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R in Insurance

Statistical computing for the insurance community

14th July 2014

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Contents

Welcome to the 2nd R in Insurance conference

We are delighted to welcome you to the 2nd R in Insurance conference at Sir John Cass Business School. After the overwhelmingly positive response to last year's inaugural R in Insurance conference, we could not help repeating and developing the event further!

This one-day conference will focus once more on applications in insurance and actuarial science that use R, the lingua franca for statistical computation. Topics covered include reserving, pricing, loss modelling, the use of R in a production environment and more. All topics are to be discussed within the context of using R as a primary tool for insurance risk management, analysis and modelling.

The conference programme consists of invited talks and contributed presentations discussing the wide range of fields in which R is used in insurance.

We hope that you find the conference enjoyable and stimulating.

Andreas Tsanakas   **Markus Gesmann**

Thanks
An event like this is not possible without the help of many. Our special thanks go to:

- Katrien Antonio, Christophe Dutang and Jens Perch Nielsen, who joined us on the scientific committee

- The Cass Events and Faculty Administration teams, who have worked tirelessly to make the conference a success.

Finally, we are grateful to our sponsors Mango Solutions, CYBAEA, PwC and RStudio. Without their generous support, this conference would not have been possible.

Programme

9:00 - 10:00	Opening keynote: Montserrat Guillen and Leo Guelman: New trends in predictive modelling – the uplift models success story
10:00 - 11:00	Session 1: Reserving (20 min. each) 1. Munir Hiabu: RBNS preserving double chain ladder 2. Els Godecharle: Reserving by conditioning on markers of individual claims: a case study using historical simulation 3. Brian Fannin: Multivariate regression models for reserving
11:00 - 11:30	Coffee
11:30 - 12:30	Lightning talks (10 min. each) 1. Roel Verbelen: Loss modelling with mixtures of Erlang distributions 2. Nicolas Baradel: R Program GUI Manager 3. Ed Tredger: Integrating R with existing software in the London Market 4. Wim Konings: Estimating the duration of non-maturing liabilities in a user friendly Shiny web application 5. Markus Gesmann: End User Computing with R under Solvency II
12:30 - 13:30	Lunch
13:30 - 14:30	Session 2: Pricing (20 min. each) 1. Giorgio Spedicato: R data mining for insurance retention modelling 2. Bernhard Kübler: Assessing exploration risk for geothermal wells 3. Xavier Marechal: Geographical ratemaking with R
14:30 - 15:00	Panel discussion: R at the Interface of Practitioner/Academic Communication
15:00 - 15:30	Coffee
15:30 - 16:30	Session 3: Life/Using R in a production environment (20 min. each) 1. Ana Debon: Modelling trends and inequality of longevity in European Union countries 2. Kate Hanley: Dynamic Report Generation in R: LaTeX vs. Markdown 3. Matthew Dowle: Introduction to data.table
16:30 - 17:30	Closing keynote: Arthur Charpentier: Going Bayesian with R – a non-Bayesian perspective
18:00 - 22:00	Reception and conference dinner, Ironmongers Hall (15 minutes walking distance from Cass)

Abstracts

New trends in predictive modelling – the uplift models success story

Montserrat Guillen, Dept. Econometrics, Riskcenter, University of Barcelona and Leo Guelman, Royal Bank of Canada

The general setting and some classical contributions on customer loyalty and lifetime value in insurance are presented. Methods to identify attributes to increase customer loyalty are reviewed, including the logistic regression model to predict the probability of policy lapse and survival analysis techniques to predict customer duration. Next, the concept of uplift modelling is introduced. This method aims to measure the impact of a proactive intervention, such as a marketing action, on a given response at the individual subject level. Applications of conventional and uplift modelling techniques in the context of insurance cross-selling, client retention and pricing are described. Uplift models provide insurers a good orientation regarding business risk management and these ideas can be generalised to financial services involving risk transfer. Features of the recently created R-package uplift are shown. Our conclusion is that more interaction between retention strategies and pricing should be encouraged and that integrated predictive modelling is a promising area.

