Data science: Practical applications in Life (re)insurance

Eamon Comerford, Milliman
Declan Whiteford, Pramerica

Introduction

- Brief introduction to data science

- Results of Milliman survey (link)

- Applications in life (re)insurance

- Pramerica experience

- Focus on automated underwriting

Eamon Comerford
Consulting Actuary
Dublin, IE
+353 1 647 5525
eamon.comerford@milliman.com

Milliman

Declan Whiteford
Associate Actuary
Letterkenny, IE
+353 74 918 8788
declan.whiteford@pramerica.ie

Pramerica

Institute
and Faculty
of Actuaries
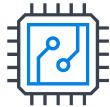
Introduction to data science

What is Data Science?

Machine Learning

Artificial Intelligence

Data Mining

Data Engineering

Data Cleaning

Data Analytics

Predictive Analytics

Data Strategy

Business Intelligence
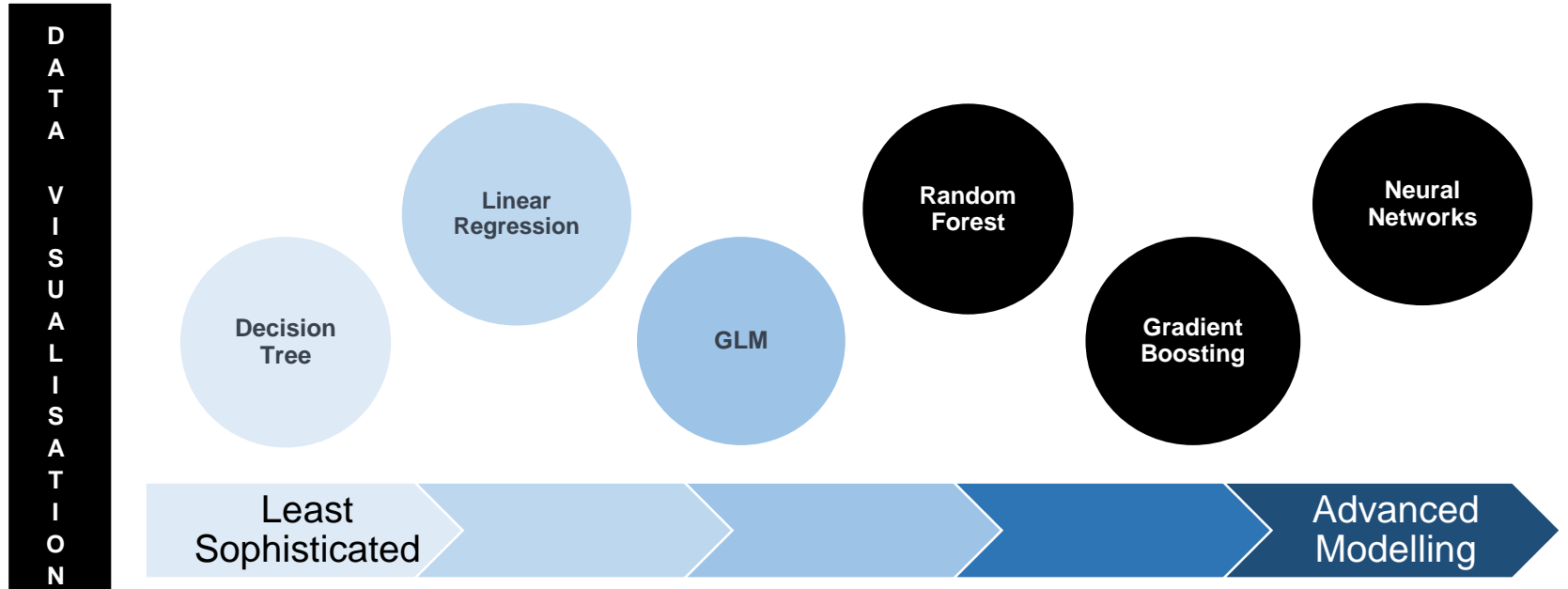
Institute and Faculty of Actuaries

Data Science Methods

Tools and Techniques used in the application of Data Science

DATA VISUALISATION

Decision Tree

Linear Regression

GLM

Random Forest

Gradient Boosting

Neural Networks

Least Sophisticated → Advanced Modelling

Institute and Faculty of Actuaries

Common tools

| Programming language | Visualisation | "Big data" sets |
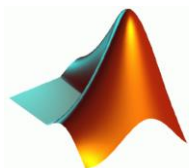
Recent developments

Actuarial bodies highlight importance of codes of conduct in data science activity

