AVIVA-CAMBRIDGE STRATEGIC PARTNERSHIP

ANNUAL REPORT

2020-21

UNIVERSITY OF CAMBRIDGE

AVIVA

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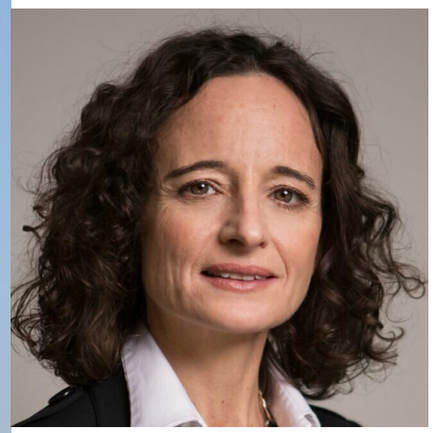
INTRODUCTION



Having joined Aviva in late 2021, as part of our creation of a central Data Office, I am honoured to take on the sponsorship of this partnership between Aviva and the University of Cambridge, and to introduce this report showcasing our recent activities.

Aviva and the University of Cambridge are both leading brands within their fields, with this partnership seeking to bring together the seemingly very different worlds of insurance and academia. Despite the outward differences, our core missions, values, and rich history are very much aligned. Both organisations are centred around the desire to create a better tomorrow for our customers or students, our employees and the wider society and communities where we live, work and study.

We are delighted to share this report, which highlights the progress of our partnership over a very difficult 18 months for everyone. Achievements include doubling our number of active PhD sponsorships, developing a placement program for neurodiverse students, and renewing our podcast series to share our data science applications with all. We are just as excited about the future with an increased focus on development opportunities for our people, working with Cambridge to share our corporate archives, and delivering our research projects supporting both Aviva's climate action agenda and community wellbeing support.

I hope you enjoy reading more about these initiatives and it piques your curiosity to continue following our partnership journey.

Alessia Kosagowsky
Chief Data Officer, Chair of Aviva Quantum

DRIVING THE IMPACT OF DATA SCIENCE

The partnership in a nutshell

The partnership is built on three pillars:

Research: applying cutting edge data science techniques to solve the hard problems that keep Aviva's people awake at night.

Training: opening the door to world-class training opportunities for Aviva employees, giving them an opportunity to revisit academia, to challenge themselves and continue their learning throughout their careers.

Communications: reaching some of the brightest students in the world as future talent, promoting the benefits of industry-academia collaboration, using the convening power of Cambridge to influence policy.

5 PhD students
1 Research Fellow
1 Partnership Manager

8 active research projects
2 complete research projects

1 bespoke training course
4 open training courses

2 hackathons
Annual showcase event
Podcast series

"Market leading insurance and investment expertise meets outstanding research and teaching, to drive the impact of data science."

SUPPLY CHAIN RISK

PhD student: Edward Kosasih
Academic supervisor: Dr. Alexandra Brintrup
Aviva sponsor: Owen Whelan

Edward's work uses a combination of natural language processing and graph theory to uncover the complex and often surprising links in the world's supply chain networks. The risks associated with supply chain disruption range from natural disasters to cyber attack, with Brexit and the Covid pandemic having made the subject particularly topical.

Surprisingly, the majority of industries have no full overview of their supply chains. It is therefore difficult to develop methodologies for more accurate underwriting of business interruption insurance.

Aviva's commercial lines team hope to directly make use of Edward's work to further understand the patterns in supply chain risk among their clients and to improve risk estimation algorithms for individual clients.

UNDERSTANDING RESILIENCE TO DEMENTIA

PhD student: Jessica McMaster

Academic supervisor: Prof. Jon Simons

Aviva sponsor: Robert Morrison

Some individuals are more resilient to the cognitive decline associated with diseases such as dementia in older age. This is understood in terms of ‘cognitive reserve’, and is influenced by factors occurring earlier in life.

Education and occupation are known to contribute to cognitive reserve, while it is suspected that more modifiable lifestyle factors such as levels of physical and social activity also play a role. Jessica’s work is focused on understanding whether such lifestyle activities in middle age might predict resilience to subsequent age-related cognitive decline, especially relating to memory and recall. This may lead to early detection of a decline and improved strategies for avoiding it.

This work has direct links to improving longevity, reducing morbidity and understanding the modelling of disease risk in older age groups.

INTERPRETING BLACK BOX MACHINE LEARNING

PhD student: Jonathan Crabbe

Academic supervisor: Prof. Mihaela van der Schaar

Aviva sponsor: Stephen Shaw

Many machine learning algorithms, particularly neural networks, appear to be a ‘black box’. That is, they seem to give the correct results but we don’t understand exactly how they do it. It is therefore difficult to assess their accuracy and reliability.

