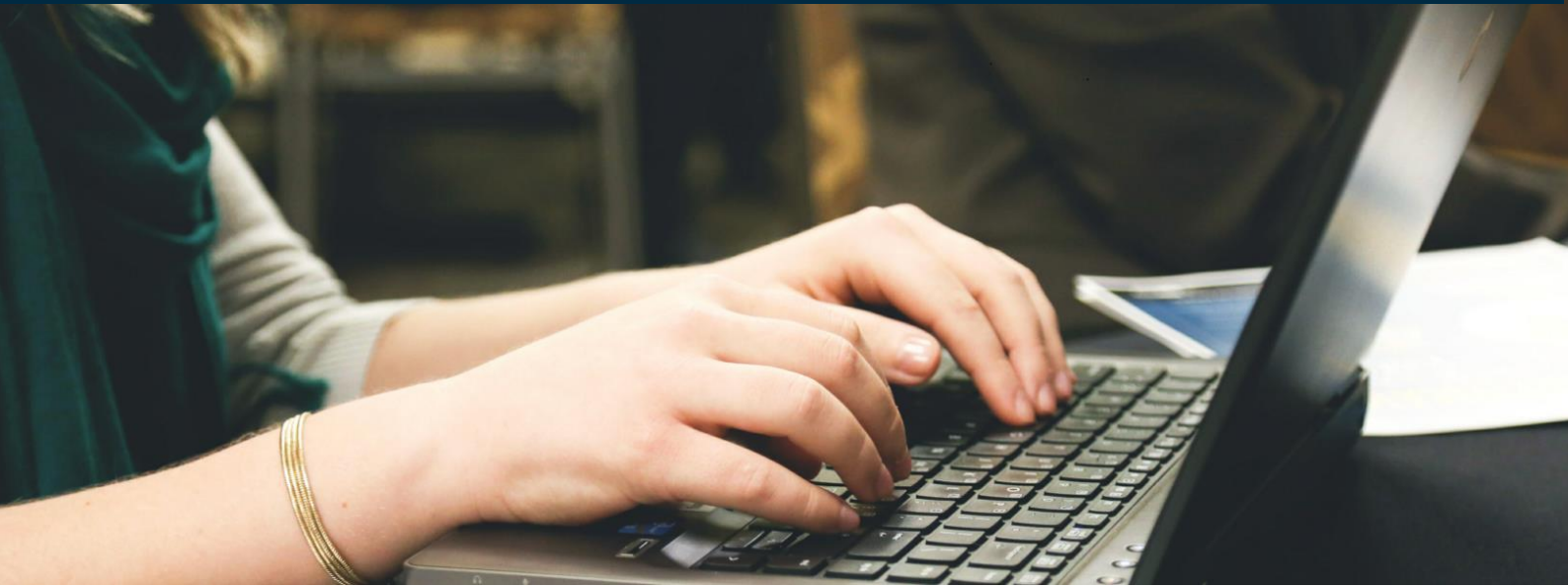# ACTUARIES IN WIDER FIELDS

A Newsletter Supplement from the Wider Fields Committee of the Society of Actuaries in Ireland

Introduction

We've all heard the stereotypes about actuaries…nerdy, introverted, maths-obsessed, boring. But in my experience the reality is a profession of very diverse personalities, skills and talents – and increasingly diverse in terms of age profile and gender too.

When it comes to employment though, that level of diversity isn't as obvious. Most actuaries still work in Insurance and Pensions - and while the odd actuary escapes every now and then to a marketing, IT or general management job the traditional roles in reserving, reporting, capital and risk management still dominate.

It was against that background the SAI set up its Wider Fields Committee, under the leadership of Mike Frazer and Tony O'Riordan. The objectives were simple – help broaden out the opportunities for actuaries to move their careers in new directions; and ensure that the Society remains relevant to those who do so.

Since then, we've seen a number of Irish actuaries becoming involved in industries like Aviation Finance and Data Analytics. Next year's addition of a Banking subject to the IFoA syllabus is likely to boost the small but increasing number of actuaries who have successfully moved into roles in that industry.

A recent SAI event which focused on supporting actuaries in setting up their own business with speakers from Fenero and Enterprise Ireland attracted 71 attendees. All encouraging signs that actuaries are finding their skills to be relevant in wider fields than in the past!