EIOPA thematic review on Big Data

EIOPA establishes Consultative Expert Group on Digital Ethics in Insurance

Rapidly increasing actuarial data science events

SAI Data Analytics Committee

IFoA Data Science MIG, and Data Science Collaboration Working Party

IFoA Data Science certificate

IFoA & RSS – A Guide for Ethical Data Science
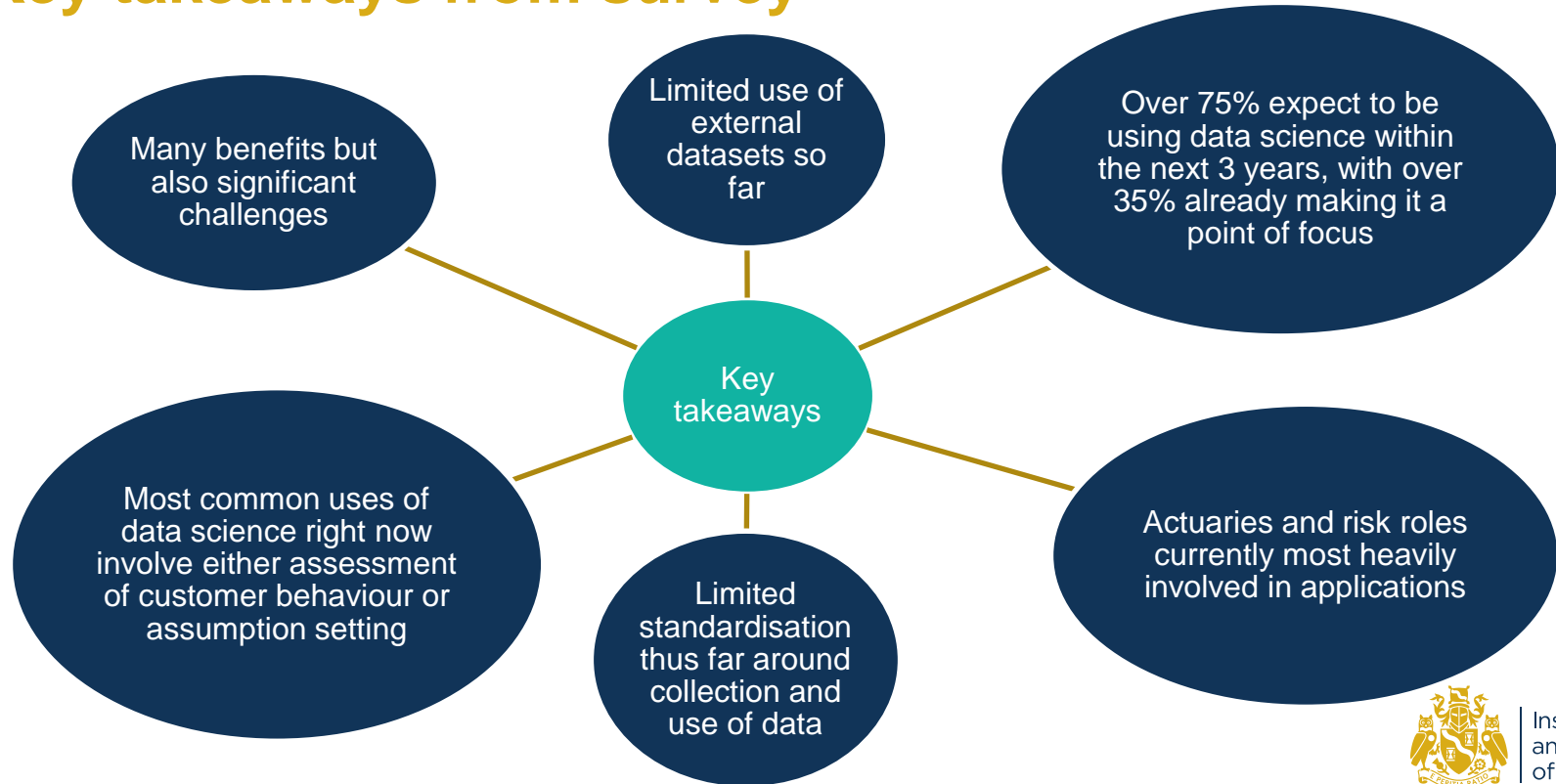
Institute and Faculty of Actuaries

