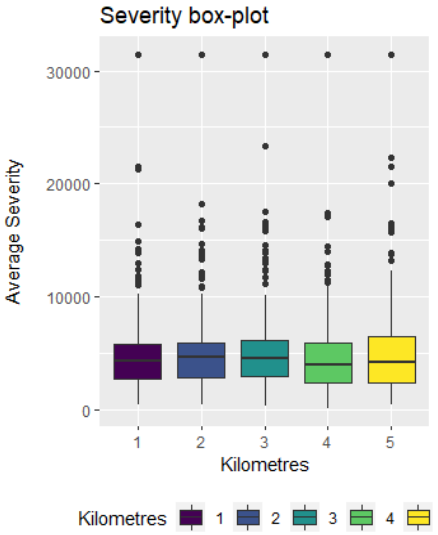


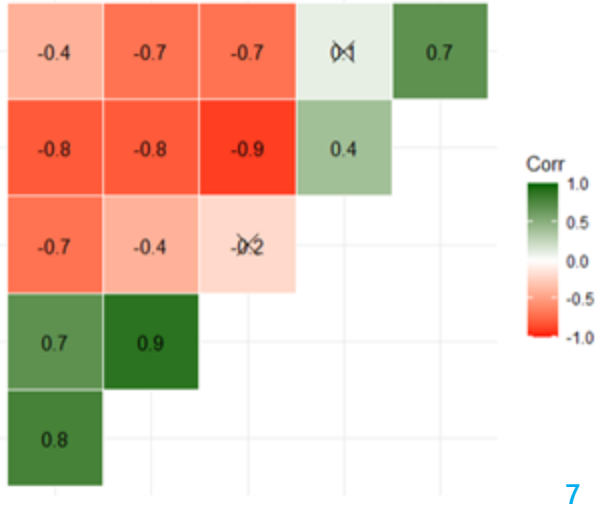












Swiss army knife of capability

Capital modelling	Valuation/ reserving	Pricing	Business management
Parameterisation tool for internal models	Trend detection	GLM driven modelling	Bonus setting
Internal model components	Algorithm driven reserving	Algorithm driven pricing	Investment optimisation
Dummy modelling	Stochastic reserving	Experience analysis	Risk modelling and monitoring

Case studies

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Improving Demographic Experience Analysis

Case study

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Legacy approaches can be OK:

- Experience analysis is simple (exits / exposure)
- Honed over time to deliver whats needed

But we've often found:

- Data challenges
- Significant manual steps
- Lack of flexibility
- Focus on handle turning

Improved using:

R + R Shiny + RMarkdown

Process benefits

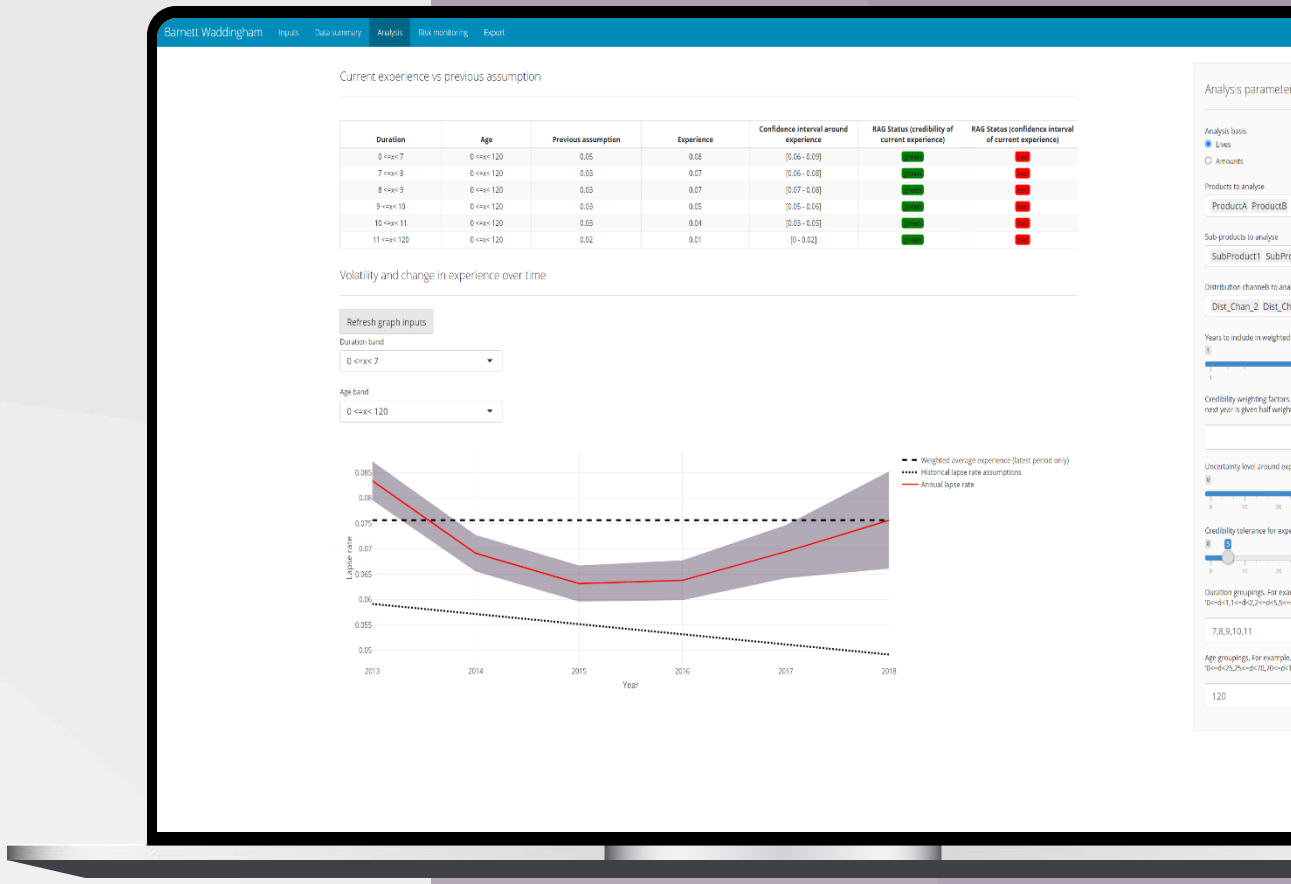
- Policy admin database
- Data validation and cleaning
- Automated documentation