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Reserving

RBNS preserving double chain ladder

Munir Hiabu, Cass Business School

The single most important number in the accounts of a non-life company is often the so-called reserve. The reserve is estimated based on a statistical analysis combining past paid claims and so called RBNS claims estimates. RBNS means "reported but not settled" and is a number set for any incurred claim in an insurance company. The statistical analysis in insurance companies is often done in practice via the classical chain ladder on so-called incurred data.

This approach involves a statistical modelling and forecasting of RBNS estimates implying that expert opinion from the claims department is changed in the reserving department. Our motivation for developing this new RBNS preserving double chain ladder approach is to ensure that expert opinion of individual claims reserving is not changed in the modelling process. We take advantage of the flexibility of the double chain ladder method and develop a reserving technique that does not change RBNS estimates via modelling and forecasting. Full stochastic cash flows of the RBNS reserve, the IBNR reserve and the reserving tail are provided. Programmes are available via the double chain ladder (DCL) R-package.

Reserving by conditioning on markers of individual claims: a case study using historical simulation

Els Godecharle, KU Leuven

Our research explores the use of claim-specific characteristics, so-called claim markers, for loss reserving with individual claims. Starting from the approach of Rosenlund (2012) we develop a stochastic Reserve by Detailed Conditioning ('RDC') method, which is applicable to a micro-level data set with detailed information on individual claims.

We use historical simulation to construct the predictive distribution of the outstanding loss reserve by simulating payments of a claim, given its claim markers. We explore how to incorporate different types of claim-specific information when simulating outstanding loss reserves and evaluate the impact of the set of markers and

their specification on the predictive distribution of the outstanding reserve.

The stochastic RDC method is implemented in R and the code is made available online. We demonstrate the performance of the method on a portfolio of general liability insurance policies for private individuals from a European insurance company.

Multivariate Regression Models for Reserving

Brian Fannin, Redwoods Group

MRMR - Multivariate Regression Models for Reserving is an R package for loss reserving. The emphasis is on the treatment of loss reserving as a multilevel linear regression problem. MRMR supports S4 classes for storage of reserving data and reserving models. A Triangle object is composed of smaller objects, which represent OriginPeriod, StaticMeasure and StochasticMeasure. The stochastic feature of the StochasticMeasure object refers to the fact that the measure may change over time. In effect, a StochasticMeasure is a traditional loss triangle. However, the data may be augmented by use of a StaticMeasure object to store data, which is fixed in time, such as written premium or other exposure elements. The OriginPeriod and measure classes support implementation of basic functionality such as rbind, c, comparison, assignment and extraction in a natural way consistent with common R objects. This enables one to easily update information as part of routine studies, join to other data sources or examine particular subsets of reserving data.

The Triangle object features basic visualisation for exploratory analysis to aid the actuary in selecting model variables. The TriangleModel object stores information regarding a fit model. One may have more than one model for the same Triangle object. When constructing a model, the development lag generally acts as a categorical parameter, though others may also be introduced. The structure of the Triangle object permits multilevel linear models so that, for example, one may view results for a particular line segmented by territory or other dimensional variables such as customer size, customer industry or urban vs. rural risks. This is effectively a wrapper around calls to the lme4 package. Finally, a TriangleProjection object stores projection of a TriangleModel to any arbitrary future time period. The Triangle, TriangleModel and TriangleProjection

classes are roughly analogous to a data frame, the result from an lm function and the result from a predict function, respectively.

Loss modelling with mixtures of Erlang distributions

Roel Verbelen, KU Leuven

Modelling data on claim sizes is crucial when pricing insurance products. Such loss models require on the one hand the flexibility of nonparametric density estimation techniques to describe the insurance losses and on the other hand the feasibility to analytically quantify the risk. Mixtures of Erlang distributions with a common scale are very versatile as they are dense in the space of positive continuous distributions (Tijms (1994, p. 163)). At the same time, it is possible to work analytically with this kind of distributions. Closed-form expressions of quantities of interest, such as the Value-at-Risk (VaR) and the Tail-Value-at-Risk (TVaR), can be derived as well as appealing closure properties (Lee and Lin (2010), Willmot and Lin (2011) and Klugman et al. (2012)). In particular, using these distributions in aggregate loss models leads to an analytical form of the corresponding aggregate loss distribution, which avoids the need for simulations to evaluate the model.