Survey results

Milliman survey on the use of data science

- Scope & Strategy

- Data Usage

- Data Science Architecture and Tools

- Resourcing and Governance
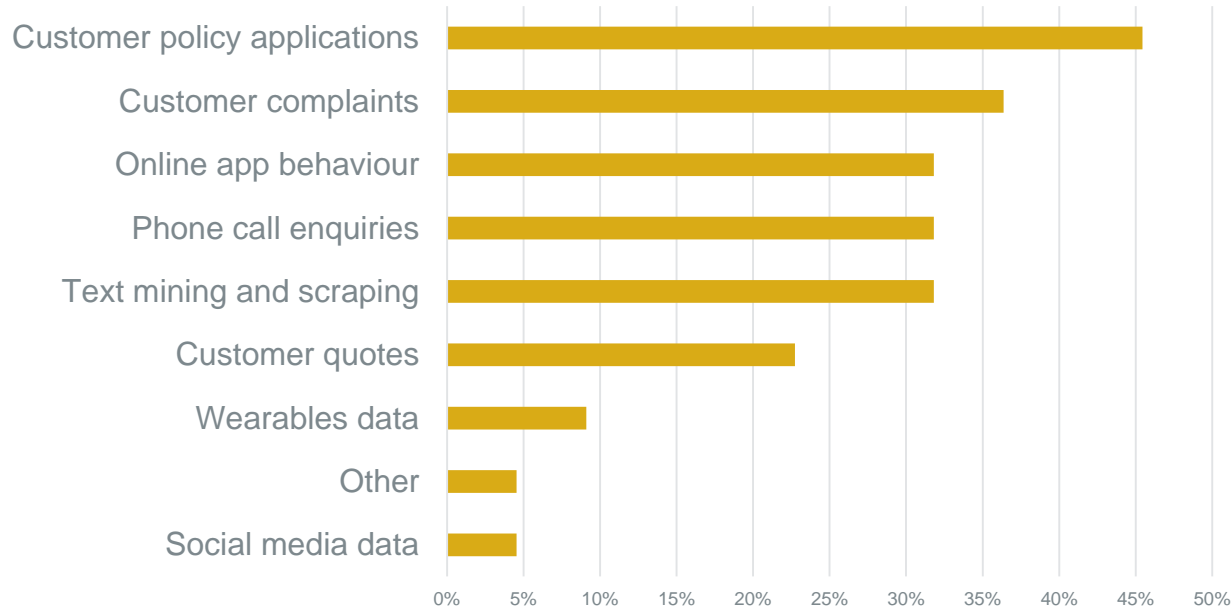
- Benefits & Challenges

Institute
and Faculty
of Actuaries

Key takeaways from survey

Many benefits but also significant challenges

Limited use of external datasets so far

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

Key takeaways

Most common uses of data science right now involve either assessment of customer behaviour or assumption setting

Limited standardisation thus far around collection and use of data

Actuaries and risk roles currently most heavily involved in applications
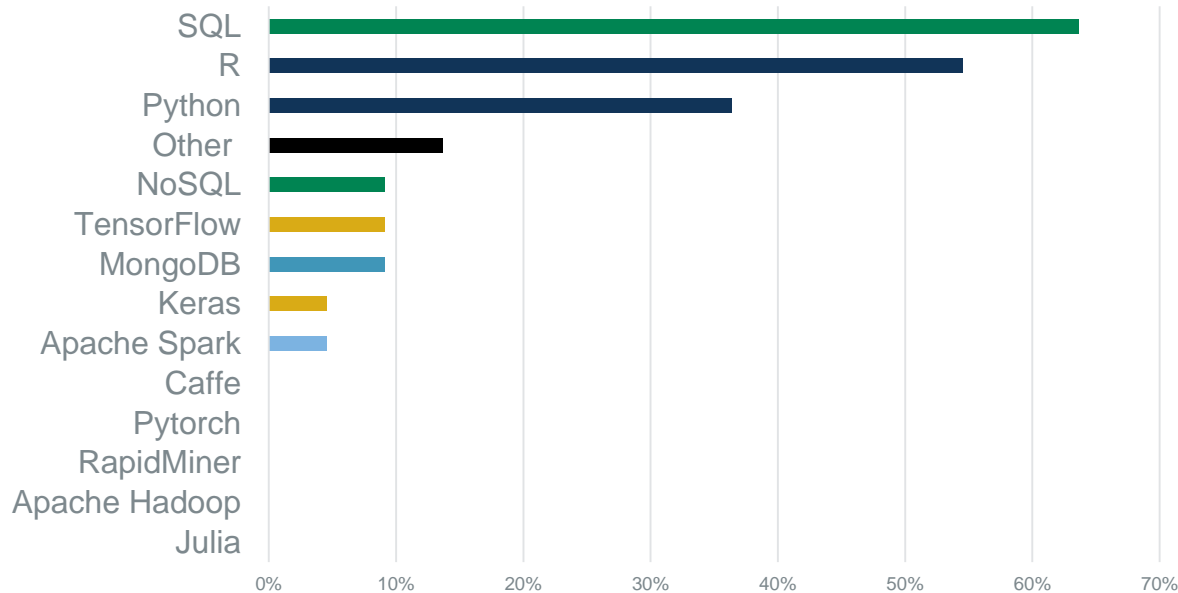
Institute and Faculty of Actuaries

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)?

