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Department of **Statistics and Actuarial Science**
Departement **Statistiek en Aktuariële Wetenskap**
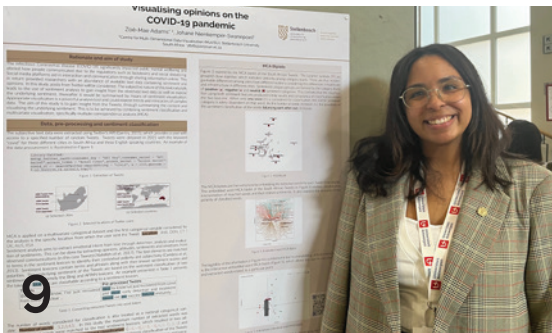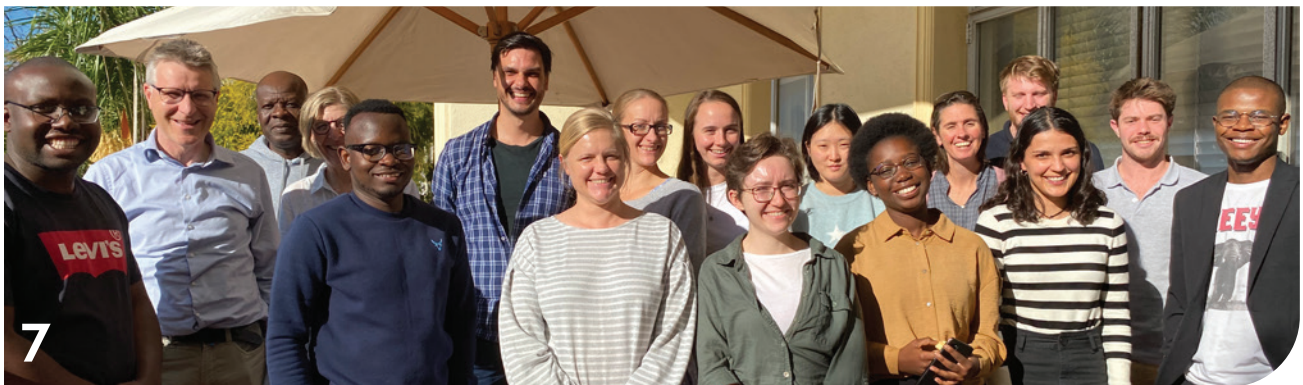
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Warm greetings (despite the cold weather) to all of you.
In my first message as Head of the Department, I am delighted to extend a warm welcome to our returning students and those who are joining us for the first time.

Our Department has thrived over the years, nurturing a community of curious minds and passionate individuals who understand the power of data and its impact on decision-making, research, and innovation. As the head of this dynamic Department, I take immense pride in witnessing the dedication and enthusiasm displayed by our students and staff alike, as well as our alumni.

Statistics, often referred to as the "science of uncertainty", plays a pivotal role in addressing complex challenges across various disciplines. From analysing health trends to unravelling patterns in financial markets, from using multivariate visualisations to graphically understand complex relationships to predicting consumer behaviour, the applications of Statistics are virtually limitless. Our Department stands at the forefront of this field, fostering excellence and pushing the boundaries of knowledge.

In recent years, the landscape of Statistics has witnessed profound transformations, largely driven by the exponential growth of statistical learning and artificial intelligence (AI). These emerging fields have opened up a world of opportunities and presented us with new challenges. Whilst pondering the precise role that Statistics has to play within this cross-disciplinary environment, I was reminded of something I heard from a colleague at another Statistics department. While other disciplines focus only on the implementation and advancement of these methods, the Statistics department has an additional function to perform, namely the *transparency* of these advanced models. In a world becoming somewhat suspicious of complicated models that cannot be explained to the man on the street, the fields of Statistics and Data Science are uniquely positioned to add transparency and explanation as to why these models work. This is also true of the other

disciplines in our Department: a large focus of Financial Risk Management and Actuarial Science research is not only to find models that work, but also to understand *why* they work.

As we look ahead, I would like to highlight the challenges and opportunities faced by the increase in statistical learning and AI models in our Department.

Challenges:

Ethical implications: The increasing use of AI and statistical models in decision-making processes gives rise to ethical dilemmas. Ensuring that these tools are unbiased and do not perpetuate discrimination therefore becomes paramount.

Data privacy and security: As we delve into big data and AI-driven technologies, safeguarding sensitive information and protecting data privacy become critical challenges. Careful attention is therefore demanded in striking the right balance between data accessibility and protection.

Interdisciplinary collaboration: The integration of statistical learning and AI with other fields demands effective collaboration and communication between experts in different domains. Breaking down disciplinary silos and fostering cooperation is key to addressing complex problems.

Opportunities:

Advancements in research: Statistical learning and AI provide researchers with powerful tools to analyse vast amounts of data, leading to new insights and discoveries that were previously inaccessible.

