AVIVA

ANNUAL **PARTNERSHIP REPORT**

2019-20

UNIVERSITY OF CAMBRIDGE

Dr. Orlando Machado, Global Chief Data Scientist, Aviva

INTRODUCTION

I’m delighted to introduce the first Annual Report of the partnership between Aviva and the University of Cambridge. Our organisations have a lot in common, from our centuries-long heritage through to our commitments to sustainability and long-term impact. With this partnership, we’re trying to bring the best of both worlds together: academic thought leadership at the highest levels of excellence, matched with a business that is taking care of 33 million people through all phases of their lives.

Data science is a fast moving field, in both academic and commercial environments, but we’ve quickly been able to use this partnership to match the leading edge of academic thinking with real-world customer problems. These range from the use of machine learning to deliver better clinical outcomes, to the ethical considerations associated with the use of algorithms – an area that will undoubtedly increase in visibility over the coming years.

Our employees are also seeing the benefits. We have been able to offer data science training at a level of excellence that simply wouldn’t be possible on our own. We unashamedly see data science as an increasing source of competitive advantage, and equipping our people with cutting-edge skills just makes good business sense.

I hope you enjoy reading more about our work. It’s an exciting and vibrant field, and there is certainly more to come.

Dr Orlando Machado
Global Chief Data Scientist at Aviva

PURPOSE

This report provides an overview of the Aviva partnership with the University of Cambridge – the initiatives and projects that have been undertaken since it began in December 2018 – as well as a view of focus areas and strategy for 2020-21. The intended audience for this report is partnership stakeholders, partners and clients.

Aviva & the University of Cambridge | Anna Dalglish, Mark Hayes | May 2020

OUR JOINT VISION STATEMENT

Early in the partnership, the steering committee, with input from key stakeholders, developed the following joint vision statement setting out what we want to achieve and what makes the partnership unique.

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

Jan Stanczuk, Aviva PhD candidate; Dr Orlando Machado, Global Chief Data Scientist at Aviva; Anna Dalglish, Partnerships Lead at Aviva; Mark Hayes, Relationship Manager at the University of Cambridge; Stefan Maczkowski, Head of Data Strategy at Aviva

Mark Hayes and Anna Dalglish, Partnership Managers, University of Cambridge and Aviva

"The partnership has hit the ground running. I put that down, firstly, to a huge commitment to the partnership from both sides. And, secondly, it's very much a meeting of minds. Aviva is asking the big and difficult questions, regardless of outcome – and those are exactly the kind of problems that Cambridge gets excited about."

Professor Andy Neely
Pro-Vice-Chancellor for Enterprise and Business Relations, University of Cambridge

OUR PARTNERSHIP VALUES

Any proposed activities are first considered against the following partnership values. These values help our governing committees to determine whether a project is aligned to our vision. All projects should:

1. Advance data science
Through high quality research and education that explores new and innovative techniques

2. Make an impact on society
Contributing positively to society, improving our lives and the environment within which we live

3. Provide value to both partners
Delivering strategic, commercial or brand value.

THE CAMBRIDGE CENTRE FOR DATA-DRIVEN DISCOVERY

Aviva is the founding industry partner of the Cambridge Centre for Data-Driven Discovery (C2D3). The activities supported by C2D3 are drawn from the underlying mathematics and computer science to applications of data science across all disciplines. These range from the physical sciences, biological sciences and clinical medicine to the ethical, legal and social issues involved in the use of data science for the benefit of society.

As a central part of this new interdisciplinary research centre, Aviva is well placed to take advantage of C2D3's wide ranging community and capacity building role across the data science research community in Cambridge.

MANAGING THE PARTNERSHIP

2019 was the first full year of the partnership. During that time the partners have been able to establish firm foundations for the development of effective projects in a way that delivers value and impact for both parties. An important part of this process was the appointment of an Aviva-funded relationship manager - Mark Hayes - based in Cambridge's Strategic Partnerships Office, to work closely alongside the Aviva partnerships lead, Anna Dalglish. Together they are able to ensure that these two large organisations are able to make the most of the plentiful opportunities that exist for collaboration. This is a unique and distinctive feature of the partnership, and is testament to the level of commitment Aviva is making to it.