This Supplement shines a spotlight on some of those opportunities, and on some actuaries who have moved their careers in new directions. Whether you're a student wondering about what direction your career will take or an experienced actuary thinking about new opportunities, we hope you'll find something in it to inspire and engage you.

Gareth McQuillan - Chair, Wider Fields Committee

Meet some Actuaries working in Wider Fields

Gareth McQuillan talked to John Nugent, Giulia Vilone, Justin Brayden and Dan Carroll, who all share their stories with us on being an actuary, barriers and opportunities in their careers to date and advice for actuaries who want to pursue a different direction.

John Nugent FSAI, Head of Premier and Private Banking at Bank of Ireland

When and how did you first decide to pursue a career as an Actuary?

As an ambitious teenager completing my CAO forms, I wanted a career that paid a good salary along with a profession that was highly regarded. How lucky I was that I actually landed in a job that I love and qualification that I'm immensely proud of and treasure to this day.

What led you to move away from traditional actuarial work?

It was due to two hugely influential people in my early career. One was a previous manager who always supported and encouraged me to push and develop myself outside the traditional actuarial roles. The second person was a HR Director in Bank of Ireland who thought very differently and whose recruitment policy was to bring a broad range of backgrounds together to bring a radically different way of thinking and challenge the status quo.

Did your actuarial training equip you well for making that move?

Passing the actuarial exams, or at least the route I took, equips you to take on and conquer any challenge in life. It requires resilience, tenacity, doggedness and an inner belief that you will ultimately succeed. It's these traits that I developed as a trainee Actuary that have stood to me most in succeeding in a rapidly changing and fast paced retail banking industry.

Are your actuarial skills relevant to your current job – if so how?

Yes, many of them. The two I use most are ability to analyse a situation/data/MI and unearth insights and the need to communicate complex matters in simple language.

Has being an Actuary ever been a barrier to you pursuing a non-traditional career?

Not at all. It has hugely helped my career. I've found that while there are different levels of awareness of what actuaries do, there is a strong perception that actuaries are extremely intelligent, great at solving complex problems and are pragmatic in their decision making. In a world where first impressions count this gives you an advantage over others. Of course you have to back this up.

Any words of advice for Actuaries who would like to pursue a different career direction?

As an Actuary you have a very broad range of highly developed skills which separates you from others, benefits the organisation and also gives you great job satisfaction through the impact you can have. Your ability to learn means you will bridge any gaps that may exist. You've all the ability to succeed and you just need to back yourself.

Giulia Vilone, CEO Piccabi Ltd (Ireland)
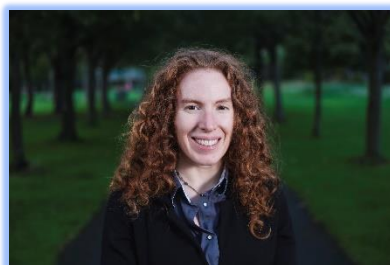
When and how did you first decide to pursue a career as an Actuary?

Right after I obtained the Masters degree in applied mathematics, I joined the actuarial team of an Italian life insurer. I really enjoyed that experience, so I decided to study in more depth the techniques and models used by my colleagues and become a certified actuary.

What led you to move away from traditional actuarial work?

I am a very curious person. I love learning new ideas, improve my skills and exploring new fields, especially those that require a strong mathematical and scientific background to solve complex problems.

Did your actuarial training equip you well for making that move?

The knowledge and skills that I developed while working and training as an actuary proved to be vital when I moved into a new professional field. I could tap into my capacity to quickly adapt to new situations, and apply technical actuarial tools to new problems to find novel and effective solutions.

Are your actuarial skills relevant to your current job – if so how?

I often use my actuarial skills to analyse various types of data to design technical solutions, make business and commercial decisions and assess their risks in terms of impact on the future cashflows and business development.

Has being an Actuary ever been a barrier to you pursuing a non-traditional career?

Being an actuary proved to be an exceptional starting point for a new career. The most valuable thing for me was that it meant I had the security of a "Plan B", which is reverting back to my actuarial career, in case things don't go as planned!

Any words of advice for Actuaries who would like to pursue a different career direction?

The actuarial training and mindset can put you in the strategic position to help companies to open up to new business opportunities by managing the associated risks in a more mindful and structured way. This is a skill that very few people possess…

Justin Brayden, Business Analyst, Goshawk Global Aircraft Leasing (Hong Kong)

When and how did you first decide to pursue a career as an Actuary?