Results from our Client Survey

Software used

Results from our Client Survey

Main potential benefits?

Chart legend:
- Low importance
- Moderately important
- Very important
- Exceptionally important

Categories (x-axis):
- Faster and real time processes
- Increased customer engagement
- Increased customer satisfaction/retention
- Increased sales
- Lower costs of operations
- Improved fraud analytics
- Increased personalisation of products
- Risk mitigation and prevention
- Enhanced risk assessments
- Individual pricing
- Enhanced liability valuation assumptions
- Regtech

Institute and Faculty of Actuaries
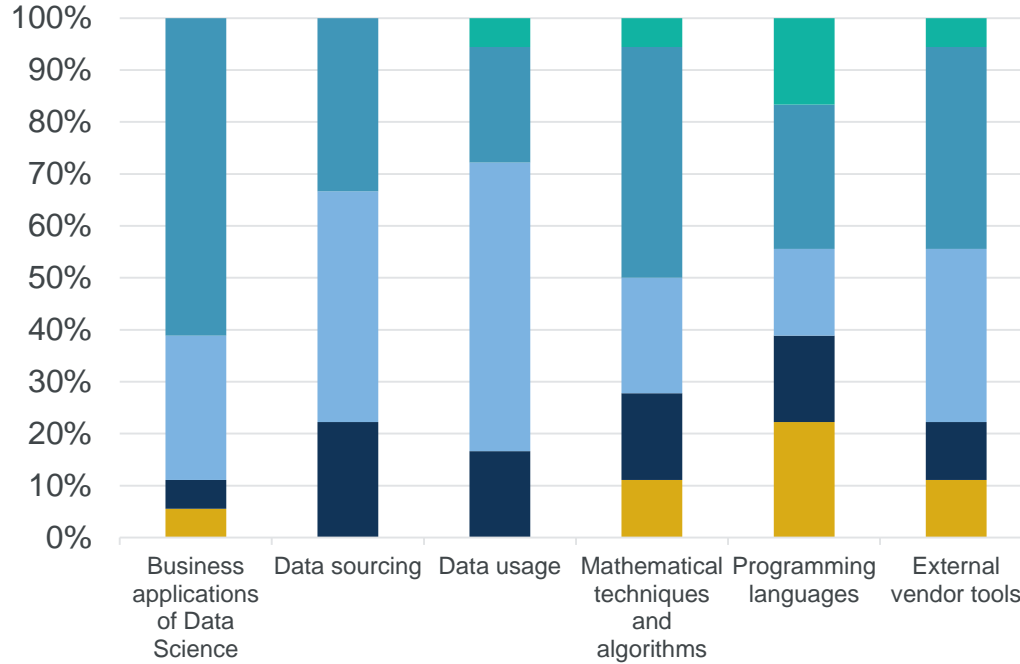
Results from our Client Survey