LOOKING AHEAD
AVIVA AND CAMBRIDGE IN 2020-21

A Over the coming year the partnership will build upon its strong foundations, increasing its breadth and diversity across the whole University and the Aviva business. COVID-19 has, inevitably, forced a re-evaluation of priorities and whilst the partnership will remain focused on data science, opportunities to support COVID-19 research are also being explored. Other hugely important topics include sustainability, climate change and planning for a zero carbon future. These will also remain on the partnership's research agenda.

Recruitment of an Aviva Research Fellow will be critical to identifying mutual areas of interest in research, matching priorities for Aviva with research expertise at Cambridge. Successful project proposals will align with all three of the partnership values: advancing data science, clear societal impact and demonstrable competitive advantage.

Training and professional development activities will remain a key theme of the partnership. Moves to ensure all content is accessible digitally in response to COVID-19 has in fact made teaching more broadly available to Aviva's data science community, across all of its markets. The technical training programme initiated in 2019 will extend its reach across the global data science practice at Aviva, and the team are currently developing a module in natural language processing. This will be the first piece of training delivered exclusively online.

A more structured and creative communications strategy will also be developed in 2020, starting with this annual report. Regular communication on partnership activities, the range of projects underway, and the impact they are making will demonstrate the value of the partnership to external stakeholders, customers and strategic partners – both current and future.

On the back of their success, the partnership podcasts series will continue, giving projects and researchers an opportunity to promote their work and discuss important topics on air with industry experts. As well as working to familiarise more people with the work of the partnership, these podcasts aim to demystify data science and open up what is sometimes considered to be an intimidating field.

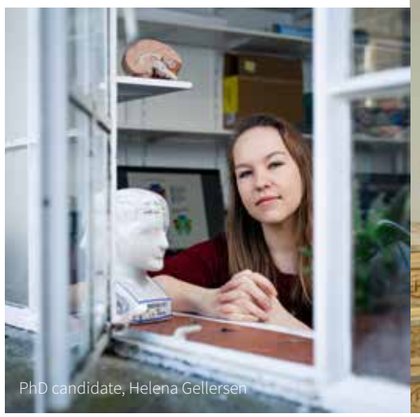
Finally, outreach activities and support will be ongoing for student-led groups and representative bodies at the University, such as the Data Science Society and the Office of Postdoctoral Affairs. This support takes different forms, from sponsorship that supports the operational costs of the society, to providing guest speakers, running workshops and helping to design an exciting programme of events. As well as allowing the partnership to keep in touch with this large and lively group at the University, outreach gives us an opportunity to identify promising talent and increase Aviva brand awareness.

RESEARCH

20 project proposals considered in 2019-20

Funding agreed for 3 further projects in 2020-21

Working with the University's Schools of Technology, Physical Sciences, Clinical Medicine, Humanities and Social Science.



PhD candidate, Helena Gellersen

STRATEGIC FOCUS AREAS

RESEARCH

Objective: To establish a diverse portfolio of research projects, co-developed and in line with the partnership values

As of April 2020 there are 13 projects listed in the partnership portfolio. These are at various stages of maturity and are diverse in size and scope. All of the partnership projects begin as proposals. They are either developed jointly by the partners, coming together around a problem statement identified by Aviva, or have been composed independently and shared with Aviva, as a potential interested party.

Successful proposals – those that are approved for funding – are of mutual interest. The partnership team is integral to finding these opportunities. In 2020, an Aviva Research Fellow will join the partnership team and will be responsible for uncovering and defining potential projects.

Three of the 13 projects lasted between one and three months. These short projects have given the partnership team the opportunity to test and shape the governance processes, specifically designed and used to ensure that the experience for both partners is positive, efficient, and that the projects are subject to sufficient legal and ethical rigour. The partnership steering and executive committees play a pivotal role in this.

October 2019 saw the beginning of two PhD projects in the Departments of Applied Mathematics and Theoretical Physics and Computer Science and Technology:

> "For Aviva, this represents a long-term investment in cutting-edge machine learning techniques that could have a wide range of practical applications as well as the clear medical benefits of improved diagnostics."
>
> **Jan Stanczuk**

Machine Learning for images of ovarian cancer

Using neural networks to analyse scan imagery and make real-time diagnostic and treatment response assessments for ovarian cancer patients.