I completed a 6 month work placement with Standard Life in Edinburgh during my third year of studying Actuarial and Financial Studies in UCD. I really enjoyed the experience and decided that pursuing the actuarial exams and securing a job as a trainee actuary would be a sensible next step after university.

What led you to move away from traditional actuarial work?

I wanted a role that was less regulatory and reporting focused than the actuarial work that I had experienced to that point, and one that would challenge me to think more commercially. Aviation Finance met those initial criteria and the deal-driven nature of the work as well as its global reach really appealed to me.

Did your actuarial training equip you well for making that move?

Yes, without a doubt. From my experience, the qualification is very well regarded externally; and, in the absence of aviation experience, I was able to draw upon previous examples of actuarial work to demonstrate that I could make the transition.

Are your actuarial skills relevant to your current job – if so how?

In my current role with Goshawk, I use the financial modelling and analytical skills that I developed as an actuary on almost daily basis. My actuarial background also meant that I was familiar with many of the financial concepts that apply to aircraft leasing. This definitely helped me navigate the initial learning curve.

Has being an Actuary ever been a barrier to you pursuing a non-traditional career?

I think being an actuary allows you to develop a highly transferable skillset. The challenge is more around how to market that skillset to non-actuaries as the subject matter can be slightly impenetrable if you're not familiar with it.

Any words of advice for Actuaries who would like to pursue a different career direction?

If you have an alternative career in mind or are just interested in learning more about another industry, use your network (friends, LinkedIn etc.) to connect with people in that industry so that you can discover first-hand what it's really like. You'd be surprised at how receptive people are to being contacted like that. I wouldn't have been able to make the move otherwise.

Dan Carroll FSAI, Chief Technical Officer and Owner at Xcentuate Management Solutions

When and how did you first decide to pursue a career as an Actuary?

When I was at school, I always loved solving maths problems. I was lucky to speak to a couple of people about their experience as actuaries and from that point on it was on my horizon. When I completed my degree in Mathematics and Economics, I naturally returned to looking at it again.

What led you to move away from traditional actuarial work?

I started my career in New Ireland and my passion for problem solving led me to work on numerous actuarial and non-actuarial projects. My natural preference is to keep working on new things and I took on the role of Head of Change in the Customer Operations department. This led me to look at ways I could improve service and ensure the area become more efficient.

Did your actuarial training equip you well for making that move?

My actuarial training (both formal and non-formal) was great at developing a mindset of how to approach complex problems, analyse them, develop and implement innovative customer orientated solutions. It taught me to look at problems from different perspectives and not to just rush in. My financial training has also been key as a vital part of what I do now is helping organisations build their business cases for change.

Are your actuarial skills relevant to your current job – if so how?

My job is currently split between running a growing company and working with a broad selection of clients. My financial skills are absolutely relevant when running a company as looking at various scenarios and recommending what actions to take if they arise is critical for this stage of the company's evolution. My actuarial skills come to the fore working with clients by helping them understand the range of potential business outcomes as well as determining risks and benefits.

Has being an Actuary ever been a barrier to you pursuing a non-traditional career?

Not at all. I have found being an actuary is very beneficial as clients recognise the strength of the qualification and experience.

Any words of advice for Actuaries who would like to pursue a different career direction?

Don't be afraid to try something different! Actuaries can always go back to more traditional roles and the different experiences will always stand to you. Most companies have lots of non-actuarial roles so you don't have to move too far to try something new.

Getting ready to make the breakthrough in Banking?

In this short article, we illustrate the depth of analysis that the actuarial profession is capable of bringing to banking, note the Society's input to the proposed new banking syllabus to ensure that it covers EU banking regulation and IFRS accounting, and outline a proposed banking careers event scheduled after the lifting of restrictions.

Depth of Analysis

In October 2020, the Banking & Aviation Finance Sub-Committee ("B&AF Committee") organised a closed meeting at which Niall Dillon and John Caslin delivered a presentation covering two topics in the wider field of banking.

The first topic examined how the Core Equity Tier 1 Capital ('CET1') ratios of banks is likely to be weakened by the combination of borrower defaults and a surge in demand for emergency liquidity loans.