How relevant are the following challenges for your organisation?
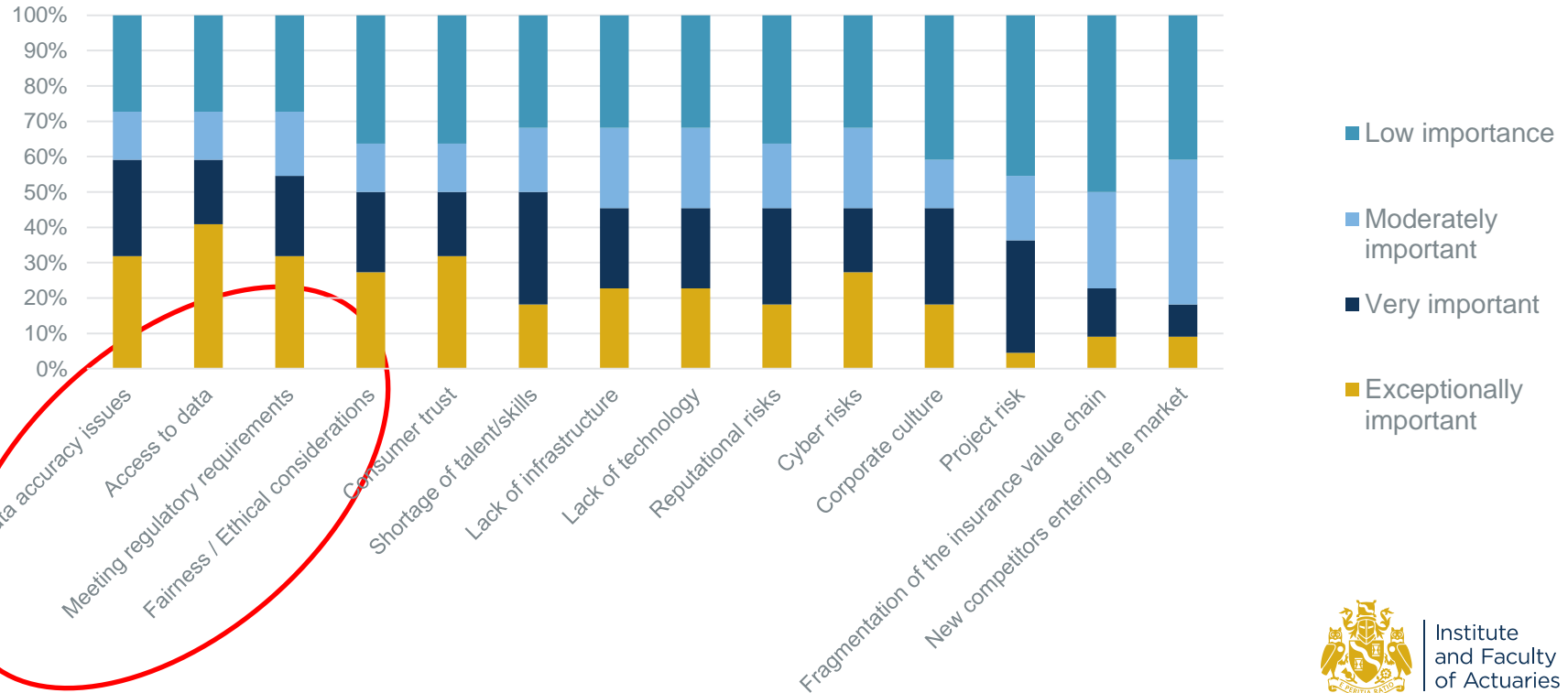
Results from our Client Survey

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

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

- ❖ Range of 1-5
    - ❖ 1 = No upskilling
    - ❖ 5 = Significant upskilling

Institute and Faculty of Actuaries

Applications in life (re)insurance

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

Distributor Oversight
Improving distributor retention and performance

✓ Pinpoint underperforming distributors and improve allocation of company's resources

Model Validation
Validating an internal model that forecasts future risk exposure

✓ Develop a transparent and robust validation process

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

Institute and Faculty of Actuaries

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.

17

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

Institute and Faculty of Actuaries

Data Science Applications for Life (Re)insurance

Milliman Case Studies

Data Analysis Architecture
Developing a cohesive data strategy

Inforce Management
Understanding customers' use of policy options

✓ Development of a standardised data science framework across the organisation

✓ 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
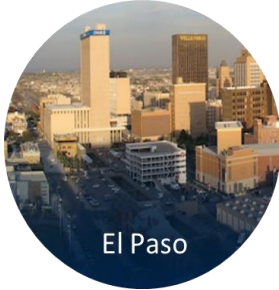
Institute
and Faculty
of Actuaries

Pramerica Experience

Subsidiary of Prudential Financial

About our company - Pramerica

El Paso

Letterkenny

Newark

Support Prudential Financial

- Founded in 2000
- Offer 50 capabilities

- 1800 Employees
- 35 Nationalities

Institute
and Faculty
of Actuaries

Automated Underwriting

FastTracking the Underwriting process

Types of Underwriting

Guaranteed Issue	Simplified Issue	Fully Underwritten	Accelerated Underwriting

- Eligibility by age
- Risk Classification: Age and gender
- Highest premium

- Short app
- Instant data
- Higher premium

- Long app
- Para-meds, labs, etc. based on age/amount
- Lower premium

- Labs waived on a subset of cases selected by predictive model
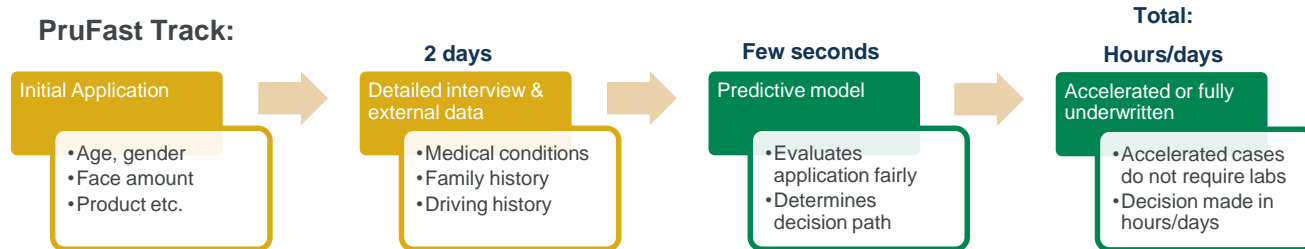- Premium equal to fully underwritten

