UNSW Business School
Risk and Actuarial Studies

The AI-Enabled Actuary:

Data Science / AI in a
University Actuarial Program

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Risk and Actuarial Studies

Agenda

1. **Statistical Regression vs Pure Prediction Algorithms -> The Data Science / AI enabled Actuary.**

2. **The UNSW Risk and Actuarial Studies Curriculum**

3. **Examples**

Traditional regression vs pure prediction algorithms

Prediction, Estimation, and Attribution

Bradley Efron

Department of Statistics, Stanford University, Stanford, CA

ABSTRACT
The scientific needs and computational limitations of the twentieth century fashioned classical statistical methodology. Both the needs and limitations have changed in the twenty-first, and so has the methodology. Large-scale prediction algorithms—neural nets, deep learning, boosting, support vector machines, random forests—have achieved star status in the popular press. They are recognizable as heirs to the regression tradition, but ones carried out at enormous scale and on titanic datasets. How do these algorithms compare with standard regression techniques such as ordinary least squares or logistic regression? Several key discrepancies will be examined, centering on the differences between prediction and estimation or prediction and attribution (significance testing). Most of the discussion is carried out through small numerical examples.

Statistical Modeling: The Two Cultures

Leo Breiman

Abstract. There are two cultures in the use of statistical modeling to reach conclusions from data. One assumes that the data are generated by a given stochastic data model. The other uses algorithmic models and treats the data mechanism as unknown. The statistical community has been committed to the almost exclusive use of data models. This commitment has led to irrelevant theory, questionable conclusions, and has kept statisticians from working on a large range of interesting current problems. Algorithmic modeling, both in theory and practice, has developed rapidly in fields outside statistics. It can be used both on large complex data sets and as a more accurate and informative alternative to data modeling on smaller data sets. If our goal as a field is to use data to solve problems, then we need to move away from exclusive dependence on data models and adopt a more diverse set of tools.

Table 5. A comparison checklist of differences between traditional regression methods and pure prediction algorithms.

	Traditional regressions methods	Pure prediction algorithms
1.	Surface plus noise models (continuous, smooth)	Direct prediction (possibly discrete, jagged)
2.	Scientific truth (long-term)	Empirical prediction accuracy (possibly short-term)
3.	Parametric modeling (causality)	Nonparametric (black box)
4.	Parsimonious modeling (researchers choose covariates)	Anti-parsimony (algorithm chooses predictors)
5.	$\mathbf{x}$ $p \times n$: with $p \ll n$ (homogeneous data)	$p \gg n$, both possibly enormous (mixed data)
6.	Theory of optimal inference (mle, Neyman–Pearson)	Training/test paradigm (Common Task Framework)

NOTE: See commentary in the text.

Source: Efron (2020), noting commentary re exceptions, and advancements over time.

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The data science / AI-enabled actuary

Learn about the Profession

Actuaries are highly qualified professionals who analyze the financial impact of risk for organizations like insurers; pensions fund managers, and more. Governed by rigorous standards of practice, they apply their mathematical expertise to forecast and minimize financial uncertainty.

What is an actuary in Australia?

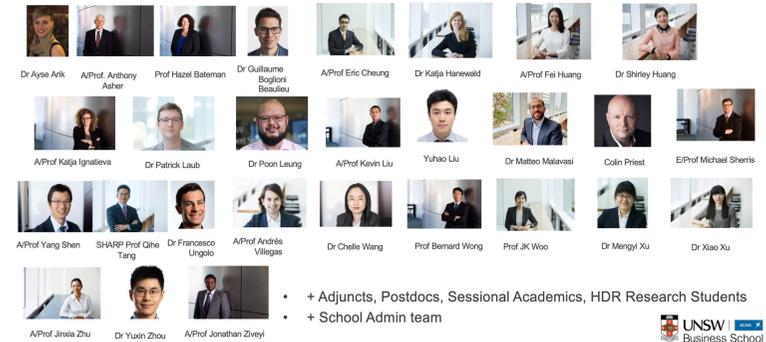**Actuaries advise on the consequences of decisions.**

An actuary is a professional who uses mathematics, statistics, data and financial theory to assess and manage risk and opportunity. Actuaries analyse data to evaluate the financial and societal impact of future events, helping businesses and communities make sound decisions about the future.

Context – about UNSW Risk and Actuarial Studies

Academics

- 28 Academics
(Australia, Asia, Europe, Africa, Americas)

- Research impact focus areas
    - climate change and insurance
    - ageing population,
    - AI/digital transformation for insurance and retirement

- Close links to industry partners, including various FMAs, the IAA Sections, and related professional associations (e.g. APRIA, IPRA).

Academics in the School of Risk and Actuarial Studies

- + Adjuncts, Postdocs, Sessional Academics, HDR Research Students
- + School Admin team

Our education programs

Actuarial Programs

- Bachelors, Grad Cert, Masters, PhD
- Currently teaching >2,000 students in the actuarial programs.
- 300-600 new actuarial bachelor students each year, even at an entry requirement of ~99 (out of 100)
- Bachelor students are highly cross – large majority combines actuarial science with another discipline(s) (e.g. commerce, computer science, math/stat, economics, climate science..)