The second topic considered how the economic fallout from the COVID-19 pandemic was probably the first real and significant test of the impact of IFRS 9 on the financial statements of banks since it became effective on 1 January 2018.

During the presentation, the very high level of risk-weighted assets on mortgage loans in Ireland was contrasted with the significantly lower level of risk-weighted assets on mortgage loans in comparable European countries. In essence, it was noted that Irish banks are required to hold more capital in respect of unexpected losses on mortgage loans than banks in other EU countries. This is one of the reasons why mortgage loans in Ireland are more expensive than in many other EU countries.

In February 2021, a report from the Banking & Payments Federation Ireland highlighted the very same issue and may also be a contributory factor in Ulster Bank's decision to exit the Irish market. The Banking & Payments Federation

Ireland report got considerable publicity in print, on-line, radio, and TV media outlets.

This illustrates the depth of analysis that the actuarial profession is capable of bringing to banking.

New Banking Syllabus

The B&AF Committee reviewed the proposed new banking syllabus to ensure that it covered EU banking regulation and IFRS accounting and therefore be highly relevant to actuaries practising in Irish banks and fintech banks.

Banking Careers Event

After the lifting of restrictions, it is proposed to hold a careers event for actuaries wishing to transition from traditional actuarial work to banking – both in the traditional sector and in fintech banks. Similar to the successful aviation finance careers event held in February 2020, the banking careers event will be held in conjunction with one of the leading global professional services recruitment consultancies. Like the aviation finance careers event, it will include speakers who have transitioned from traditional actuarial work to banking, will address issues of study leave for trainee actuaries, and introduce banking recruiters to the skills of actuaries.

John Caslin FSAI – Chair, SAI Banking & Aviation Finance Committee

Did You Know?

There are several actuaries in Ireland working in wider fields, but below we cite four international examples from South Africa, the US and the UK, as well as an invitation from Elon Musk.

First from South Africa, we have ***Roland Grabe***. Roland graduated in 2014 with a degree in actuarial science from the university of Pretoria. He then started with PWC before moving to Paramount Life. Subsequent to this, he took up a role in First Technology Enterprise Data Solutions, a specialist Data Science consulting firm with a countrywide footprint in South Africa. However, in 2018, he moved to his current role, as senior data scientist in Isabella Garcia International.

As its website claims, "*Isabella Garcia International is a cosmetics company with our roots in all things beautiful. We offer exceptional quality Skincare, Haircare & Beauty Products, to protect and nurture one's body and soul.*"

Isabella Garcia International – a cosmetics retailer employing an actuary working as a data scientist.

Next we have Len Llaguno, Julie Hagerstrand, and Robert Chin.
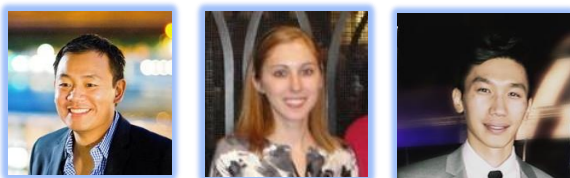
These ex Willis Towers Watson actuaries are all partners in KYROS Insights. KYROS Insights uses actuarial science and machine learning to help loyalty programs predict customer behaviour. Per their website, "we are the only actuarial firm globally that solely focuses on loyalty programs. Our team's intense focus in this area for over a decade gives us a unique expertise that is unmatched in the industry."

Len Llaguno explains how all loyalty programmes have two actuarial problems that require long term predictions – *"Firstly, predicting redemption costs - loyalty programmes are issuing points today but won't know the cost of these points for years; cost assumptions are required. Secondly, predicting customer lifetime value – the whole point of a programme is to increase customer lifetime value (i.e. the stream of future profit, net of redemption costs, that a programme member will generate during their lifetime). Being able to quantify customer lifetime value is critical to proving the value that the programme is generating for an organisation and to maximise that value."*

"The actuarial toolbox is basically a framework to predict over long horizons". **Len Llaguno, KYROS Insights**

Roger Massey had a traditional start to his actuarial career, with a first in Maths and Psychology from Manchester University. Roger spent some time in the Pru as a pricing actuary, before joining EY. In 2004 he then set up the Actuarial Recruitment Company (ARC), a general insurance actuarial recruitment company with his EY colleague Andy Clarke. However after fifteen years in recruitment, in 2019 Roger set up a small field archery focused business called *1066 Field Archery* and he now makes and sell bows, arrows, strings and targets for a living.