Jonathan is working to develop a systematic and comprehensive framework for interpreting black box machine learning methods such as deep learning. This will be applicable to a wide range of data, from images to time series.

Algorithms which are explainable can be further understood in terms of their fairness and bias, particularly important considerations for the insurance industry. Understanding the mechanisms of black box algorithms means we can also improve their predictive power.

CONTEXT AND FAIRNESS FOR MACHINE LEARNING

PhD student: Michelle Lee

Academic supervisor: Dr. Jat Singh

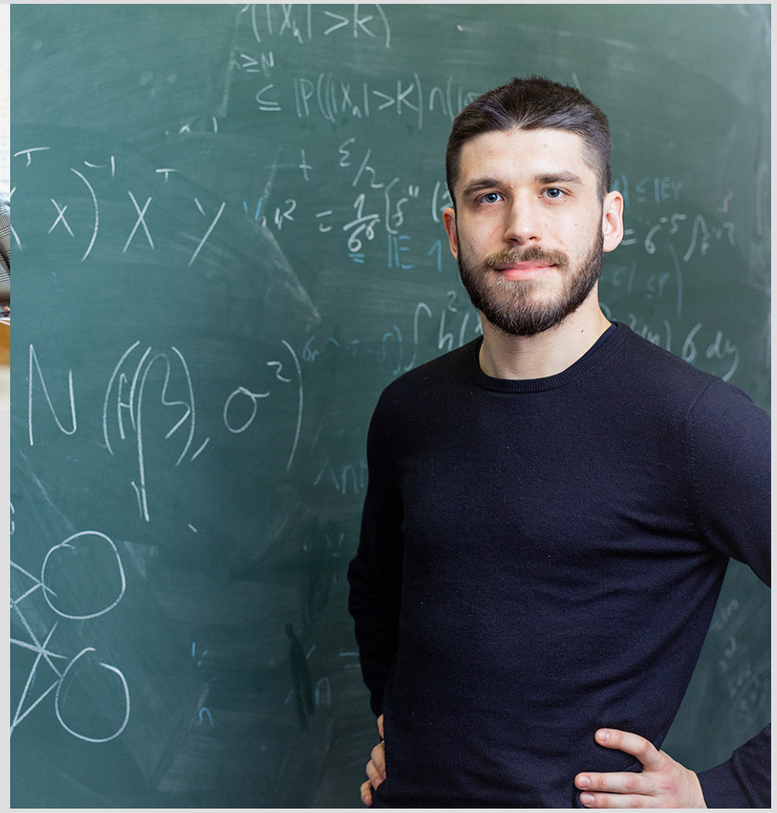
Aviva sponsor: Stephen Shaw

Consumer trust – and its possible erosion – is a critical issue for insurers. Michelle began her PhD in October 2019 looking at algorithmic fairness and transparency.

Since then she has been gaining attention both for her academic publications and her wider dissemination activities. In 2020-21 she published several new papers, one of which – 'Landscape and Gaps in Open Source Fairness Toolkits' – won a Best Paper Award at ACM CHI Conference for Human Factors in Computing Systems. A complete list of her publications can be found here: michellesengahlee.com/publications

Michelle has also given a number of talks to organisations such as the Financial Data Professionals (FDP) Institute and the Oxbridge Women in Computer Science Conference, for which she won the Best Lightening Talk award.

She was nominated for Most Influential Women in UK Tech 2020 and won an award as 'Standout 35' for Women in FinTech Powerlist. In her free time, Michelle volunteers for DataKind on its Ethics Committee. With St. John's College, she ran a computer science workshop for Generating Genius which works with disadvantaged black Year 12 pupils in London who are interested in pursuing STEM degrees.



DEEP GENERATIVE MODELLING

PhD student: Jan Stanczuk

Academic supervisor: Prof. Carola Schoenlieb

Aviva sponsor: Robert Morrison

Jan is a third-year PhD student working on deep generative modelling and its applications. He is studying algorithms which use neural networks to learn high-dimensional probability distributions. This is one of the fundamental areas of modern data science with a very broad range of applications from music generation to medical imaging.

He is working on deepening the theoretical understanding and improving the performance of generative models. In his first paper he examined the mathematical underpinnings of Wasserstein Generative Adversarial Networks, one of the most successful generative models, which despite impressive performance still lack a solid theoretical foundation.

Jan is a part of AIX-COVNET, a collaboration which is developing an open-source artificial intelligence tool that combines chest imaging data, clinical and laboratory data to support the diagnosis, triaging and treatment planning for COVID-19 in the UK. He contributed by analysing how generative models could help in imputation and classification of clinical data.

