AVIVA-CAMBRIDGE STRATEGIC PARTNERSHIP

ANNUAL REPORT

2021-22

UNIVERSITY OF CAMBRIDGE

AVIVA

INTRODUCTION

I am delighted to share our third annual report on the partnership between Aviva and the University of Cambridge and to have the pleasure of introducing this report showcasing our progress and deliveries over the past academic year.

This special partnership joins two data focused areas within each of our respective organisations. In the University of Cambridge, the Centre for Data-Driven Discovery (C2D3) brings together researchers and expertise from across the academic departments and industry to drive research into the analysis, understanding and use of data science and AI. At Aviva our Quantum community brings together our data specialists from across all our global businesses for the benefit of collaboration, development, and innovation.

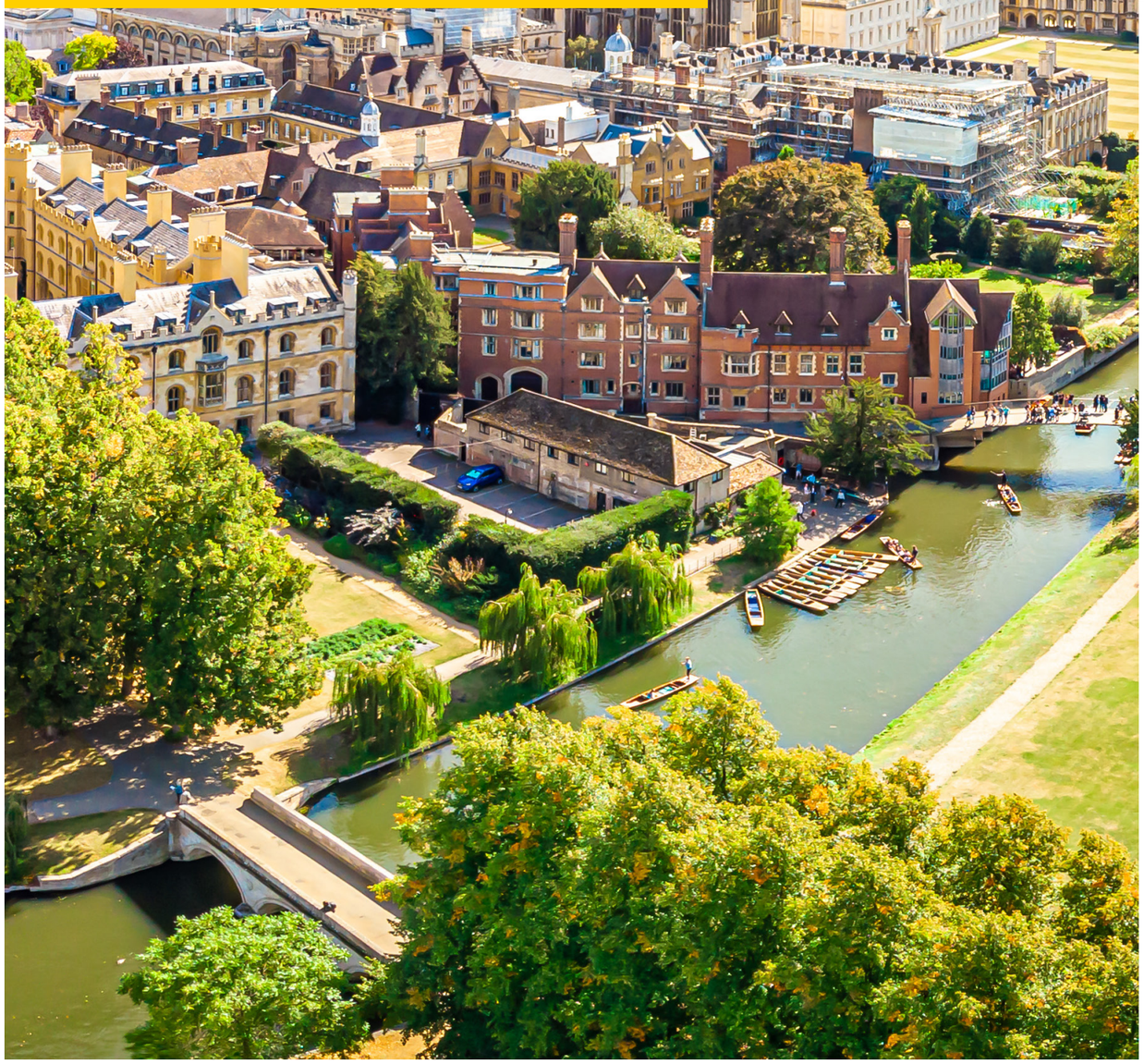
Having been there for our customers for 325 years, we know it takes many things to make a successful partnership. It takes Aviva, and it takes our strong relationships beyond the insurance industry to create a better tomorrow for our customers, our employees and the wider society and communities where we live, work and study. Therefore, we are thrilled to have completed another year working in lockstep between Aviva and Cambridge and to be able to in turn share this with you.

