Data science usage and applications in life (re)insurance
Disclaimer

The views expressed in this presentation are those of the presenters and not necessarily of the Society of Actuaries in Ireland, or of the presenters’ employer.

These slides are for general information/educational purposes only. Action should not be taken solely on the basis of the information set out herein without obtaining specific advice from a qualified adviser.
Introduction

- Brief introduction to data science
- Results of recent Milliman survey
- Applications in life (re)insurance
- Other thoughts

Karl Murray
Senior Consultant
Dublin, IE
+353 1 647 5509
karl.murray@milliman.com

Eamon Comerford
Consulting Actuary
Dublin, IE
+353 1 647 5525
eamon.comerford@milliman.com
What is Data Science?

- Machine Learning
- Artificial Intelligence
- Data Cleaning
- Data Mining
- Data Analytics
- Predictive Analytics
- Data Strategy
- Business Intelligence

These slides are for general information/educational purposes only. Action should not be taken solely on the basis of the information set out herein without obtaining specific advice from a qualified adviser.
Data Science Methods
Tools and Techniques used in the application of Data Science

Decision Tree
Linear Regression
GLM
Random Forest
Gradient Boosting
Neural Networks

Least Sophisticated
Advanced Modelling

These slides are for general information/educational purposes only. Action should not be taken solely on the basis of the information set out herein without obtaining specific advice from a qualified adviser.
Milliman survey on the use of data science

- Scope & Strategy
- Data Usage
- Data Science Architecture and Tools
- Resourcing and Governance
- Benefits & Challenges
Results from our Client Survey
How does data science fit in to your organisation’s overall strategy?

- Not a point of focus currently
- More on the agenda for the next 3 years
- A major point of focus for limited applications
- A major point of focus with a consistent approach across business areas

- Over 75% expect to be using data science within the next 3 years, with over 35% already making it a point of focus.

These slides are for general information/educational purposes only. Action should not be taken solely on the basis of the information set out herein without obtaining specific advice from a qualified adviser.
Results from our Client Survey

Does your organisation have a dedicated data architecture/infrastructure for Data Science?

- Yes – comprehensive: 5%
- Yes – limited at this point or currently being developed: 45%
- No: 50%

These slides are for general information/educational purposes only. Action should not be taken solely on the basis of the information set out herein without obtaining specific advice from a qualified adviser.
Results from our Client Survey

How would you describe your current activities relating to sourcing and accumulating data for Data Science applications?

- Purchasing external data
- Collecting external data (by in-house resources)
- Investing in collecting more internal data going forward
- Investing in harnessing more existing internal data for use

These slides are for general information/educational purposes only. Action should not be taken solely on the basis of the information set out herein without obtaining specific advice from a qualified adviser.
Results from our Client Survey

Which of the following sources or methods have you used to capture data for onwards Data Science processing (or plan to use in the next 3 years)?

- Customer policy applications
- Customer complaints
- Online app behaviour
- Phone call enquiries
- Text mining and scraping
- Customer quotes
- Wearables data
- Other
- Social media data

These slides are for general information/educational purposes only. Action should not be taken solely on the basis of the information set out herein without obtaining specific advice from a qualified adviser.
Results from our Client Survey

Which of the following types of tools or techniques have you used in the application of Data Science (or plan to use in the next 3 years)?

- Regression
- Visualisation
- Machine learning
- Clustering
- GLM
- Artificial intelligence
- Bayesian methods

Chart Title

These slides are for general information/educational purposes only. Action should not be taken solely on the basis of the information set out herein without obtaining specific advice from a qualified adviser.
### Common tools

<table>
<thead>
<tr>
<th>Programming language</th>
<th>Visualisation</th>
<th>“Big data” sets</th>
</tr>
</thead>
<tbody>
<tr>
<td>R</td>
<td>Tableau</td>
<td>Apache Hadoop</td>
</tr>
<tr>
<td>Python</td>
<td></td>
<td>Apache Spark</td>
</tr>
<tr>
<td>Julia</td>
<td>Power BI</td>
<td></td>
</tr>
<tr>
<td>SAS</td>
<td>Qlik</td>
<td></td>
</tr>
<tr>
<td>MATLAB</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

These slides are for general information/educational purposes only. Action should not be taken solely on the basis of the information set out herein without obtaining specific advice from a qualified adviser.
Results from our Client Survey

Software used

- SQL
- R
- Python
- Other
- NoSQL
- TensorFlow
- MongoDB
- Keras
- Apache Spark
- Caffe
- Pytorch
- RapidMiner
- Apache Hadoop
- Julia

These slides are for general information/educational purposes only. Action should not be taken solely on the basis of the information set out herein without obtaining specific advice from a qualified adviser.
Results from our Client Survey

Main potential benefits?

These slides are for general information/educational purposes only. Action should not be taken solely on the basis of the information set out herein without obtaining specific advice from a qualified adviser.
Results from our Client Survey

How relevant are the following challenges for your organisation?

- Data accuracy
- Access to data issues
- Meeting regulatory requirements
- Fairness / Ethical considerations
- Consumer trust
- Shortage of talent/skills
- Lack of infrastructure
- Lack of technology
- Reputational risks
- Cyber risks
- Corporate culture
- Project risk
- Fragmentation of the insurance value chain
- New competitors entering the market

Exceptionally important
Very important
Moderately important
Low importance
Results from our Client Survey

How involved are the business areas with data science applications?

