



UNSW Workshop in Risk and Actuarial Frontiers: Data Science and AI in Actuarial Practice

SUMMARY

This workshop brings together leading academics and industry professionals to explore the impact of Data Science and AI on the insurance industry. Participants will engage in discussions on cutting-edge topics such as AI-driven insurance pricing, risk modelling, and regulatory challenges. The event will feature keynote presentations, panel discussions, and networking opportunities, offering insights into the future of actuarial science in a rapidly evolving digital landscape. Hosted by the UNSW School of Risk and Actuarial Studies, this workshop aims to foster collaboration and knowledge exchange between researchers and practitioners.

The workshop will feature short industry and research presentations, discussions, and networking opportunities for the participants. Registration is free, but spaces are limited. We invite academics, research students and selected industry partners.

DATE

Tuesday, 10 December 2024, 9.00 AM – 4:30 PM

(Registration and coffee on arrival from 9am)

VENUE

Patricia O'shane (former Central Lecture Block) Room 104, UNSW

[K-E19-104 - E19 Patricia O'Shane 104 | Learning Environments - UNSW Sydney](#)

CONTACT

School of Risk & Actuarial Studies, UNSW Sydney

- Eric Cheung, eric.cheung@unsw.edu.au
- Katja Ignatieva, k.ignatieva@unsw.edu.au
- Fei Huang, feihuang@unsw.edu.au
- Andres Villegas a.villegas@unsw.edu.au
- Qihe Tang qihe.tang@unsw.edu.au

9:00 – 9:30	Registration and Coffee
9:30 – 9:45	Welcome and Acknowledgment of Country – Professor Frederik Anseel, the Dean of the Business School Welcome by the Head of School – Professor Bernard Wong
9:45 – 11:05	Session 1: Latest development in AI Moderator: Fei Huang (UNSW) <ul style="list-style-type: none"> • Academic Keynote: Toby Walsh (UNSW): The future of AI (40 min, 9.45-10.25am) • Industry Keynote: Jon Shen (Suncorp): We're living in the age of AI... so why do we still need humans? (40 min, 10.25am-11.05am)
11:05 – 11:25	Morning Tea
11:25 – 12:05	Session 2: Panel discussion: Challenges and opportunities for Actuaries Moderator: Bernard Wong (UNSW) <ul style="list-style-type: none"> • Toby Walsh (UNSW) • Jon Shen (Suncorp) • Bozena Hinton (International Actuarial Association) • Fei Huang (UNSW)
12:05 – 12:50	Session 3: Innovative applications of AI and statistical tools <ul style="list-style-type: none"> • Jonathan Cohen (Taylor Fry): Measuring the impact of personalisation: Insights from a large-scale marketing case study (15 min, 12.05-12.20) • John NG (Zurich Financial Services): Machine Learning in Mortality Modelling: A Practical Guide (15 min, 12.20-12.35) • Andres Villegas (UNSW): Blending Statistical Learning with Demographic Insights in Mortality Modelling (7.5 min, 12.35-12.42) • Katja Ignatieva (UNSW): AI-Powered Detection of Corporate Greenwashing (7.5 min, 12.43-12.40)
12:50 – 14:05	Lunch
14:05 – 14:55	Session 4 Moderator: Eric Cheung (UNSW) <ul style="list-style-type: none"> • Academic Keynote: Mario Wüthrich (ETH Zürich) “Recent developments in deep learning for solving actuarial problems” (50 min)
14:55 – 15:55	Session 5: Actuarial applications of data science Moderator: Katja Ignatieva (UNSW) <ul style="list-style-type: none"> • Zilinka Jiang (Quantium): AI that works: AskTelstra – Case study on AI implementation (15 min, 14.55-15.10) • Sheldon Lin (University of Toronto): Modelling Inhomogeneity and Variability of Insurance Portfolios via Mixtures, Random Effects and Beyond (15 min, 15.10-15.25) • Jared Spowart (AIA): Artificial Intelligence: Opportunity or Threat to the Actuarial Profession? (15 min, 15.25-15.40) • Patrick Laub (UNSW): Neural networks and uncertainty (7.5 min, 15.40-15.47) • Bernard Wong (UNSW): TBA (7.5 min, 15.48-15.55)
15:55 – 16:30	Workshop Wrap Up (5min), Afternoon Tea

ABSTRACTS

Toby Walsh (UNSW): The future of AI

It's being compared to the discovery of fire or of electricity. Either way, artificial intelligence will revolutionise human civilisation. How? What impact will it have on jobs, and on business?