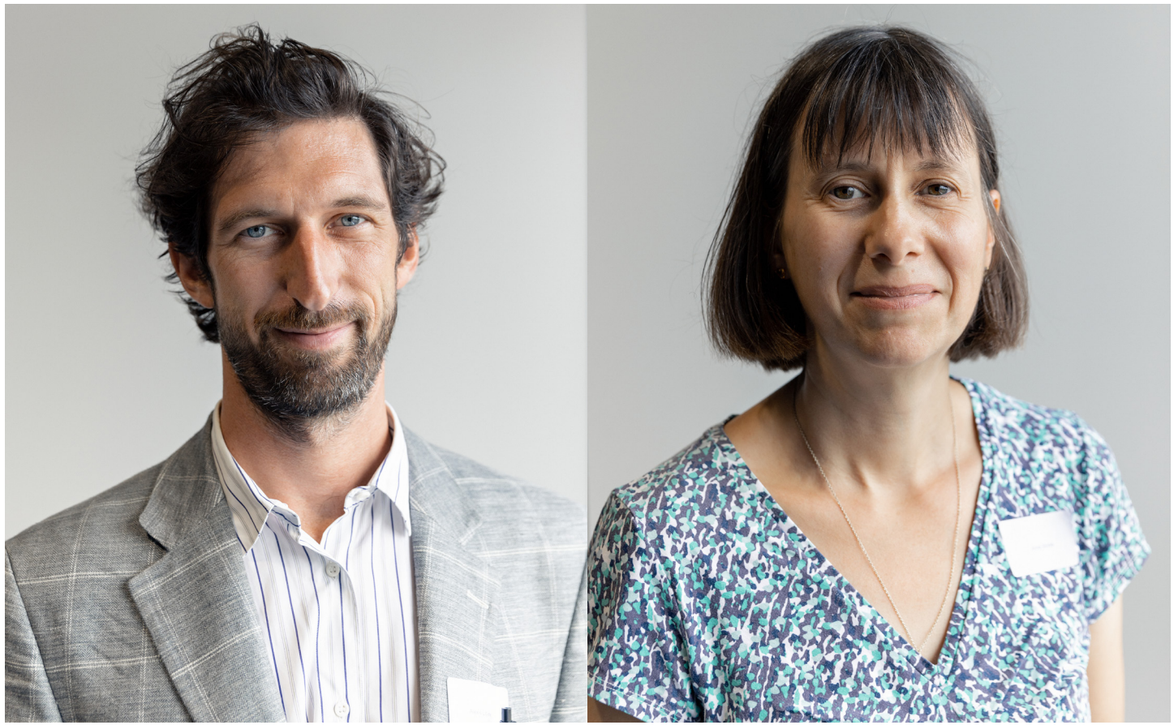
This report highlights the progress of our partnership over the 2021-2022 academic year as we move back into some new normality following what has been a turbulent period for everyone. Achievements include the completion of our first sponsored PhD and the progression of our remaining four, a post-doctoral project unlocking the history of Aviva's oldest records, and the delivery of a Grand Challenges report on building resilient communities in the face of climate change. We are just as excited about the future with a new PhD on Natural Language Processing (NLP) explainability, a training collaboration with the University's Judge Business School on data-enabled decision-making, and an additional partnership with the University's Careers Department to support Aviva's new Data graduate programme.