Real-world applications: The growth in statistical learning has led to innovative applications in fields such as healthcare, finance, climate science, and social sciences, making a tangible impact on people's lives.

As we champion academic excellence, it is imperative that we prepare our students to

face these challenges and seize the vast opportunities presented by statistical learning and AI. Our commitment to producing ethical and well-rounded statisticians, data scientists, risk managers, and actuaries is grounded in instilling the values of ethical conduct, critical thinking, and a holistic understanding of the field.

The Statistics community at our university offers not only a place for academic growth but also a hub for forging lifelong friendships and connections. Sadly, we have had to say farewell to some members of the Department (read below), but hopefully this will open the door to new colleagues from around the country, bringing a cross-pollination of expertise and experience, which can only enhance the value to students and researchers at Stellenbosch. I encourage all students to actively engage in our student organisations, seminars, workshops, and social events (frighteningly, end-of-year functions are just around the corner!). These activities offer invaluable opportunities to expand your horizons, build networks, and have fun along the way.

As we embrace the last semester with enthusiasm, let us remember that, together, we are a community of problem-solvers, innovators, and agents of positive change. Our collective journey promises to be a rewarding one, and I cannot wait to witness the extraordinary contributions each of you will make.

Thank you for partnering with us. Here's to a semester filled with growth, discovery, and shared accomplishments.

Warm regards,
Justin Harvey

FAREWELL TO DAVID

It was with a mixture of emotions that we recently had to bid farewell to a valued member of our academic family, Dr David Hofmeyr. After six years of dedicated service and outstanding contributions to the Department of Statistics and Actuarial Science, David has decided to embark on a new chapter in his journey. He will return to his PhD alma mater for some additional research opportunities.

David joined the Department in 2017 after completing his PhD at Lancaster University in the UK. During his time here he convened numerous undergraduate and postgraduate modules in Mathematical Statistics and also assisted in programme renewal. He was also involved in module development and strategic focus for many of the new Data Science modules in the BDatSci curriculum.

Throughout his time with the Department, David exemplified the true spirit of excellence in academia. As a brilliant statistician, his passion for data analysis (specifically in unsupervised learning problems, such as clustering) has been both inspiring and contagious. David's expertise in these fields has elevated our Department's reputation, and his teaching has left a lasting impact on countless students.

As a colleague, David has always been approachable, open to collaboration, and willing to generously share his knowledge. His mentorship has instilled a staunch commitment to precision and accuracy.

We will remember the warm smile peeking out from behind a computer screen at which he is furiously typing away, framed with headphones held together by BIC pens, copious amounts of duct tape, and an undying love towards said headphones! David's energy and friendliness are contagious, and he will be missed as a colleague.

"On behalf of the entire Department of Statistics and Actuarial Science, I extend our heartfelt gratitude to David for his steadfast dedication, valuable insights, and unwavering commitment to excellence. We wish him the very best in all his future endeavours, confident that he will excel and leave an indelible mark wherever he goes," says Prof Justin Harvey, Head of the Department.

Jan Beirlant appointed as extraordinary professor in Statistics

Prof Jan Beirlant has been appointed as extraordinary professor in Statistics, effective from 1 January 2023.

Prof Beirlant, an emeritus professor of Mathematical Statistics in the Department of Mathematics at the Katholieke Universiteit Leuven (KU Leuven), is an internationally known expert on Extreme Value Theory and its applications in diverse disciplines, including Financial Risk Management and Actuarial Science. Both of these areas are extremely important to the research and teaching activities of our Department.

Apart from his research and teaching career, Prof Beirlant has served as Dean of Science at KU Leuven from 2003 to 2009 and as a Vice-Rector of KU Leuven, responsible for their Kulak campus in Kortrijk, Belgium. In the wider statistical community he has served as president and is an honorary member of the Belgian Statistical Association and a fellow of the International Statistical Institute. He has held several visiting positions at the University of Washington, Université Paris VI, Université Louis Pasteur Strasbourg, Université de Montpellier, University of the Free State, and the Technical University Budapest.

Prof Beirlant has wide-ranging experience in research, PhD supervision, teaching, and departmental and university administration. He has been supervisor or joint supervisor of approximately 20 PhD theses, including a recent joint thesis with Prof Tertius de Wet of the Department of Statistics and Actuarial Science. He has had a long association with Stellenbosch University through sabbaticals spent at, and visits to, KU Leuven by members of our Department. He has also visited our Department many times and served as a member of a Departmental review panel in 2019.

He has published 114 papers, all in the highest-ranking Statistics journals, and he is the joint author of three books on topics important to the teaching and research of our Department. He also has several joint publications with both current and previous members of the Department.