Jan Stanczuk is a PhD student on the Cambridge Mathematics of Information PhD programme. This is a four-year research training programme, with half of the first year dedicated to training in new mathematical concepts. As part of this mathematical training, Jan has had specialised course work in data-driven inverse problems, probability and partial differential equations.

Jan's training will continue in 2020 with course work in computational mathematics, but in addition to this he will work on a small research project on automated deep learning. Jan is set to share his learnings with the Aviva team, helping them to understand how these sophisticated methods might apply to the insurance industry. This kind of knowledge sharing is a unique feature and benefit of the partnership for the Aviva team. There is a direct channel of communication between an academic team and practicing data scientists at Aviva, ensuring both organisations stay at the forefront of data science.

Preparing the groundwork for the later years of his PhD project, and specifically the development of image reconstruction from CT data, Jan has also begun studying deep learning methods. Alongside the methodological advances, this work will contribute to an ongoing and extensive project at the University to better diagnose and identify treatment pathways for cancer patients. Both dimensions of the project are of real importance to Aviva.

PhD candidate, Michelle Seng Ah Lee

Context and fairness in machine learning

Developing a computational toolkit for the implementation of fair machine learning algorithms

Michelle Lee began her PhD in the University's Department of Computer Science and Technology in October 2019 and was Aviva's inaugural PhD student. She was able to hit the ground running having set the foundation to her thesis in machine learning before arriving in Cambridge. Indeed her interest in, and passion for the topic of fairness has been longstanding and it is evident beyond her PhD. Michelle spends time consulting on the topic, and works with Data Kind, a global charity that uses data science for social good.

Michelle's work recognises that fairness is subjective. One person's definition of fairness could be very different from another's. This is an important point to acknowledge, particularly when building decision-making algorithms. How we define fairness mathematically is another key area of investigation. In Michelle's opinion, the solution centres around transparency and giving decision-makers a practical way for people to assess whether an algorithm supports their firm's values.

Working with the Compliant and Accountable Systems Research Group, Michelle co-authored three new papers at the end of 2019 and was invited to join the Financial Data for Social Good research group at the Alan Turing Institute, to work on a project studying customer vulnerability in financial services. Interspersed with her academic writing, Michelle has on multiple occasions spoken at or contributed to internal events at Aviva, and will continue to do so into 2020.

Michelle's PhD work is invaluable to Aviva's understanding and approach to the topic of fairness. Through her many publications she also addresses broader data ethics considerations that are also high on Aviva's agenda. As her work develops, Michelle will be working closely with advisers from Aviva – primarily Group Chief Data Scientist, Dr Orlando Machado – to review papers and identify insurance-specific use cases for analysis. Since the emergence of COVID-19, Michelle has been sharing her insights into the ethical considerations of contact tracing and post-lockdown tracking.

> "There needs to be a way of saying, these are your options. If you choose this one, it will have this effect, but it may have consequences for this group. And here's how to address that."
>
> **Michelle Lee**

Training

Objective: To open 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.

The pursuit of education at the highest level of international excellence is central to the mission of the University of Cambridge. Thanks to the partnership, Aviva employees can access technical training specifically tailored for data science practitioners, and introductory training is also available for non-specialists. The partnership team is also in the process of designing an executive education programme focused on data-driven organisations and how to maximise the opportunities presented by data and data science.

Introduction to Neural Networks

A two-day course introducing the fundamental concepts of neural networks for deep learning

In December, 21 Aviva employees from the General Insurance & Life Analytics and Customer Science teams in the UK, Canada, France, Italy and Poland attended a two-day face-to-face training session on neural networks and deep learning. The course was delivered at the Centre for Mathematical Sciences by computational neuroscientists Dr. Stephen Eglen, Dr. Jim Stone and Lancelot da Costa.

For the attendees, the training was a valuable introduction to the topic, laying down a foundation and enabling the group to identify future applications of this technique. The group was given an intensive introduction to the mathematical foundations of deep learning, giving sufficient understanding to configure and optimise their use of commonly used toolkits such as Keras and TensorFlow. A practical session then consolidated their learning with examples on image processing.