I hope you enjoy discovering more about these initiatives and that you continue to follow our journey into the future.

Alessia Kosagowsky
Chief Data Officer, Chair of Aviva Quantum

"It takes our strong relationships beyond the insurance industry to create a better tomorrow for our customers, our employees and the wider society and communities where we live, work and study."





Alexis Litvine & Anna Stone

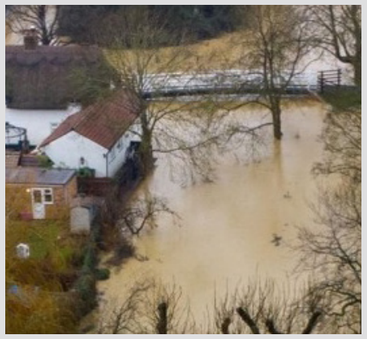
MINING AVIVA'S 325 YEARS OF HISTORICAL ARCHIVES

Alexis Litvine & Anna Stone

This project was co-funded by Aviva and the Economics and Social Science Research Council. It aims to create a proof-of-concept of integrated handwriting recognition and AI document segmentation technology developed by Osiris-AI, enhanced with new geolocation features, applied to Aviva's oldest insurance record collection.

To demonstrate the usefulness of the technology, we partnered with Aviva's archives to digitise the complete collection of the Hand-in-Hand insurance policy registers held at the London Metropolitan Archive. We created a structured dataset that will be available to researchers and the public. These registers are particularly interesting because of their long coverage and their wealth of observations (approximately 1.8M unique observations) on London properties insured against fire for the period 1697-1865. These data were geolocated to specific locations in London using a new custom-built crowdsourcing interface.

We will soon be able to offer a striking visualisation of the data created using Osiris-Ai technology. Thanks to the funding we received from Aviva, our work will be widely publicised, helping us to promote our technology and expertise while promoting Aviva's rich heritage.



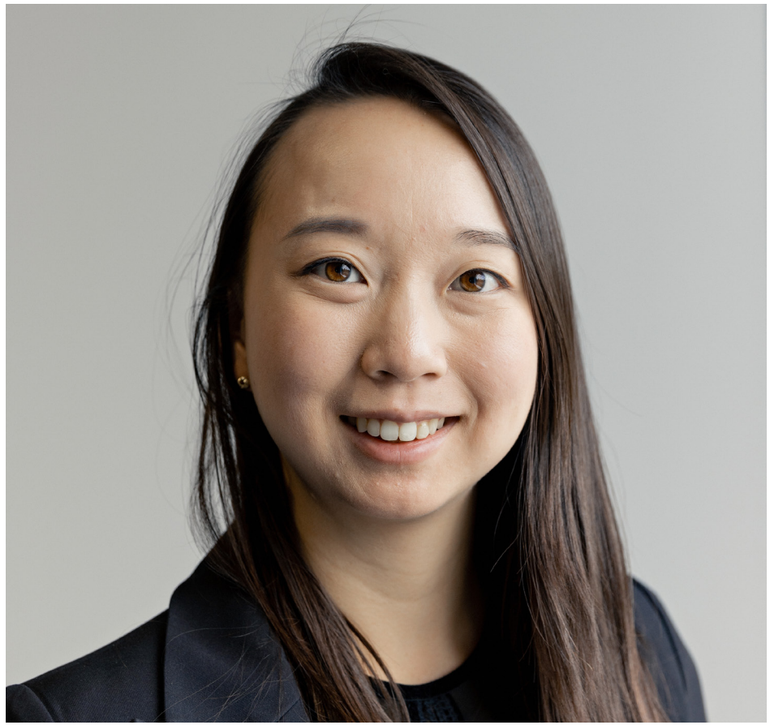
Floris Blok discussing the 'The impact of climate change on the social environment in England' white paper.