Contributions to the broader commerce programs

- Risk Management
- Retirement & Pensions/Superannuation
- Data Analytics, AI in Business

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UNSW Actuarial Curriculum and Pedagogy

- **Research-led, industry-linked curriculum**

- **Data Science & AI as a core UNSW actuarial skillset** - multiple actuarial designed/offered courses (data viz & communication, stat machine learning, AI/deep learning, actuarial data science applications, ++), gradual embedding into other 'standard' actuarial courses.

- **Actuarial electives** - superannuation and retirement benefits, retirement savings and spending over lifecycle, climate risk management, **AI&deep learning for actuaries**, **generative AI for actuaries**, quantitative ethical AI; + advanced research courses

- **Embedding of authentic components** e.g. 'Sandbox industry experience', 'Datathon', "Case study challenge", "Kaggle style competitions".

- **Pedagogy assisted by AI** (e.g. AI stakeholder communications, peer learning on how to use GenAI, "ClassChat" AI lecture companion.)

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Example: ACTL4305: Actuarial Data Science Applications

Content
• Introduction of Actuarial Data Analytics • Business Environment • Exploratory Data Analysis: Data Visualisation • Case Study
• Exploratory Data Analysis: Manipulation and Transformation • Exploratory Data Analysis: Import Data, Quality Check and Data Cleaning • Case Study
• Modelling and Shrinkage Techniques • Case Study
• Model Assessment and Selection • Communication • Case Study
• Generalised Linear Model • Case Study
Review and Reflection
• Random Forest • Case Study
• Gradient Boosting Machines • Case Study
• Neural Networks • Case Study
• Professional Ethics in Data Modelling • Case Study

Source: F. Huang, UNSW

School of Risk and Actuarial Studies
ACTL4305/ACTL5305
Actuarial Data Science Applications

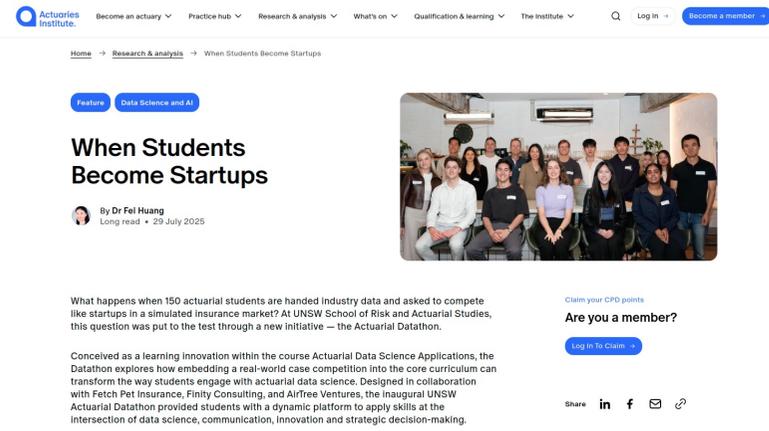**Industry Datathon Challenge 2025**

This is a real industry project partnered with Freely (not just another assignment)!

freely

Travel Insurance Conversion: Insights and Growth Opportunities

Background

Travel has rebounded strongly, surpassing pre-COVID levels for Australians. In June 2025 alone, there were 914,080 short-term overseas trips (less than one year) — according to the Australian Bureau of Statistics (release: 14 August 2025).

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Feature   Data Science and AI

When Students Become Startups

By Dr Fei Huang
Long read • 29 July 2025

What happens when 150 actuarial students are handed industry data and asked to compete like startups in a simulated insurance market? At UNSW School of Risk and Actuarial Studies, this question was put to the test through a new initiative — the Actuarial Datathon.

Conceived as a learning innovation within the course Actuarial Data Science Applications, the Datathon explores how embedding a real-world case competition into the core curriculum can transform the way students engage with actuarial data science. Designed in collaboration with Fetch Pet Insurance, Finity Consulting, and AirTree Ventures, the inaugural UNSW Actuarial Datathon provided students with a dynamic platform to apply skills at the intersection of data science, communication, innovation and strategic decision-making.

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Example: ACTL3143: AI and Deep Learning for Risk and Actuarial

AI for Actuaries

Lecture Materials

MODULE 1 **Foundations**

Artificial Intelligence (pdf)

Python (pdf)

MODULE 2 **Tabular Data**

Deep Learning with Keras (pdf)

Preprocessing (pdf)

Classification (pdf)

MODULE 3 **Computer Vision**

Computer Vision (pdf)

MODULE 4 **Text & Language**

Natural Language Processing (pdf)

MODULE 5 **Sequences**

Time Series & RNNs (pdf)

MODULE 6 **Advanced Tabular**

Optimisation (pdf)

Entity Embedding (pdf)

MODULE 7 **Applications**

Distributional Regression (pdf)

Interpretability (pdf)

MODULE 8 **Generative AI**

Generative Networks (pdf)

Source: P. Laub, UNSW - https://laub.au/DeepLearningForActuaries/

Thank you!

Additional References

- Open Source UNSW Course material: https://laub.au/ai , https://unsw-risk-and-actuarial-studies.github.io/ACTL3142/

- Labit Hardy, H., Liu, K., Villegas, A., (2025) Generative AI and Actuarial Education. UNSW Internal Report

- Priest, C, (2025) AI, Actuaries, and Education. Actuaries Institute Summit.