Institute and Faculty of Actuaries

Accelerated Underwriting – The Impact
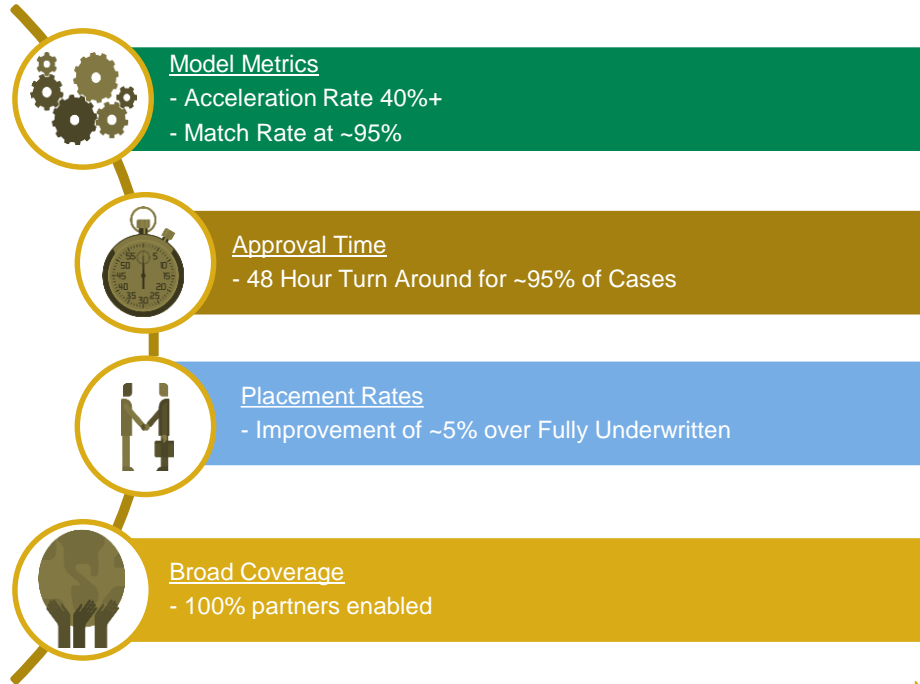
Traditional Underwriting:

Initial Application
- Age, gender
- Face amount
- Product etc.

2 days

Detailed interview & external data
- Medical conditions
- Family history
- Driving history

Total:

20 - 30 days

Traditional Underwriting process
- Human error prone
- Intuition involved
- Exam and labs ordered

Goal → Speed up and simplify insurance while enhancing underwriting predictability

PruFast Track:

Initial Application
- Age, gender
- Face amount
- Product etc.

2 days

Detailed interview & external data
- Medical conditions
- Family history
- Driving history

Few seconds

Predictive model
- Evaluates application fairly
- Determines decision path

Total:

Hours/days

Accelerated or fully underwritten
- Accelerated cases do not require labs
- Decision made in hours/days