Jon Shen (Suncorp): We're living in the age of AI... so why do we still need humans?

People are frail, irrational and full of biases. Are we qualified to be in the driver's seat as AI reshapes our world? More powerful models are released every week, triggering new scientific breakthroughs and an escalating arms race. This talk explores the paradoxical yet effective partnership between humans and machines as we navigate the uncertain future ahead.

Jonathan Cohen (Taylor Fry): Measuring the impact of personalisation: Insights from a large-scale marketing case study

We will discuss a case study of a large-scale marketing personalisation engine that executes millions of actions each week, highlighting the challenges in measuring effectiveness in personalised customer interactions. Traditional aggregate measurement methods prove inadequate in this context, as customers receive dynamic sequences of individualised treatments and success depends on identifying and leveraging heterogeneous treatment effects for an 'audience of one'.

We will explore three interconnected challenges: linking personalisation efforts directly to business value, accurately tracking the performance of individual treatments, and quantifying the added benefit of personalisation over simply applying the best aggregate treatment to all customers. We'll highlight the application of familiar actuarial concepts such as credibility, along with broader elements around causal measurement that enhance the actuarial toolkit and will also draw parallels with applications in insurance claims management.

John NG (Zurich Financial Services): Machine Learning in Mortality Modelling: A Practical Guide

The goal of mortality modelling is to predict and understand mortality and longevity. With the proliferation of data, advances in technology and the development in machine learning techniques, (re)insurers and pension funds are better positioned to produce more precise mortality estimation, supporting key functions such as pricing, reserving, underwriting and solvency management. This session presents an overview of current machine learning applications in life insurance, organised within biometric contexts using both discrete-time and continuous-time frameworks [1]. Practical approaches for implementing machine learning in mortality modelling will be discussed, alongside important considerations such as explainability, monotonicity, graduation, and convergence.

[1] Ng, J. (2023). "Multivariable Mortality Modelling, Survival Analysis, and Machine Learning". IFOA Longevity Bulletin: The Machine Learning Issue. <https://actuaries.org.uk/media/mwbojehy/longevity-bulletin-issue-15.pdf>

Andrés Villegas (UNSW): Blending Statistical Learning with Demographic Insights in Mortality Modelling

This talk highlights how combining statistical learning tools with demographic and actuarial insights improves mortality modelling for older populations. We present two case studies. The first examines retirement-age mortality in Australia using detailed linked data from the entire population (2016–2017). Applying a flexible Poisson generalised linear model with Hermite Splines, we explore how factors like socio-economic conditions, income, marital status, and homeownership affect mortality. The second focuses on China's oldest-old population (80+), integrating classic parametric mortality models with machine learning techniques like survival trees. Using data from the Chinese Longitudinal Healthy Longevity Survey, we uncover the association between health, lifestyle, and socio-demographic factor on the China's oldest-old population.

Katja Ignatieva (UNSW): AI-Powered Detection of Corporate Greenwashing

This proposed project aims to develop an innovative artificial intelligence (AI) framework to tackle the issue of corporate greenwashing, where companies exaggerate or misrepresent their environmental claims. By leveraging advanced natural language processing (NLP) techniques, such as semantic analysis and named entity recognition, the research will focus on identifying misleading environmental disclosures in corporate communications. One of the key objective is to design a Green Authenticity Index to evaluate corporate sincerity, providing a foundation for future tools that could empower regulators, investors, and consumers with transparent insights. This proposal aligns with Australia's evolving sustainability regulations, aiming to promote corporate accountability and enhance sustainable investment practices.