Follow-on 'office hours' support sessions with the tutors were available after the course, giving the participants a chance to check in if they needed clarification or support, and for future reference the core lecture material was made more widely available in video format.

As we learn how to adapt to a COVID-19 world, our technical modules will be moving online, and we are currently designing a course on natural language processing that will be targeted at an intermediate to advanced group of data scientists.

TRAINING

25 Aviva staff completed training courses at the University

Average recommendation rating given to training 4.5/5

Global reach across Aviva for training, involving staff from the UK, France, Italy, Poland and Canada

Business analytics: decision making using data by Cambridge Judge Business School

A non-technical introduction to the methods and frameworks that enable us to put data to work

Working with data is no longer solely the province of those that know their Python. It is crucial that management has an understanding of what it can do with data in a way that is not only commercially beneficial, but is also fair and ethically considerate. Research shows that businesses that use data in their decision-making perform better. Knowing the right questions to ask, and being able to identify where an opportunity might lie can make a considerable difference to business performance.

Cambridge Judge Business School has recognised the importance of these skills, and with its most experienced academics at the helm, has created an online introductory course in the key topics of business analytics. This includes decision bias and experimentation, through to descriptive, predictive and prescriptive analytics, and concludes with the ethical, legal and organisational considerations, making it a comprehensive training programme suitable for those who have minimal experience in this field.

A handful of Aviva staff have already taken the course, and the plan is to enrol more colleagues across the company in future intakes. These staff will be from functions such as Marketing and Strategy, which will benefit from increasing their knowledge in these areas.

Talent

Objective: To increase awareness of Aviva as a data-led company and recruiter of data scientists, using partnership activities as a means of identifying and recruiting talent

Adopting a grassroots strategy, in 2019 Aviva began its sponsorship of the student-run Data Science Society, with some 600 members. It has also worked closely with other key extracurricular groups at the University, such as the Office of Postdoctoral Affairs. This has enabled Aviva to connect directly with a significant number of undergraduate and postgraduate students and researchers and see first-hand how they work, interact, and come across as individuals. It is believed that this is crucial to understanding their potential, whether they would be a good fit at Aviva, or working on one of the partnership research projects.

Another important feature of the partnership talent strategy, and valued aspect of the partnership more broadly, is the visibility of Aviva at the University. This is helped by having the dedicated partnership management team, which enables its members to not only regularly work from and meet with the network, but attend, speak at and organise a number of events.

The most thoroughly tested event format has been the data science challenges. These events meet both objectives of raising awareness of Aviva as a data-led business, and testing and identifying talent through partnership activities.

Attendees work either individually or in small groups and after devising solutions present their findings back to a small panel of judges. Those who perform well get a chance to spend more time with Aviva at its offices, getting some valuable industry experience and learning more about the company.

As well as hosting and participating in events, and connecting directly with individuals in the student and research community, Aviva shares any appropriate vacancies for its data science team, or its graduate scheme, with the University's Careers Service.

> One of the great things that has come out of the Aviva partnership is the sort of close working that we've had. Our students have really benefited from this. For example, we've had Aviva staff come in and guide our students as to how to communicate on very technical issues that people often struggle to communicate, and of course some of the senior staff at Aviva do that wonderfully. ”
>
> **Anna Vignoles**
> Co-chair Cambridge Centre for Data Driven Discovery (C2D3)

The postdoctoral "Meet the Company" data science challenge

A half-day hackathon and presentation workshop for early career postdoctoral staff and students

In September 2019, the Cambridge Office of Postdoctoral Affairs hosted a half-day data science workshop for around 20 early-career research staff and doctoral students. The primary purpose of this event was to raise awareness of the new partnership, of Aviva and kickstart a relationship with the postdoctoral community.