Roger admits that he is totally addicted to traditional field archery. By traditional, he means any kind of bendy bow without sights. For Roger, field archery offers much more enjoyment than just shooting arrows. He enjoys understanding how things work and making things. It started with arrows, then strings, then casting 3D targets and then ultimately making composite bows.

Along with his son Jack, he regularly attends competitions in the South of England, in addition to National Championships. In 2017 and 2018 Jack won the NFAS 3D National Championships shooting in the Junior Hunting Tackle Category. In the same years Roger was 2nd both times (or first loser as Jack calls him).

Last but by no means least, we move to *Steven Mendel*. Steven has over 25 years' experience as an actuary in financial services which has included leading Close Brothers Wealth Management during the launch of their non-advised offering; creating the world's first art-focused wealth advice offering for Christie's; working as part of the team that formed Barclays Wealth and heading the McKinsey UK Savings and Investment Group.

Steven founded *Bought By Many* about 8 years ago, which is *"disrupting the world of pet insurance through the innovative use of tech, and is building a business to become an irresistible employer that is obsessive about customer service."*

In April 2019 Steven was included in the London Business School Review of 30 People Who Are Changing The World. In the Insurance Choice Awards, *Bought By Many* was named Pet Insurance Provider Of The Year in 2021, and Best Pet Insurance Provider in 2020. It has ranked in the Sunday Times Tech Track 100 for three consecutive years as one of the UK's fastest growing tech businesses.

Bought By Many says that it offers unique policies, including one which never increases in price and another that offers a customer their money back if they have not claimed.

And finally, if you have a hankering for wider fields, perhaps you might be interested in the tweet from Elon Musk from last year as follows:

Elon Musk @elonmusk · Jul 24, 2020
We are actually looking for revolutionary actuaries for Tesla Insurance! Please inquire, if interested.
1.1K   1.2K   18.7K

Ger Bradley FSAI is a member of the SAI Data Analytics Committee and the SAI Wider Fields Committee.

Interpretable machine learning: What to consider

Well-designed machine learning models can be powerful tools for driving better decision making and growing your business. But what if your models are inadvertently creating problems for your business or clients? For 'black box' models, it can be difficult to 'look under the hood' and find out what's driving model performance. Dr Gráinne McGuire FIAA discusses what to consider when it comes to machine learning.

What does my model really do?

The machine learning (ML) community is paying close attention to topics of fairness, interpretability, transparency and accountability. Much current ML research centres on developing tools for explainable ML. Many ML models are considered black box models – models that produce decisions based on various inputs, but the process by which the decisions are made are opaque, usually due to model complexity. Explainable ML essentially involves a post-processing stage, which takes the output of the black box model and overlays a mechanism to explain the results of it. This focus on 'explainability', however, can be problematic. Explanations may be poor, incomplete and not particularly meaningful. A modeller may clearly understand the theory of the model and its predictions at a high level, but find it difficult to explain why a particular outcome is predicted for a specific set of inputs.

In contrast to explainability, interpretability actually requires a full understanding of the path of computations leading to a prediction. In a 2019 article in Nature Machine Intelligence titled Stop explaining black box machine learning models for high stakes decisions and use interpretable models instead, Cynthia Rudin (Professor of Computer Science, Electrical and Computer Engineering, and Statistical Science at Duke University) and her collaborators argue:

- There's often a false dichotomy between interpretability and accuracy, and interpretable machine learning models can often perform just as well as black box models.
- It's highly likely an interpretable model of comparable performance to the best black box models exists for many datasets.
- Interpretable models should be the default type for any high-stakes decision. Also, interpretable models are less prone to error, and any errors that do occur can be detected much easier and sooner.

Why do we use black box models?

Before we drill down further into interpretable ML, it's helpful to remember there are several reasons why we might favour black box models – it's often an efficient way to fit well-performing models. Unlike an interpretable model, which often requires considerable analyst skill, domain knowledge and feature engineering to fit, a black box model can process a lot of data, discover the key patterns and generate accurate predictions in a fraction of the time.

In many settings, fitting a good model quickly is important:

- To automate the labour-intensive parts of a process, which frees up skilled analysts to have more time for understanding and taking a deep dive into the results.
- To enable more regular updating of key financial or other time-based information.
- To increase a model's speed to market, which can lead to better results for a company.