In actuarial science, claim severity data is often censored and/or truncated due to policy modifications such as deductibles and policy limits. Lee and Lin (2010) formulate a calibration technique based on the EM algorithm for fitting mixtures of Erlangs with a common scale parameter to complete data. Here, we construct an adjusted EM algorithm which is able to deal with censored and truncated data, inspired by McLachlan and Peel (2001) and Lee and Scott (2012). Using the developed R program, we demonstrate the approximation strength of mixtures of Erlangs and model e.g., the left truncated Secura Re data from Beirlant et al. (2004), and use the mixtures of Erlangs approach to price an excess-of-loss reinsurance contract.

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R Program GUI Manager

Nicolas Baradel and William Jouot, PGM Solutions

R is known to be a great programming language. However, we believe that it lacks two important features: creating graphical interfaces and generating reports. RPGM is a new brand software, standing for "R Program GUI Manager". This tool enables any programmer to easily make R programs, to create user-friendly interfaces and powerful report generation abilities, that can export results as PDF files or as Excel spreadsheets.

Indeed, RPGM contains a powerful IDE, the Editor, with an R script editor with strong keywords coloration, function auto-completion and a quick and easy access to the R help pages by just pressing F1 when the cursor is on a function. As TCL/TK, users can create graphical interfaces, but without a single line of code and without having to learn a new language. All common widget types can be inserted such as text/number inputs, file/folder choosers, check boxes, dropdown lists and images.

Furthermore, RPGM also contains a "Client" software, aimed for end users, which executes programs made with the Editor. Most of the time, the end user does not know and does not have to know about R and the given implemented feature. R is completely hidden, as the user will communicate with R through the user-friendly generated client interface, yet the R console can be displayed for debugging purposes.

RPGM can also generate PDF reports using the powerful LaTeX language. No need to know how LaTeX works for using it thanks to the Report Editor, although raw LaTeX code can also be inserted. Excel spreadsheets can also be generated, based on an already existing Excel file with formulas and graphics. RPGM will add results from R in the spreadsheet in a specific cell name. For more information and screenshots, visit www.pgm-solutions.com.

Integrating R with existing software in the London Market

Ed Tredger and Dan Thompson, UMACS

Whilst the vast majority of us know spreadsheets are incredibly useful, there are things that they simply cannot cope with. Our talk will focus on what R enables actuaries to do beyond what existing software can handle, using example from the London Insurance Market. All of this talk is based on practical experience of using R in real-world examples and draws from the presenters' personal experiences.

There are three distinct sections to the talk:

1. The limitations of spreadsheets, now and in the future

2. Why is R the solution?

3. Practical examples of R integrating with Excel

The first section of the talk discusses why increasing volumes of data, demand for MI and reporting and the increasingly complex nature of reserving, pricing and capital modelling will push current software beyond their limits.

The second part of our talk discusses why we believe R is particularly well placed to go beyond the limitation of spreadsheets and manage the integration of other pieces of software.

The third part will discuss different implementations of R we have found have added significant end-user value. This part of the talk will use examples of how R has been successfully used in pricing, reporting and capital modelling.

Estimating the duration of non-maturing liabilities in a user friendly Shiny web application

Wim Konings, Reacfin

One of the challenges in the risk management of non-maturing liabilities (e.g. saving accounts) is the estimation of the interest rate sensitivity (or duration) of these instruments. The aim of our talk is double:

- First a replicating portfolio approach will be presented for this problem. This approach consists of testing a large number of random investment strategies over a historical time horizon in order to select this strategy that replicates best the interest rate evolution of the saving account. In practice the replicating portfolio is chosen to be the strategy that minimises the variance of the margin between the saving account rate and replicating portfolio rate. By testing a large number of portfolios we are also able to construct a risk-return plane that can be used for optimising the investment strategy.

- Second, we will present how such a model can be turned into a user-friendly web application using the Shiny package.

End User Computing with R under Solvency II

Markus Gesmann, Lloyd's

Under the Solvency II regime insurance companies have to demonstrate that applications built for the internal model outside an IT controlled environment have an appropriate control framework in place.