AVIVA RESEARCH FELLOW

In October 2020, Dr Hankui Peng joined C2D3 from the University of Lancaster for a 12-month post-doctoral position as the Aviva Research Fellow, based in the Department of Applied Mathematics & Theoretical Physics. Hankui brought to the role her research background in text clustering algorithms and active learning techniques and her previous experience in the financial services industry, working for Citibank China and the Bank of East Asia.

Working with colleagues in Prof. Carola Schonelieb's Centre for the Mathematics of Information in Healthcare, Hankui has developed new techniques in superpixel image segmentation.

In September 2021 she led a research workshop for Aviva Quantum and in December 2021 delivered a hands-on technical masterclass in image analysis.

THINKLAB

October 2020
Begining of ThinkLab research-based approach and experts' interview

2021–2022
Pilot scheme at Aviva

Beyond
Established internship programme and further development

The ThinkLab programme is unique within the University of Cambridge, bringing together students and industry experts over several months to work on 'big picture' problems, delivering impactful, practical solutions.

In June 2020 Aviva challenged the ThinkLab team, led by Dr. Tyler Shores, to design an internship scheme for data scientists specifically aimed at recruiting neurodiverse individuals on the autism spectrum. A group of Cambridge PhD students and current Aviva employees, all of whom self-identified as neurodiverse, participated in a series of workshops to share their professional experiences, identifying the essential features of a recruitment scheme and the ongoing support neurodiverse individuals would require to succeed in the workplace. They were assisted by a distinguished group of external experts: Dr. Temple Grandin – the well-known autism advocate and author, Dirk Muller-Remus – former CEO of Auticon Germany and Prof. Amanda Kirby – CEO of Do-IT profiler.

The recruitment scheme went live for data science roles in September 2021, and now includes other areas within Aviva such as pensions client relations, risk management and claims handling. The Aviva neurodiversity resources hub can be found at exceptionalindividuals.com/aviva-resources-hub

Engineering PhD student Dante McGrath shared his experiences as part of the ThinkLab team:www.thinklab.strategic-partnerships.admin.cam.ac.uk/news/thinklab-experience-dante-mcgrath

MENTAL WELLBEING

Identifying innovations for the prevention, diagnosis and treatment of depression

Olivia Remes & Peter Templeton, funded by the Aviva Foundation

Depression accounts for the largest share of the world's burden of disease measured by years lost to disability, and its prevalence is increasing. Around 322 million people globally suffer from depression. 75% of people with a mental health problem develop depression before the age of 24, and 50% develop it before the age of 14. Current treatments for depression in under-18s are effective in only 60% of cases.

This project has three major aims: in the near term, to identify innovations for the prevention, diagnosis and treatment of depression, particularly in younger people, and to identify enablers and barriers for the most promising innovations. In the medium term, to pilot promising early interventions for depression. And in the longer term, to help bridge the different elements of the healthcare ecosystem to enable earlier and more effective intervention.

A series of 12 workshops were conducted (with worldwide participation from academia, clinicians and industry, including Aviva), generating innovative ideas for a joined-up understanding of the social, biological and psychological factors that contribute to depression. These ideas were evaluated and prioritised, identifying enablers and barriers for their use in self-care by individuals and their families, by the formal healthcare system, and by the wider mental health ecosystem.

There are clear opportunities to prevent and intervene early in the development of depression by considering it as a 'system of systems.' These systems consider an individual's economic, emotional, physical and social environments; their underlying health conditions; their choices and actions regarding diet, exercise, sleep and substance use; their biological systems, including their genes, gut microbiome, stress response system, and immune system.

TRAINING & OUTREACH

Despite the challenges posed by moving all of the University's teaching online, as well as courses aimed at industry, Aviva colleagues have participated in numerous virtual and hybrid events including some very well received courses led by our PhD candidates and research fellow.

One key course, led by Edward, was on process mining which was not only an excellent technical introduction but a great opportunity for Aviva staff to meet colleagues from other C2D3 partners. Aviva people have also attended courses on fostering diversity and Data-Led Decision Making run by the Judge Business School and an Introduction to Machine Learning at the Newton Institute.

September 2021 saw our second cohort of PhD students, featured in this report, presenting short talks at the partnership annual showcase event. They also continue to contribute to life at Aviva by featuring in the Aviva Quantum podcast series and giving online seminars to a wide audience from across Quantum.

As the world has re-opened in 2022 Aviva delegates have been able to join Cambridge events including a vulnerable customer workshop and the AI4ER research showcase. We look forward to returning the favour as Aviva hosts the 2022 Partnership showcase event in Norwich on 7 September.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