In short, black box type algorithms such as gradient boosting machines or neural networks are extremely flexible and high-performing tools for fitting models to large datasets. It's no accident that algorithms such as XGBoost are top performers on competition websites such as Kaggle.
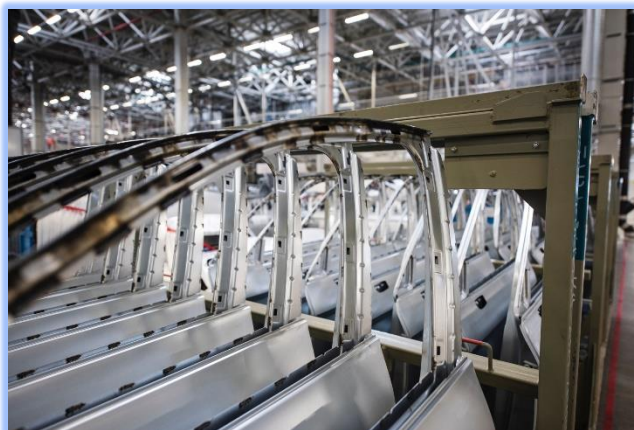
Black box models are particularly helpful when speed to market is important

So, we should always build black box models?

If only it were that simple. A problem with black box models is that we don't know exactly why they do what they do (if we did, they would be interpretable). This is true even if we add an explainability overlay on these models – by definition this overlay must be wrong some of the time, otherwise it would be the model.

Let's consider two types of situation in which we build models:

- Models that have very significant individual impacts (we'll call these VSI models). This could be a decision to give an individual a mortgage, or a medical diagnosis relating to a serious illness.
- Those that don't (non-VSI models). This might include things like marketing or recommender systems.

A simple way to think of a model is that it categorises people into different groups and develops prediction rules for each of these

groups. Then, for a new person not in the model data, it works out what groups this person is most similar to and forms a prediction on that basis. But no matter how good the model is, it will be wrong sometimes because people are individuals, not averages.

For a non-VSI model, being wrong often does not lead to highly negative individual outcomes, and a lot of the time the cost of being wrong is borne by an organisation and not the individual. For example, if a streaming service starts recommending horror movies to me, I might cancel my subscription. In this case, the cost of the error is mainly borne by the streaming service provider. However, suppose a model is used to diagnose a serious medical condition. This would be an example of an VSI model – the wrong diagnosis could be fatal to the individual concerned.

Another problem with black box models is that they don't extrapolate well to new regions of data – an example is the husky vs wolf classifier, which seemed to have very impressive accuracy rates at distinguishing between wolves and huskies, until it was realised that the classifier was just identifying snow in images – the model was essentially: if snow, then husky, else wolf.

No snow, must be a wolf!

Black boxes bad. Interpretable machine learning models good?

Yes and no.

In an ideal world, we would always build interpretable models. However, constructing interpretable models is often computationally hard. Even when it's possible to construct an interpretable model, there's usually a requirement to spend much more time on feature engineering and selection – models require much more skilled analyst time and domain expertise and are therefore considerably more expensive to construct.

There are many settings, particularly in the commercial world, where rapid reactivity and speed of deployment are critical. On the other hand, particularly for VSI models, the expense of constructing an interpretable model should be weighed against the consequences of getting things wrong for the individual affected by the decision. Take a model like COMPAS (a widely used model in the US which produces recidivism scores, which are then used when making parole decisions). Suppose the model assigns a high score of reoffending largely because of a data entry error where previous convictions were recorded as a '7' instead of a '1'. An interpretable model, which explains the seven previous convictions were a major factor contributing to the high

score, offers some hope that this error could be corrected, unlike a black box model with no explanation.

So why aren't all models with significant impacts on individuals interpretable?

Rudin and her team highlighted several reasons for why it is that not all VSI models are interpretable. These include the costs of development, and possible difficulties in recouping model development costs for models that end up being a simple list of rules, or a scoring system, based on a small number of factors.

Furthermore, for something like the case of medical misdiagnosis, or the COMPAS example, there's a system flaw in that the costs of being wrong are misaligned – in the case of getting a medical diagnosis wrong, the individual bears the cost of the mistake, not the company providing the algorithm. Dealing with this may require policy changes to encourage or demand greater interpretability in VSI models, and greater accountability.