Mario Wüthrich (ETH Zürich) Recent developments in deep learning for solving actuarial problems

This presentation gives an overview of the latest developments in deep learning and their applications to actuarial problems. Inspired by the huge success of large language models (LLMs), our main focus is on discussing Transformers and Attention Layers, introduced by Vaswani et al. (2017). These deep learning architectures can be used in different ways to solve actuarial problems. Their use is rather intuitive for experience rating in insurance pricing, but they can also be used in regularizing hierarchical high-cardinality categorical covariates. Moreover, we discuss the recently developed Credibility Transformer, which augments the classical Transformer by a Bühlmann credibility mechanism that crucially helps to regularize network training and, as a side-product, it provides an explainable encoded version of the input information.

This is joint work with Ronald Richman (Old Mutual Insure, University of Witwatersrand) and Salvatore Scognamiglio (University of Naples Parthenope)

Zilinka Jiang (Quantium): AI that works: AskTelstra – Case study on AI implementation

What happens when your perfect AI meets messy reality? At Telstra, we learned that a timely response beats a perfect answer every time. This talk shares practical lessons from transforming how our customer service team members work - revealing why speed, simplicity, and clean data matter more than technical sophistication in building AI that people actually use.

Sheldon Lin (University of Toronto): Modelling Inhomogeneity and Variability of Insurance Portfolios via Mixtures, Random Effects and Beyond

Most insurance portfolios, especially in Property and Casualty (P&C) insurance are policy specific and policyholders possess different risk characteristics. As a result, they are highly heterogeneous. Furthermore, certain risks from insurance policies are unobservable or uncontrollable, which adds additional variability/randomness of an insurance portfolio. Hence, modelling and analyzing the claims, risk classification, ratemaking and reserve determination entail many challenges, especially from a data-driven modelling perspective. In this presentation, I will share some recent works from our team on how to address these challenges using real insurance data. I will begin with the use of a simple Mixture of Experts model that enables to capture the heterogeneousness of an auto insurance portfolio and the nonlinear relationship between policy attributes and claims, and show how the model can be used for policy selection for the Risk-Sharing Pool of the Facility Association of the Province of Ontario, Canada. We further add random effects to the model to address the temporal dependence of the claim history within each of the policies and show such an approach provides better risk classification for the portfolio. We then turn our focus to the problem of IBNR reserving, which is significantly impacted by both systematic and unsystematic variability in reporting delays. This variability is addressed through a hierarchical modeling framework, incorporating a Dirichlet distribution on reporting delay. Our real data application shows that the approach improves the accuracy and reliability of IBNR reserving.

Jared Spoward (AIA): Artificial Intelligence: Opportunity or Threat to the Actuarial Profession?

Artificial intelligence (AI) is transforming industries at an unprecedented pace, sparking discussions about its potential to replace human roles, particularly in knowledge-driven fields. For emerging actuaries, this raises a crucial question: Is the actuarial profession at risk, or does AI represent an unparalleled opportunity for growth?

Actuaries have traditionally possessed a solid grounding in key areas such as mathematics, probability, financial theory, risk management, and ethical decision-making—all of which remain essential in the age of AI. To fully harness the opportunities presented by this technological shift, actuaries must also focus on developing core AI competencies.

This presentation will explore both the potential threats and opportunities that AI brings to the actuarial profession, highlighting how these traditional strengths, coupled with new AI skills, position actuaries to lead the responsible adoption of AI and help organisations unlock its full potential.

Patrick Laub (UNSW): Neural networks and uncertainty

A typical neural network takes in some input, applies some magic, then produces a single number as the output. As the internal logic is so opaque, it is not obvious when a network is making confident predictions or is just wildly speculating (giving the digital equivalent of a shrug). This brief talk will touch on *distributional regression* where we ask the networks to give us predictions in the form of probability distributions, and specifically our [Distributional Refinement Network](#) (DRN). The DRN starts from the actuarial Swiss army knife (the GLM) and augments it with some neural network flexibility.

Bernard Wong (UNSW): TBA