Institute and Faculty of Actuaries

Accelerated Underwriting – Performance

Model Metrics
- Acceleration Rate 40%+
- Match Rate at ~95%

Approval Time
- 48 Hour Turn Around for ~95% of Cases

Placement Rates
- Improvement of ~5% over Fully Underwritten

Broad Coverage
- 100% partners enabled

Institute
and Faculty
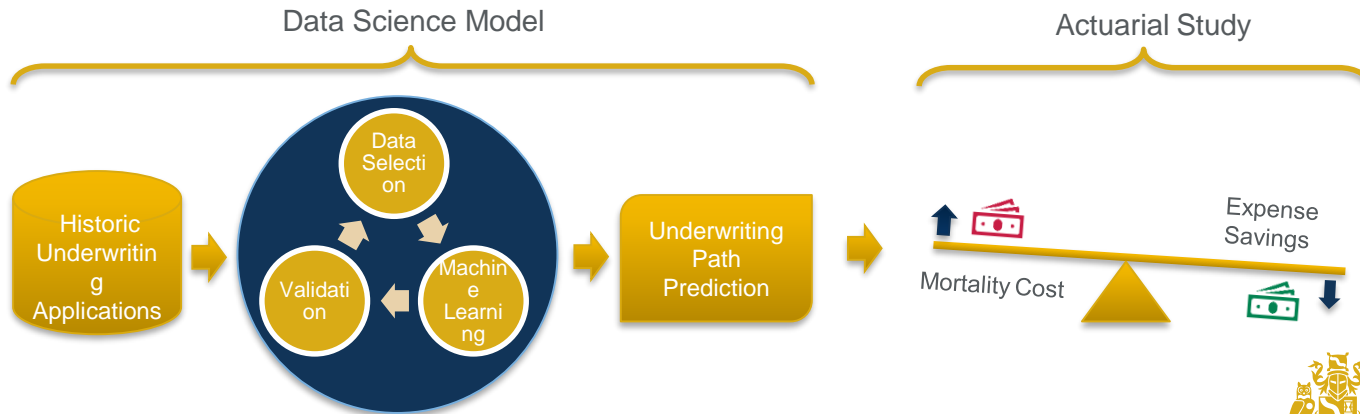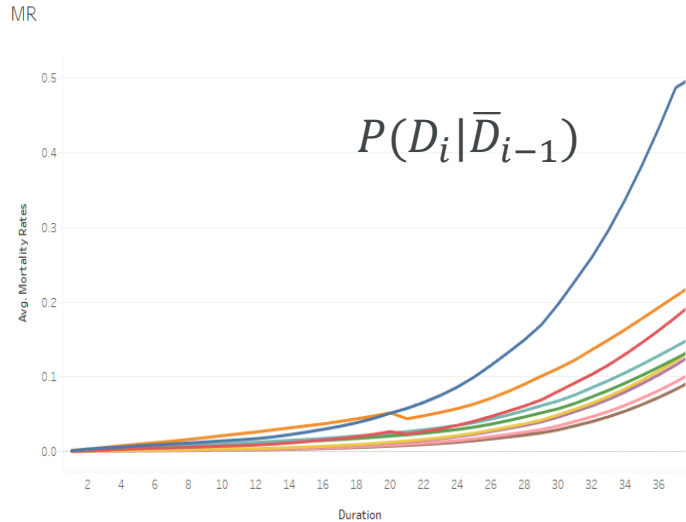of Actuaries
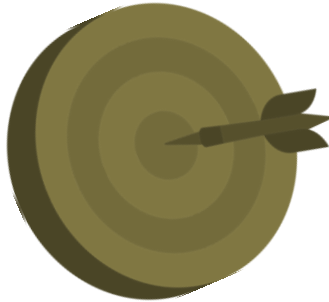
How Actuarial Science and Data Science Met

Through collaboration with the Actuarial team in Prudential, we were able to implement a Mortality driven cost benefit analysis which integrates with the predictive model.
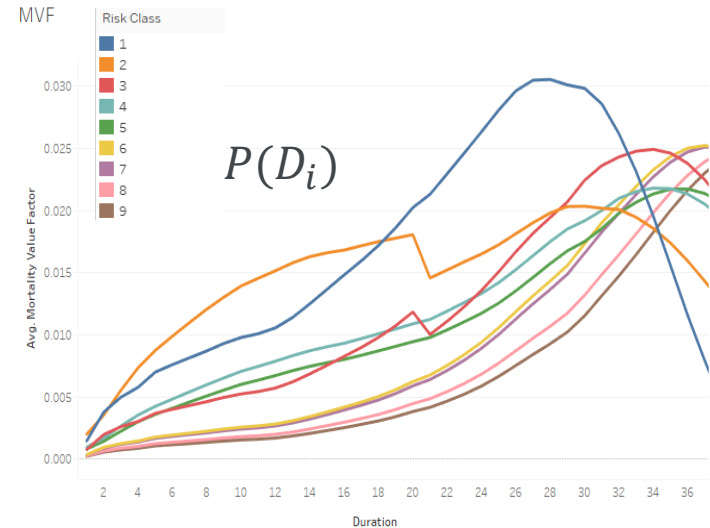