The EU's General Data Protection Regulation aims to give more control to individuals over their personal data, and a 'right to information about the logic involved' in automated decisions – a 'right to an explanation'. This is a step in the right direction, but, as noted above, explainable ML models and interpretable ML models are two different things and there is no guarantee that any explanation would be accurate. Furthermore, you have to know you've actually received an automated decision before you can seek your explanation. If you were a woman not being shown data science job ads because an ML algorithm was trained on data with only men in similar jobs, then chances are you would never know.

What can we do when creating an interpretable machine learning model proves difficult?

Difficulties in the creation of interpretable machine learning models may sometimes be mitigated by using black box models as part of an iterative process towards developing an interpretable model. For example, one model-building process involves using a black box model at a preliminary stage in an analysis to identify key features of interest which are then incorporated into an interpretable model. This is frequently an iterative process, since black box models are useful for identifying un-modelled patterns in the data and, at each step, our understanding of the underlying data grows. This understanding will serve us well when models are deployed for use.

We often see this idea and related concepts in practice in work that actuaries do – we need to understand and be able to clearly explain and interpret our model results for our clients. In the GI area for example, while machine learning is certainly a useful tool, frequently it is used to generate insights during exploratory and development work. Interpretable models such as Generalised Linear Models continue to be in widespread use.

Dr Gráinne McGuire FIAA is a Director in Taylor Fry and a member of the SAI Data Analytics Committee.

Data Analytics Library

The SAI's Data Analytics Committee created and recently updated the Data Analytics Library as a resource to support members who are interested in developing their Data Analytics skills.

Structure
The library has the following structure:
- Introduction
- Support from the Society
- Getting Started
- Materials
- Events and opportunities

The following sections expand on some of these areas.

Getting Started
This page is for members just starting out on their data analytics journey. There are two linked sections here:

1. *Step by Step Guide* – This provides details in stages as to how a member can get started in learning data analytics. Information is provided on introductory books, courses and articles. Also, there are links to packages (both in R and Python) that can be downloaded by the member to practice coding.
2. *Courses and Skills* – Here, various online courses are linked for members who might find it easier to learn using this method. There are a variety of courses available both free and paid as well as options with recognised qualifications attached.
The skills associated with data scientists are also listed in this page in addition to how actuaries can add value to data analytics projects.

The Committee realised that, since the inception of the Data Analytics Library, many members have embraced Data Analytics so we are aiming to make the Library more relevant to their needs.

The following sections contain new learning resources and information so that members can continue discovering new and exciting projects in data analytics. Please do get in touch if you want to give a talk on your research.

Materials
As well as listing some articles, books, software downloads and online videos that are available to facilitate learning, this page also has:

Meet-ups
This contains various meet-up groups which can be joined to better enhance your knowledge of Data Analytics particularly outside the actuarial sphere. Despite the pandemic, these groups are still active, holding regular virtual meetings which can be freely attended.

Datasets
There are lots of datasets freely available that can be used in your coding projects. Some publicly available ones are listed here. More insurance-focused datasets can be found in the Github section below.

Events and Opportunities
Talks
There has been a number of talks and events held by the Society in relation to Data Analytics over the past while. Links to recordings and slides from relevant talks are included here as well as instructions on finding more within the Society's Upcoming Events portal.

Study groups
We have linked to the forum for the R and Python study groups here too. If there are ways that the Library can better support the members of the study groups, please let us know.

Github
Linked in this section are Github repositories of the SAI and some other actuarial groups as well as those from open insurance data initiatives. Seeing what others have created and shared from their work is a sure way to spark some new ideas for yours!

If you have any suggestions as to what would be useful for you in the Data Analytics Library, please send them to info@actuaries.ie