Open source communities had to overcome those challenges in the past already: How to organise work across multiple teams? How to define interfaces? How to deal with security, incident management, documentation, testing, roll out, etc.?

The R documentation on writing R extensions answers those questions and offers a blue print and framework

for end user computing. Over 5000 packages on CRAN demonstrate the success of this approach.

This talk will illustrate how the R package development standards map to the Solvency II requirements for end user computing.

Pricing

R data mining for insurance retention modelling

Giorgio Spedicato, ACAS Data Scientist at UnipolSai

Retention analysis is a very important task that insurers do when performing tariff revisions. Retention and conversion represent the two blocks of price optimisation that are currently among the most sophisticated pricing analyses carried out by actuaries working on personal lines.

However, academic literature has given little attention to this topic. The use of predictive modelling techniques, like classification trees, random forests, SVM, neural networks, knn, as long as time-to-event modelling has been deeply explored and actively used by data scientists and practitioners in other industries, like marketing, healthcare, banking etc.

The almost uniquely used model in actuarial practice and the only model implemented in standard pricing software is logistic regression. The aim of this paper is twofold:

- First, some data mining techniques (among the most used) will be applied on a real data set and their predictive performance will be compared with standard logistic regression results.

- Second, the optimal renewal premium decision will be determined within all different methodology and results in term of underlying probability will be performed.

The analysis will be performed by the use of R statistical software (R Core Team, 2013) and specialised predictive modelling package, in particular the caret package (Kuhn, 2008).

Assessing Exploration Risk for Geothermal Wells

Bernhard Kübler, Fraunhofer Institute for Industrial Mathematics

In the course of Germany's 'energy transition' alternative power sources are being extensively investigated. A particular form of these renewable energies is geothermics whose resources in Germany are estimated to 1200 EJ (Exajoules). As the power of a geothermal installation is proportional to the product of water temperature T and flow rate Q, a geothermal well is said to be successful if the crucial parameters T and Q exceed some critical thresholds fixed by the investor. The hazard that the drilling yields lower values than those required by the investor is referred to as exploration risk.

Typically, investors transfer exploration risk to a reinsurance company. Therefore, not only investors but also insurance and reinsurance companies seek for an accurate assessment of exploration risk. Also, low interest rates and regulatory standards (Solvency II) trigger insurers to consider new asset classes like alternative investments. Due to generating stable cash flows, investing in renewable energies and infrastructure is seen to be an eligible strategy for insurers. Within this context, risk management and reporting purposes call for a thorough assessment of the associated risk.

Besides the classical Kriging approach, we particularly employ Support Vector Machine Regression (SVR) to measure exploration risk. To our knowledge, up to now SVR has not been used in the context of geothermics. The major advantage of a Machine Learning based approach is its ability to model even quite complex nonlinear relationships appropriately. We also address estimation risk by deriving statements concerning the reliability of (point) estimates gained by SVR.

Our first results based on real data indicate that the Machine Learning tools yield forecasts being more precise than Kriging. This should enable investors and insurers to enhance their assessment of exploration risk, with corresponding potentials to realise cost savings.

Geographical ratemaking with R

Xavier Marechal, Reacfin

In motor insurance, most companies have adopted a risk classification according to the geographical zone where the policyholder lives (urban / non urban for instance, or a more accurate splitting of the country according to Zip codes). The aim of this talk is to introduce in the tariff a new explanatory variable based on the policyholder's district taking into account the other explanatory variables already present in the technical tariff.

It is usually better to take into account both the frequency and the mean cost as behaviour can be quite different but a lot of companies concentrate on the frequency in order to establish their geographical ratemaking.

We will briefly present different solutions to define a categorical geographical variable but we will focus on the use of GAM for the case study in R. The readShapeSpatial function will be introduced to plot country maps.

Life insurance

Modelling trends and inequality of longevity in European Union countries

Ana Debón, Universitat Politècnica de València and Steve Haberman, Cass Business School

Comparisons of differential survival by country are useful in many domains. In the area of public policy, they help policymakers and analysts assess how much various groups benefit from public programs, such as Social Security and health care. In financial markets and especially for actuaries, they are important for designing annuities and life insurance.