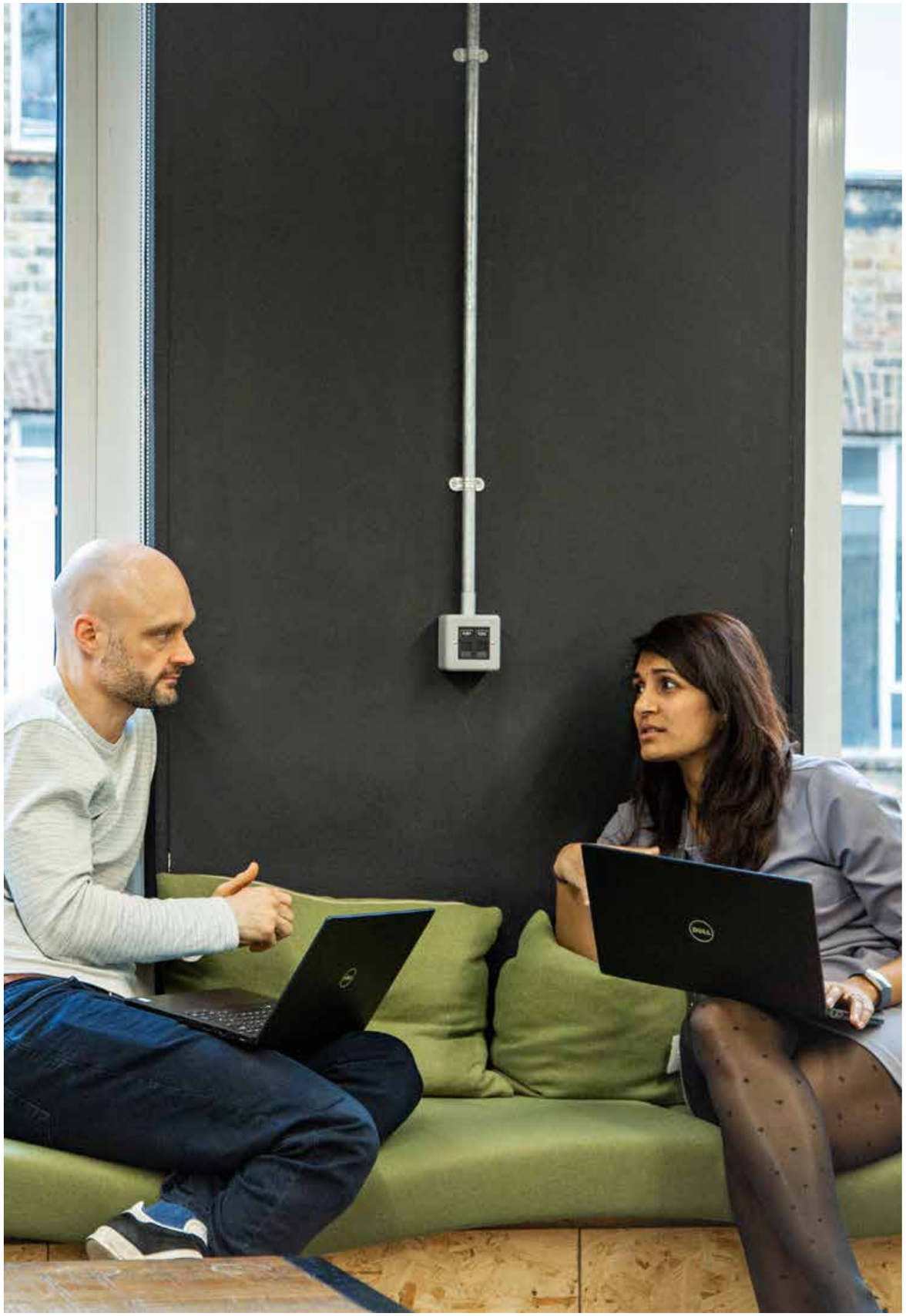
The event started with an introduction to the company, followed by an internal case study on the use of natural language processing at Aviva. The group was then given two hours to complete a challenge prepared by an Aviva data scientist – a task even the most experienced of data scientists would have found testing.