Data Science Model

Actuarial Study

Historic Underwriting Applications

Data Selection

Validation

Machine Learning

Underwriting Path Prediction

Mortality Cost

Expense Savings

Institute and Faculty of Actuaries

Mortality through Visualisation

Conditional Mortality

MR

$$P(D_i | \overline{D}_{i-1})$$

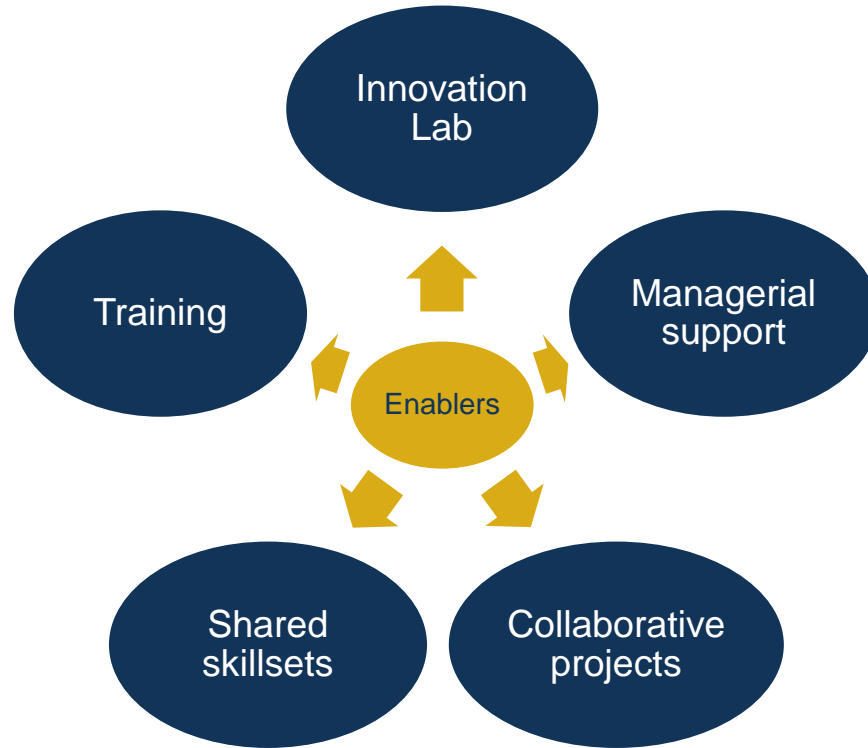## Unconditional Mortality

MVF

$$P(D_i)$$

Institute and Faculty of Actuaries

Actuarial & Data Science Partnership

Creating a collaborative environment

Actuarial & Data Science Partnership

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.
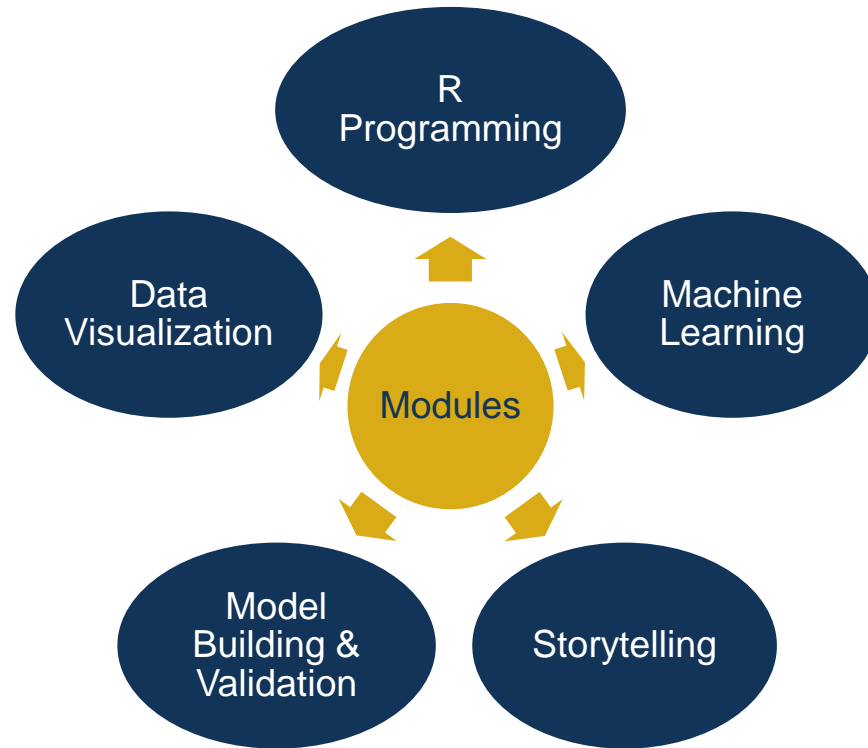
Data and Actuarial Academy

- Internally developed 12 week programme

- Upskilling actuaries in data science techniques (and vice versa)

- R based lapse project

- Running for 3 years

- Also used for internal rotation

Institute
and Faculty
of Actuaries

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 and Actuarial Academy

Institute
and Faculty
of Actuaries

Questions

Comments

The views expressed in this presentation are those of invited contributors and not necessarily those of the IFoA or the presenters' employers. The IFoA do not endorse any of the views stated, nor any claims or representations made in this presentation and accept no responsibility or liability to any person for loss or damage suffered as a consequence of their placing reliance upon any view, claim or representation made in this presentation.

The information and expressions of opinion contained in this publication are not intended to be a comprehensive study, nor to provide actuarial advice or advice of any nature and should not be treated as a substitute for specific advice concerning individual situations. On no account may any part of this presentation be reproduced without the written permission of the IFoA and the presenters.

Institute and Faculty of Actuaries