In this study, we present a method for clustering information about differential survival by country and review mortality indicators to study inequalities and trends on mortality. Then we use this approach to group mortality surfaces for European Union countries. Additionally, the indicators allow us to characterise each group. All these statistical analyses were performed using the R environment for statistical computing.

Using R in a production environment

Dynamic Report Generation in R: LaTeX vs. Markdown

Kate Hanley, Mango Solutions

Dynamic document generation allows for the seamless integration of R code and document templates when generating reports. Changes in the R code are filtered through to the document, reducing the possibility of errors and discrepancies between the R code and final report, and minimising the burden of quality control procedures.

The knitr package provides excellent tools to facilitate this process, and allows documents to be generated directly from R. However, there is often uncertainty concerning which mark-up language to use to create the report templates, and the choice often depends on a variety of factors.

This presentation focuses on two widely used mark-up languages, LaTeX and markdown. Code examples are used to illustrate the differences between the two languages, allowing for a discussion of the pros and cons of each in terms of learning curve, flexibility and ease of use.

Introduction to data.table

Matthew Dowle, data.table-project

The data.table package provides an enhanced version of data.frame including fast aggregation of large datasets, fast ordered joins, fast add/modify/delete of columns by group using no copies at all, list columns and a fast file reader: fread(). Its goal is to reduce both programming time (fewer function calls, less variable name repetition) and compute time on large data (64bit with 8GB+ RAM). It was first released in 2008.

The presentation will cover the essential syntax (creating a data.table, fast and friendly file reading with fread, keys (setkey), update by reference (:= and set*), ordered joins forwards, backwards, limited and nearest) with a focus on quality assurance (over 1,000 tests and release procedures) and support (a review of 1,200 Q&A on Stack Overflow's data.table tag).

Going Bayesian with R - a non-Bayesian perspective

Arthur Charpentier, Université du Québec à Montréal, Professor

Bayesian philosophy has a long history in actuarial science. Liu et al. (1996) claim that "Statistical methods with a Bayesian flavour [...] have long been used in the insurance industry." If actuarial students discover Bayesian statistics with credibility, the Bayesian philosophy can be extremely powerful. Not only to quantify uncertainty when only a few observations have been observed (and asymptotic results cannot be invoked) but also to make computations possible when a lot of observations are available (and classical computations will be too complex). With the perspective of a muggle, I will try to explain the power of Bayesian techniques (usually seen as a magical black box by non-Bayesians).

Biographies of presenters

Nicolas Baradel

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Nicolas Baradel is a PhD student in Applied Mathematics at CREST-ENSAE and co-founder of pgm-solutions, a company specialised in R software for the development of professional tools.

After an actuarial specialisation at ENSAE ParisTech, he worked one year in the Group Risk Management of AXA as a P&C risk analyst, especially in the development of R tools for the estimation/management of atypical risks. Today, he is a PhD student in Control Stochastic, in particular in the applications in actuarial science.

His interests lie in mathematical applications and computer science. He is currently writing an R book in French for beginners, with applications to statistics and the actuarial and finance sciences.

Arthur Charpentier

Professor of actuarial science at UQAM, Canada
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Arthur Charpentier is professor of actuarial science at UQAM, Canada. He has published two books in non-life insurance mathematics and recently edited "Computational Actuarial Science with R". He is also the editor of the blog http://freakonometrics. hypotheses.org/.

Ana Debón

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Ana Debón is an Associate Professor at the Department of Statistics of the Universitat Politècnica de Valencia, Spain. She holds a PhD in Mathematics. She has been a Visiting Researcher at Concordia University in Montreal, Canada and at Cass Business School in London, UK. She is specialised in Statistics applied on Actuarial Science. Her work has appeared in leading journals as well as in several books and chapters of collective volumes. Her research entitled Projection of mortality indicators for Spain won the INE Awards "Eduardo García España" in 2013.