THE IMPACT OF CLIMATE CHANGE ON THE SOCIAL ENVIRONMENT IN ENGLAND

In July 2021 Aviva published their "Building Future Communities" report, a first look at the opportunities and challenges involved in creating resilient homes and businesses in a changing climate. This looked at the three aspects of the natural, built and social environments and proposed seven specific areas requiring urgent action if properties and communities are to be protected in the future. At a workshop held with the Cambridge Grand Challenges programme in September 2021, it was agreed that the social environment aspects of the report deserved further scrutiny.

The following December Aviva commissioned a white paper in response to this challenge, authored by four Cambridge PhD students (Floris Blok, Mark Barrow, Tallulah Eyres and Christina Xiao) led by Konstantina Stamati. Completed in March 2022, the paper studied the UK communities most effected by coastal flooding and heat waves and any link between climate-related risk and social factors such as deprivation. For coastal flooding it is difficult for individual property owners to take action to mitigate the risk. There is therefore a key role for the insurance industry and government to help in this area. By contrast, the effect of heat waves tends to depend on individual circumstances, such as age and levels of insulation in a property. It is easier for individuals to take action to mitigate the risk of heat waves, such as installing more insulation, air conditioning and painting roofs and walls white. The report concluded that there is little very little evidence linking climate-induced risk to social deprivation. There is also limited data on the resilience of individual dwellings. Gathering such data is key to ensuring these risks are properly priced in, and here heat waves are relatively understudied compared to flooding risk.

Michelle Lee



CONTEXT AND FAIRNESS FOR MACHINE LEARNING

PhD student: Michelle Lee

Academic supervisor: Dr. Jat Singh

Aviva sponsor: Stephen Shaw

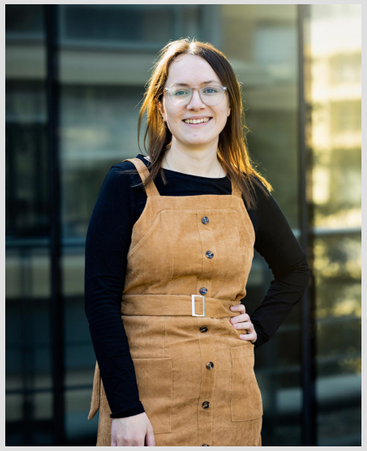
This summer Michelle Lee became the first Aviva-sponsored PhD student to complete her degree. Congratulations Michelle!

Michelle's work has focussed on characterising bias and unfairness in machine learning algorithms, particularly in the financial services industry and as applied to automation in recruitment processes. Reconciling the differences in definition and approach to this subject between computer scientists, philosophers and economists, Michelle then identified how unfairness can arise at different stages in a machine learning pipeline. A key early outcome of her work was a summary of open source software toolkits for AI fairness.

From October 2021 to January 2022 Michelle was based at the Alan Turing Institute where she co-founded their Trustworthy AI forum. She has been a long-term member of the Datakind volunteer network, which aims to help organisations use AI to effect social change.

Michelle now returns to working full time for Deloitte as their AI ethics lead and continues to work with Aviva on a consultancy basis. To keep in touch with Michelle and to keep up-to-date with her latest work see michellesengahlee.com

PHD STUDENT UPDATES



Jessica McMaster

Identifying factors underlying resilience to age-related cognitive decline

PhD student: Jessica McMaster

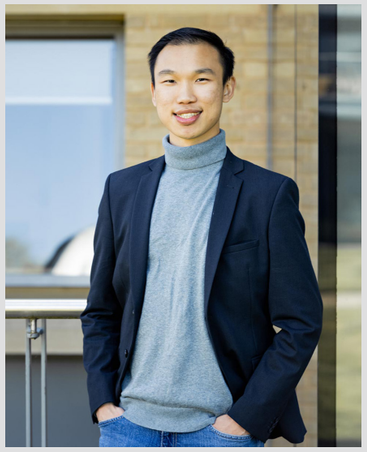
Academic supervisor: Prof. Jon Simons

Aviva sponsor: Robert Morrison

Jessica's work aims to understand whether individual health-related factors and lifestyle behaviours throughout life effect cognitive performance in later life. Examples include the extent of an individual's social support network, their engagement in cognitively demanding hobbies, their quality of sleep, smoking and alcohol consumption.