- Actuarial and risk roles are the most heavily involved in data science applications.
- We would also expect an increased involvement over time from customer service, underwriting and sales functions.
Results from our Client Survey

What is the level of upskilling required by individuals in your organisation for the following areas?

- **Business applications of Data Science**
  - Range of 1-5
  - 5 = Significant upskilling
- **Data sourcing**
- **Data usage**
- **Mathematical techniques and algorithms**
- **Programming languages**
- **External vendor tools**

- Significant skills gap in business applications of Data Science.
- All areas would benefit from an increase in the levels of training available to individual.

These slides are for general information/educational purposes only. Action should not be taken solely on the basis of the information set out herein without obtaining specific advice from a qualified adviser.
Data Science Applications for Life (Re)insurance

Milliman Case Studies

Data validation and imputation
Dealing with incomplete and dirty data as well as a large number of diverse legacy portfolios

- Use of advanced techniques to identify missing data patterns to develop more credible experience analysis

Model Validation
Validating an internal model that forecasts future risk exposure

- Develop a transparent and robust validation process

Distributor Oversight
Improving distributor retention and performance

- Pinpoint underperforming distributors and improve allocation of company’s resources

Customer Behaviour
Identifying the key drivers leading to transfers between unit-linked funds and guaranteed funds

- Understand policyholder behaviour and develop marketing actions to encourage/discourage the propensity to switch

These slides are for general information/educational purposes only. Action should not be taken solely on the basis of the information set out herein without obtaining specific advice from a qualified adviser.
Data Science Applications for Life (Re)insurance

Milliman Case Studies

Cross selling and discounts
Offering customers a discount for purchasing multiple product types
- Identify best targets, offers and delivery channels for different customer segments

Customer Engagement
Reducing high rates of policy lapsation
- Analytics on customer behaviour (e.g. premium payments, queries, complaints) to produce early warning indicators & trigger communications

Quotations and pricing
Asking fewer questions when offering an online quotation
- Improve customer experience and overall efficiency

Targeted Products
Understanding a complex target market with varied customer needs
- Improved product design and reduced conduct risk

These slides are for general information/educational purposes only. Action should not be taken solely on the basis of the information set out herein without obtaining specific advice from a qualified adviser.
Data Science Applications for Life (Re)insurance

Milliman Case Studies

Data Analysis Architecture
Developing a cohesive data strategy

- Development of a standardised data science framework across the organisation

Inforce Management
Understanding customers’ use of policy options

- Identify distinct customer segments and apply predictive modelling to create behavioural profiles for each segment
- Use insights from behavioural finance, consumer behaviour, family, health, and other facets of the lives of customers

These slides are for general information/educational purposes only. Action should not be taken solely on the basis of the information set out herein without obtaining specific advice from a qualified adviser.
Results from our Client Survey

For what business decisions or applications is Data Science used at your company?

- Understanding customer behaviour
- Actuarial assumption setting
- Monitoring for fraud
- Optimising operational processes
- Conducting process quality assurance
- Product optimisation
- Optimising underwriting processes
- Other
- Ensuring compliance standards
- Cross-selling
- Conducting customer/market research
- Overseeing conduct risk
- Optimising sales and marketing
- Identifying and managing risks
- Product personalisation

These slides are for general information/educational purposes only. Action should not be taken solely on the basis of the information set out herein without obtaining specific advice from a qualified adviser.
Starting a Data Science Initiative

Choosing the right project
- Start with a narrowly scope and build on it
- Align data science activities with the organisation's overall goals
- Ensure adequate funding and access to data

Hiring the right people
- Identify tradeoffs between budget and salaries, specialisation and generalisation etc.
- Domain knowledge
- Start small and grow over time

Creating the team
- Encourage cross-functional knowledge sharing
- Ensure that project managers have a strong technical understanding in order to have right expectations of their team

Data Governance
- Develop an enterprise-wide set of principles around governance of data
- Take advantage of emerging data sources such as sales and marketing data, lifestyle data captured by wearable devices, electronic medical records, etc.

Key to Success

These slides are for general information/educational purposes only. Action should not be taken solely on the basis of the information set out herein without obtaining specific advice from a qualified adviser.
The Data Question

- Data is everywhere
- First define the problem to be solved
- Importance of domain expertise
- Develop a framework for collecting data that is needed for this purpose
- Pay attention to GDPR and other legislative requirements
- Put a good data management structure in place
Key takeaways from survey

▪ Over 75% expect to be using data science within the next 3 years, with over 35% already making it a point of focus
▪ Most common uses of data science right now involve either assessment of customer behaviour or assumption setting
▪ Limited use of external datasets so far
▪ Actuaries and risk roles currently most heavily involved in applications
▪ Limited standardisation thus far around collection and use of data
▪ Data science is seen as a way to deliver major benefits in increasing customer engagement, increasing customer satisfaction and retention, increasing sales, improving fraud detection and achieving process efficiency
▪ Biggest challenges facing companies involve a lack of infrastructure and technology, cyber risks, regulatory expectations, a shortage of talent, data quality, and access to data
Thank you