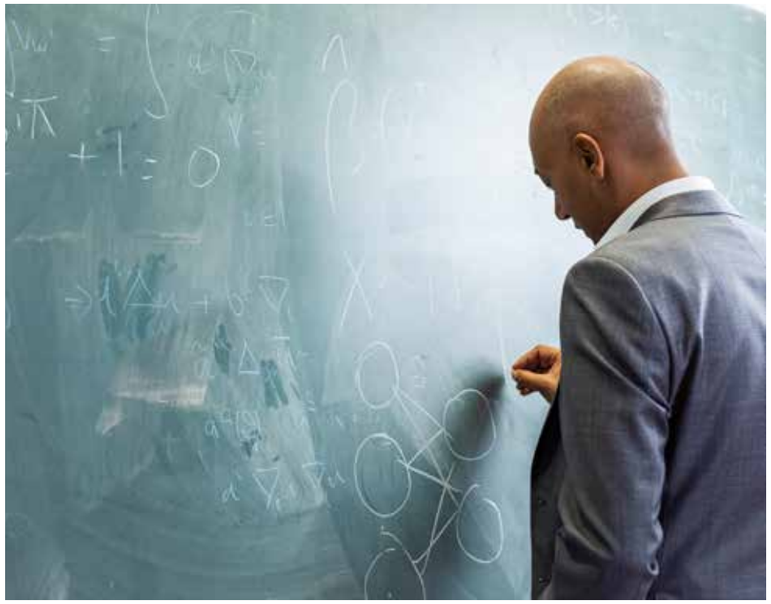
Data Science Society natural language processing competition

More recently, the team designed a competition to mirror some of the technical and commercial skills employed by Aviva data scientists. Participants were handed publically available text and vote count data for 15,000 petitions submitted to the UK government. The task was to predict whether a petition will surpass 50 signatures, based only on its raw text, and to then automatically group the texts into topics.

On the technical side, the task exposed participants to the exciting world of natural language processing, and on the commercial side, candidates had to show they could communicate technical ideas to a diverse audience and differentiate between optimising a metric and producing a useful tool. Group Chief Data Scientist, Dr Orlando Machado, introduced the competition with a short talk about Aviva and what makes a great data scientist, emphasising the importance of strong communication skills and providing some tips on how to explain complex technical projects in a simple way.

Some genuinely predictive models were produced and presented alongside terrific visualisations. There were two stand out winners, who will spend some time with senior figures in Aviva's data science practice and have the opportunity to gain some industry experience.





Brand

Objective: To increase awareness of the Aviva-Cambridge partnership at Cambridge, at Aviva and externally; and to leverage the partnership to strengthen relationships with strategic partners and clients

Presenting at team meetings, away days and conferences at Aviva has been an effective way to raise awareness of the partnership and has been integral to identifying new opportunities for the partnership to deliver value. The partnership is referenced regularly to demonstrate Aviva's commitment to furthering data science, including pitches for new business and industry roundtables. In addition, and as projects have materialised, Aviva has begun communicating updates externally through brand social media channels and other means, such as podcasts.

Aviva Case Study: Cambridge for Business

Displaying the progress of the partnership so far, the Aviva case study on Cambridge for Business was developed as part of partnership toolkit for internal and external communications, and to increase both brand and partnership awareness. Read the case study at www.cam.ac.uk/business/aviva.

The Aviva-Cambridge Research Podcast

The partnership podcast is a series of short recorded interviews, focusing on the ideas and impact of the partnership's research projects. In September 2019 three podcasts were recorded, featuring researchers undertaking projects funded by the partnership. The intention was for these podcasts to amplify awareness of the partnership, and introduce those with little to no knowledge of data science to the work of the partnership.

The first podcast featured Dr Orlando Machado, both introducing the partnership and discussing its importance to Aviva. Subsequent recordings featured researcher Helena Gellersen, on the risk factors that might be used to predict the onset of dementia, and Michelle Lee, on measuring algorithmic fairness. You can listen to them at www.soundcloud.com/aviva_plc/sets/the-aviva-podcast.

Episodes of the podcast have performed brilliantly and have certainly enabled us to increase awareness of the partnership. The podcasts were the most successful of those featured on the Aviva channel, and so further podcasts are scheduled and due for release in summer 2020.

BRAND

5 Aviva speakers at University events and seminars

8 University speakers at Aviva events

More than 1700 listeners to the Aviva Podcast series

“

Our organisations have a lot in common, from our centuries-long heritage through to our commitments to sustainability and long-term impact. With this partnership, we’re trying to bring the best of both worlds together: academic thought leadership at the highest levels of excellence, matched with a business that is taking care of 33 million people through all phases of their lives.”

Dr Orlando Machado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