Matt Dowle

Maintainer, data.table
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Matt Dowle has a background is investment banking and hedge funds in London, quantitative equity research and trading both low and high frequency. He began as a programmer with Lehman Brothers in 1996, then moved on to become an analyst with Salomon Brothers (later becoming Citigroup) where he was fortunate to learn S-PLUS from Patrick Burns (author of S Poetry and the R Inferno). He switched to R in 2002 after a comparison of predicted vs. realised tracking errors for random portfolios taking one hour in S-PLUS was reduced to one minute by R with minimal code changes. He moved to Concordia Advisors in 2004 and Winton Capital in 2008, both hedge funds. He is currently taking a career break and working on his R package data.table together with collaborators.

Brian Fannin

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Brian Fannin is the chief actuary of The Redwoods Group, a specialty provider of commercial insurance, based in North Carolina in the United States. The Redwoods Group is committed to using insurance as a platform to improve the lives of the communities in which they do business. Brian has held a number of positions at both primary and excess insurance companies, both in the US and in Germany. He is a member of the CAS' open source software committee, with a focus on R. His principle areas of research are in stochastic reserving, predictive modelling and visualisation of data. Brian believes that objective analysis of data will lead to the delivery of social justice.

Markus Gesmann

Manager, Analysis, Lloyd's of London
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Markus Gesmann manages the Analysis team at Lloyd's of London. His team provides Lloyd's and managing agents with a central analysis function to support informed decision-making. Markus joined Lloyd's shortly after the formation of the Franchise Performance Directorate in 2003 and helped to build many of the benchmarking tools to oversee the market's underwriting performance and monitor Lloyd's risk appetite. He has been closely involved in the Performance Management Data return, establishing a consistent framework for price monitoring in the Lloyd's market. Markus is a frequent speaker at industry conferences and R events. He is also the maintainer of the ChainLadder and googleVis R-packages.

Els Godecharle

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Els Godecharle is currently working on a PhD in actuarial science in the insurance research group at KU Leuven under the supervision of Associate Prof. Dr. Katrien Antonio. Her research puts focus on stochastic models in non-life and health insurance and includes stochastic modelling, actuarial science, actuarial statistics, scientific computing and programming. Els holds a bachelor's degree in mathematics from KU Leuven and graduated from KU Leuven with a Master of Science in Mathematics, with professional option, in 2012.

Leo Guelman

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Leo Guelman is currently the Director of Statistical Modelling & Analytics at RBC Insurance. He leads and is accountable for providing advanced statistical modelling, predictive analytics and decision management solutions for insurance. Leo is the founder and co-organizer of the Toronto R user Group and the author of the uplift R package. He holds a Master's degree in Economics from the University of British Columbia and he's currently a PhD Candidate in Economics at the University of Barcelona.

Montserrat Guillen

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Montserrat Guillen is Chair Professor of Econometrics at the University of Barcelona and director of the research group Riskcenter. She also holds a position as visiting professor at the University of Paris Panthéon-Assas. Her research focuses on statistics applied to insurance and quantitative risk management. She has published many scientific articles with co-authors from all over the world. She was elected President of the European Group of Risk and Insurance Economists, the Geneva Association, in 2011. She has served in many scientific boards, international programs and steering committees and she has also conducted R&D joint programmes with many companies. She is member of the Royal Academy of Doctors.

Kate Hanley

R Consultant, Mango Solutions
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Kate Hanley became interested in statistics during her undergraduate studies at Durham University, where she was introduced to the R language and both frequentist and Bayesian statistics. She decided to pursue this interest through an MSc in statistics at Lancaster University, and at the University of Bristol as a statistics research student.

Kate joined the Mango team in September 2013 and has had many opportunities to develop her knowledge of the R language. During her time at Mango, she has developed a keen interest in the area of dynamic report generation using R. Her key areas of statistical interest are Markov Chain Monte Carlo and Bayesian statistics, and she enjoys having the opportunity to teach the R language to both new and advanced users.

Munir Hiabu

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Munir Hiabu is a PhD Student at the Faculty of Actuarial Science and Insurance at Cass Business School, City University London under the supervision of Professor Jens Perch Nielsen. Prior to this, he obtained a BSc and MSc degree in Mathematics from the University of Heidelberg, Germany. At Cass, Munir's main research focuses on estimation of outstanding liabilities in non-life insurance. In this actuarial field, he works on methods to further develop and understand classical approaches like the chain ladder method. That work also includes developing new methods in non-parametric and semi-parametric survival analysis which have a much wider application apart from non-life insurance, including but not limited to life insurance, economics and medicine.