Eilish Bouse FSAI is Actuarial Manager with Grant Thornton and a member of the SAI Data Analytics Committee
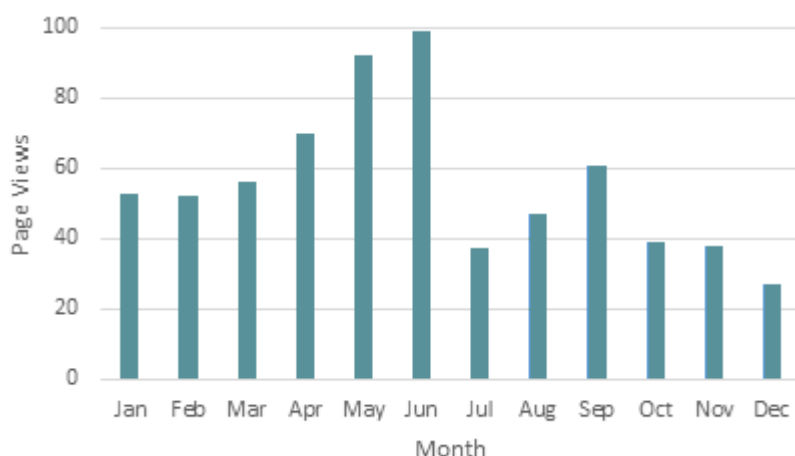
2020 Library Stats

Total Views	671
Most active Month	June
Avg. time spent on page	00:01:44

2020 Page Statistics for the Data Analytics Library

Preparing Actuarial Students for the Future World of Work

Dr Mark Farrell FIA shares his thoughts on how an actuarial education in university prepares students/graduates for a career beyond the traditional areas of actuarial science.

Exponential data, emerging technologies and alternative models of how, when and where we do our work are transforming the business landscape. Hence, university students are expected to develop skills that will stand them in good stead in an increasingly volatile, uncertain, complex and ambiguous (VUCA) world. As students of risk and guardians of the future financial wellbeing of people, organisations and society, this is particularly important for actuarial students.

Actuarial university students are also increasingly aware of the fact that their career trajectory is unlikely to be as linear and straightforward as the actuaries that have gone before them. Future actuaries are likely to end up working in wider fields and in areas that we have not yet even considered.

So what skills are actuarial students expected to develop during their time at university, to ensure we prepare them for the new world of work where they may work in both familiar and not so familiar roles?

Well, some things haven't changed. Skills such as time management, organisation, reasoning, presenting ideas, self-motivation, problem-solving and listening are likely to remain key skills for future actuaries, regardless of the field they end up working in. Indeed, university students typically learn many of these important fundamental skills informally through their university life as they adjust to living away from home, making new friends and balancing their study and leisure time. More formally, actuarial students develop important fundamental skills of critical-thinking, research, analytical and communication as they make their way through the exam curriculum.

One of the big changes I've witnessed with university education, is the level of engagement that students (and lecturers) have with the business world and the need to ensure that theory is not taught in isolation, but is instead supplemented with real-world experience and practical application.

Putting 'Theory into Practice' (TIPS) - facilitating actuarial students to apply critical thinking, analytical and communication skills to ensure that theoretical knowledge can be deployed to solve real-world business problems.

This can take many forms. For example, many actuarial programmes now offer a placement or sandwich period, where students get to apply some of the theory they have learnt in lectures to the actual world. Placement programmes have many benefits, as students are thrust into an unfamiliar environment and forced to deal with various challenges. Hence, they develop and further fine-tune skills such as working as part of a team, managing expectations, and of course, for actuaries, performing data analysis and building financial models.

Other ways of engaging university students with real-world applications include a renewed focus on case study work and relating theory to real-world experience as much as possible. This is often facilitated by bringing in guest lecturers from the business world and placing a greater emphasis on practical model-building exercises, where students are expected to apply their own creative thinking and imagination to solving problems aligned with what they might encounter in the real world. The recent SAI prize for the creative use of actuarial skills is a great example where university students were able to apply the increasingly important skills of creativity and imagination to solve future actuarial business problems. This allowed university students to provide innovative solutions for education (valuing long-term investments), transportation, the environment and sustainability, sport (including transfer markets), machine learning on satellite imagery, productivity in charitable call centres, and the health service.

Preparing actuarial university students to solve a wider range of problems faced by the business world helps them to build up confidence and provides students with more tangible outcomes that future employers/customers can relate to. This helps students to have more concrete examples to share at job interviews or at prospective client presentations. Having students work in small teams, in addition to focusing on individual exam curriculum, also helps students to deal early on with the challenges of developing team cohesiveness in a work environment.

> *"The illiterate of the 21st century will not be those who cannot read and write, but those who cannot learn, unlearn, and relearn."*
> **Alvin Toffler**

Whilst the future is uncertain, it is important that we equip students with transferable skills that will allow them to quickly transition into new areas of work and possibly even completely reinvent their career on a frequent basis.

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