Analysis benefits

- Easy drill down
- Numerical, and visual outputs with statistical testing

Business benefits

- More time for other tasks
- High frequency monitoring
- Experience insights



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Transformation of capabilities for actuarial team

Case study

Challenges

Infrastructure

Scalability for seasonal and ad-hoc workloads

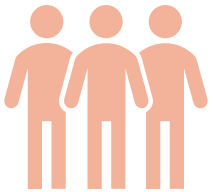
Optimised for nothing

Network drives and access not for home working

Tools

Proprietary technology not updated for years and moving to end-of-life

Mishmash of poorly-understood libraries



Skills and collaboration

Inexperienced with the tools

Collaboration was difficult

Programme of change

Infrastructure optimisation

- Optimising existing tools and platform
- Migrate to hybrid on-premise and Azure environment

Adopt best practices

- Review existing against best practices; 34 scripts using 19+ packages
- 14 key areas of recommendations

Re-tooling

- Migrate from near end-of-life proprietary MLS + RevoScaleR to open source
- Benchmark improvements; 127 benchmarks; 17 models

Up-skilling and process re-engineering

- Consistent approach; collaboration; confident reproducible research
- Skills transfer – building the new capabilities together

Outcomes

Massive productivity step-change

Owning tools and enabling team-work

Control and ownership

Robust code and better understood models;
master of own destiny

Stronger stakeholder engagement

Engaging communications and robust validation

Develop actuaries' skills

Applicable to wider business and open new career paths

Operational risk model

Case study

Case study: Operational risk model

What was the problem?

Bespoke

- Model was a bespoke component of operational risk.
- No "standard" approach to modelling, so needed some flexibility in approach.
- Existing model did not pass validation.

Expert judgement

- Limited data so the model relied heavily on expert judgement.
- For standalone sub-components, this was easily managed.
- However, the experts were also needed to model dependencies between sub-components.

Non-actuaries

- Finance, Compliance, Distribution and various other functions were involved in calibrating the model.
- Not all were statistically trained so needed an intuitive way to explain the results of the model.

Practicalities

- The existing model was too big and too slow.
- Simplifications were made to optimise the run-time but it was still slow.
- The model could only be opened on a "super-computer".

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Case study: Operational risk model

What did we do?