Bernhard C. Kübler

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Bernhard C. Kübler is a member of scientific staff at Fraunhofer Institute of Industrial Mathematics ITWM, Department of Financial Mathematics. His research activities focus on risk management, geostatistics and statistical fraud detection. He has gained work experience in the financial industry, particularly in credit risk and liquidity risk. Bernhard holds a PhD from the University of the German Federal Armed Forces Munich. Prior to that, he graduated in Mathematical Finance, Economics and Mathematics.

Xavier Maréchal

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Xavier Maréchal is one of the founders of Reacfin. As Head of the Innovation & Quality department he leads the Centers of Excellence at Reacfin. Xavier is also one of the co-authors of: "Actuarial Modeling of Claim Counts: Risk Classification, Credibility and Bonus-Malus Systems" (Wiley, 2007). Xavier is a qualified actuary of the Institute of Actuaries in Belgium (IA|BE) and Member of the Non-Life workgroup of the IA|BE. Xavier has extensive experience in the actuarial field obtained during his 10 years as a senior consultant and now as a principal for many national and multinational insurance companies. He has gained a complementary experience in various fields going from Non-Life ratemaking and provisioning to life modelling and ALM.

Wim Konings

Consultant at Reacfin
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Wim Konings is a financial consultant at Reacfin (an actuarial and financial consulting firm based in Belgium) with five years of experience in financial modelling and risk advisory. Wim holds a Masters in Finance from Antwerp Management School and a Masters in Sociology from the University of Ghent.

Giorgio Alfredo Spedicato

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Giorgio Alfredo Spedicato received an MSc in Actuarial Science from the Catholic University of Milan in 2006 and a PhD in Actuarial Science from the University of Rome, La Sapienza in 2011. He is a fully qualified member of the Italian Actuarial Professional Body, a Chartered Statistician of the Royal Society of Statistics and an Associate of the Casualty Actuarial Society since 2013. Prior to his actuarial career he worked as a freelance statistical consultant for two years before joining Axa Italy as MTPL pricing actuary in 2008. After three years he moved to Aviva Italy where he worked as general insurance reserving actuary. Since 2014 he works as Data Scientist at UnipolSai, the largest Italian insurer. Occasionally Giorgio still provides statistical consulting services to students and researchers.

Ed Tredger

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Ed Tredger is a Fellow of the Institute of Actuaries, holds a PhD in statistics, and has used R for more than 10 years in insurance, government and academia. His main areas of interest are pricing, capital modelling and developing R as a key tool for solving the unique problems presented by the London Market.

Dan Thompson

Senior Actuarial Analyst, UMACS
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Dan Thompson currently works in capital modelling and pricing. He also runs the software arm of UMACS - namely the flagship product Ulytica, a London Market-focused pricing platform. He previously worked for Acturis, a leading commercial insurance platform, after graduating with a degree in Theoretical Physics.

Dan's projects within the Lloyd's market have involved:
- Developing solutions with Excel, VBA, R, C++ and XML.
- Building workflows for underwriters by linking Excel with R, Subscribe, ImageRight, Google Earth, databases, web pages, etc.
- Linking R to syndicate data to produce automated real-time pricing and capital reports in Sweave

Roel Verbelen

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Roel Verbelen pursues a PhD in Statistics at the Faculty of Economics and Business at KU Leuven under the supervision of Prof. Dr. Gerda Claeskens and Associate Prof. Dr. Katrien Antonio. The main focus in his research is the use of advanced statistical methods for pricing and reserving in actuarial science to allow a better use of the available risk information leading to more accurate predictions and to better risk management. Roel obtained a Bachelor in Mathematics at the University of Ghent in 2011 and a Master in Statistics at KU Leuven in 2013. With his Master thesis Phase-type distributions and mixtures of Erlangs. A study of theoretical concepts, calibration techniques and actuarial applications, Roel received the 2013 IA|BE price from the institute of actuaries in Belgium for the best thesis concerning an actuarial topic.