This year Jessica recruited 500 middle-aged adults (aged 40-65) from both the Aviva staff base and the general public to take part in an online memory task and lifestyle questionnaire. This relatively large sample size will help to determine subtle relationships between lifestyle factors and memory performance in mid-life.

To learn more about Jessica's work listen to her recent podcast with Robert Morrison, available at soundcloud.com/aviva_plc/quantum-special-cognitive-resilience



Edward Kosasih

Measuring supply chain risk

PhD student: Edward Kosasih

Academic supervisor: Dr. Alexandra Brintrup

Aviva sponsors: Owen Whelan & Mark Dunham

The analysis of business interruption risk due to supply chain failure is largely built on manual and passive tools such as supplier questionnaires and the partial deployment of technologies such as RFID for asset tracking. Instead, Edward uses natural language processing and graph theory to build an automated search engine for supply chain information, based on a diverse set of publicly available and commercial databases. This work is a collaboration with Versed.AI, a Cambridge spin-out with support from Aviva Investors.

Edward has recently published papers in the International Journal of Production Research (www.tandfonline.com/doi/full/10.1080/00207543.2022.2100841) and spoken at the 'Makers and Movers: The future of supply chain' conference.

Jan Stanczuk

Deep Generative Modelling

PhD student: Jan Stanczuk

Academic supervisor: Prof. Carola Schoenlieb

Aviva sponsor: Robert Morrison

Jan's work on deep generative modelling has a multitude of applications centred around the generation of realistic synthetic data. This can be used to generate completely synthetic data or simply to fill in the gaps in sparse real datasets. Recent prominent examples of foundational AI models for computer generated art and text are based on these techniques.

His most recent work investigates the use of diffusion models for image generation, vastly increasing the potential for rapid and realistic results and the likelihood of successful detection of 'deep fakes' and other fraudulent uses of AI-generated data.

Jonathan Crabbe

Interpretable machine learning

PhD student: Jonathan Crabbe

Academic supervisor: Prof. Mihaela van der Schaar

Aviva sponsor: Stephen Shaw

Jonathan's work aims to understand how 'black box' machine learning models arrive at their results and how they can therefore be improved upon in terms of reliability and robustness. In particular, Jonathan is studying how the results of machine learning models can be improved by tagging input data with human-defined concepts, which have a much broader definition than traditional machine learning features. Concepts can be applied to many forms of data: textual, time series and images.

Read more about Jonathan and his work at jonathancrabbe.github.io/ His code is also freely available at github.com/JonathanCrabbe

Michelle Lee presenting at the partnership showcase event in September 2022

RECENT EVENTS

This year saw the welcome return of in-person gatherings for many of us, and the first in-person annual showcase event for the Aviva-Cambridge partnership. Edward Kosasih joined us at the Aviva Quantum conference in March 2022 where he presented his work on supply chain risk modelling. In September our annual partnership showcase event was held at Homerton College in Cambridge. Following introductions by Prof. Andy Neely and Alessia Kosagowsky, we heard from our archives project, the Grand Challenges work on community climate resilience and from Michelle Lee summarising her completed PhD thesis.

This was closely followed by our other four PhD students presenting to the Aviva Quantum community in Norwich at the end of October, alongside Jat Singh (academic supervisor for Michelle Lee) who gave his perspective on what makes a good academic-industry collaboration.

Our first executive education programme with the Judge Business School kicked off at the end of November with its first in-person session. We look forward to further sessions, both in-person and online as this course on data-enabled decision making unfolds into 2023.

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