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Lessons from the world of data science

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A changing mindset

Learn quickly, learn often

Use the right tool for the job

Stretch your imagination

Be prepared to productionise

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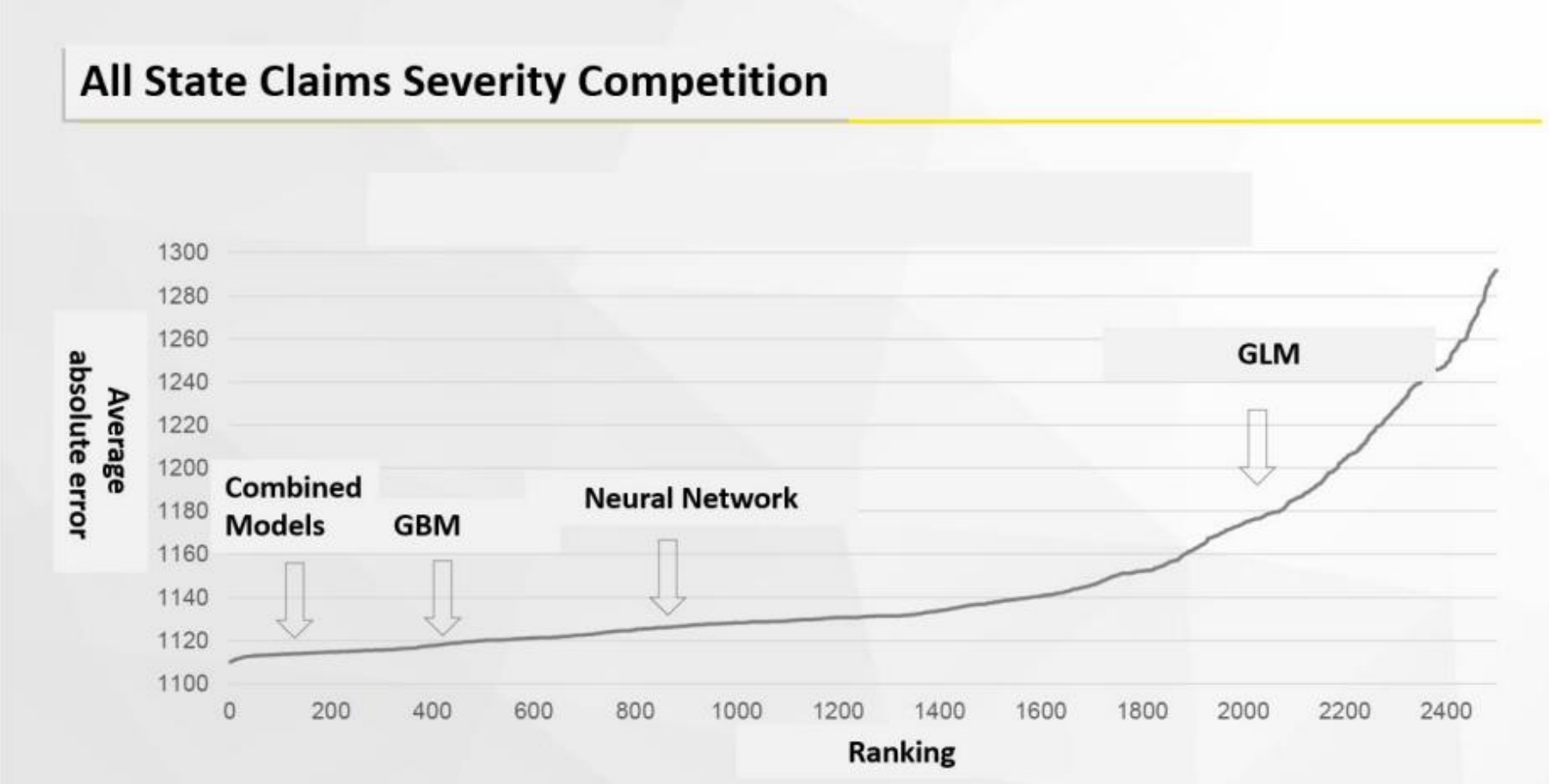
Applying the lessons



Source: Dr Ji Yao, 2019, unpublished research

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Building high performance analytics teams

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Leading for analytics – embrace the opportunity

Enabler: open source (and cloud)

Spend **differently**: **on** your people and processes **which are** your differentiators

Own your tools, **with the responsibility** and **opportunities**

People: Help your people grow

Wider career **paths** => **personal** development plans

More opportunities => engage the wider business

Results: Demonstrate you are a business leader

Think about metrics for **success**: **what** are the numbers your CEO care about?

Own the change: who does what differently, precisely, to deliver the business value?

Building high-performance teams

Skills	Understand different skills and temperaments, and use them effectively
	Engineer, Farmer, and Explorer
	Be realistic about what you need
Collaboration	Effective, productive teams with limited key man risk
	Tools: git, markdown, software development tools. **Approach**: standard packages and tools; controlled environment. **Processes**: reproducible research, peer-review, pair-programming. **Metrics**: reward collaboration
Flexibility	Business isn't static
	Infrastructure, e.g. hybrid cloud and open source skills
	Resourcing models, e.g. collaboration with external

Recap

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