Prof Beirlant's recent appointment as an extraordinary professor in the Department of Statistics and Actuarial Science further strengthens his association with us. His international expertise and wide-ranging experience will be of great benefit to our research specifically, and to the Department in general.

Did you know?

Here are some interesting or helpful things about the Department of Statistics and Actuarial Science you may not know.

- Recordings of past seminars since the second semester 2021 are available **HERE**. Scroll down on the page and click the 'view podcast here' link.

- Past newsletters are available **HERE**.

- The Department has a dedicated **FACEBOOK PAGE**.

- Dr Morné Lamont and Dr Chris Muller have been members of the Department for 20 years as of 2023. Congratulations!

NRF ratings bestowed on staff members

The results of the latest round of applications for National Research Foundation (NRF) ratings were released at the end of 2022. The Department of Statistics and Actuarial Science congratulates two of our researchers who were successful in this round.

Prof Sugnet Lubbe was awarded a B2 NRF rating for 2023-2028 in the latest round of applications. A B rating is awarded to "researchers who enjoy considerable international recognition by their peers". The B2 category is awarded if "all or the overriding majority of reviewers are firmly convinced that the applicant enjoys considerable international recognition for the high quality and impact of his/her recent research outputs". This is the first time Prof Lubbe has received a B rating, having previously held the ratings of: C2 (2011-2016) and C1 (2017-2022).

Prof Lubbe's research is centred around multi-dimensional visualisation and specifically biplots. She and Prof Niël le Roux, an emeritus professor in the Department, have built a strong research group over the past 25 years, which culminated in the establishment of MuViSU (Centre for Multi-dimensional Data Visualisation) in July 2021. As an executive committee member of both the International Federation of Classification Societies and the International Association of Statistical Computing, Prof Lubbe is an active member of the international multi-dimensional visualisation community. She regularly attends both national and international conferences and will deliver a plenary address in September at the upcoming Correspondence Analysis and Related Methods Conference in Bonn, Germany.

Prof Lubbe views the NRF rating process as an important facet of academic life, which provides one with an objective opinion of one's research outputs and contribution. Any NRF rating is a 'stamp of approval' from one's peers and an important aspect of an academic's CV.

After having served on the Mathematics and Statistics Specialist Committee for NRF Rating and Evaluation over the last four years, Prof Lubbe has now been invited by the NRF to act as the NRF Rating and Evaluation Committee chairperson for unrelated research disciplines.

Dr Mesias Alfeus was awarded a Y2 NRF rating for 2023-2028. This rating indicates that all or most of the reviewers recognised that he has the potential to establish himself as a researcher within the next five years. Over the past few years, he has built up a research record worthy of his NRF rating. This is a remarkable feat only three years (at the time of submitting his application) after obtaining his PhD.

Dr Alfeus's academic research interests are stochastic volatility modelling (option pricing, model calibration, and hedging), interest rate modelling (LIBOR transition and roll-over risk), and financial econometrics (filtering methods and empirical estimations). He is exploring and developing new mathematical approaches to implement state-of-the-art financial models that are able to capture the dynamics of observed financial market risks or phenomena. He is one of the pioneers of the framework of stochastic modelling of "roll-over risk", the main risk preventing the arbitrage strategy from being exploited since the arbitrager might not be able to roll over (shorter tenor) debt at the benchmark rate in the future but will have to pay a higher rate or credit spread. This work is now regarded as a seminal work in academic literature. For long-dated instruments, a "roll-over risk" is likely going to be more pronounced when the LIBOR rate is replaced, especially in developing countries.

Well done to both Sugnet and Mesias.

Department launches new
Data Science 314 module

The Department of Statistics and Actuarial Science was excited to launch a brand-new Data Science module – Data Science 314 (DS314) – in the first semester of 2023. This forms part of the Department's popular Bachelor of Data Science (BDatSci) degree programme, which was introduced in 2021.

In this module, supervised learning topics are covered in the first term, whilst the second term is devoted to unsupervised learning. In terms of supervised learning, the following content is covered: generative models for classification, resampling methods, feature selection and regularisation, regression splines and generalised additive models, ensemble learning using boosting and random forests, and support vector machines. In terms of unsupervised learning, the content includes data pre-processing, distances and similarity measures, dimension reduction, data visualisation, and clustering.

The module emphasises theoretical and practical work, and all students need to successfully complete both a supervised and unsupervised learning project. This is followed by the Data Science 344 module in the second semester. Here students focus on topics in cloud computing, deep learning, and natural language processing, where again both theoretical insight and practical skills will receive thorough attention.

Dr Surette Bierman is the course coordinator, whilst Dr David Hofmeyr assisted with content development. The lecturers were Dr Biermann, Dr Hofmeyr and Prof Sugnet Lubbe.

Dr Bierman says: "It was a privilege to engage with a conscientious group of students. We cannot wait to witness their positive contributions to our society in the near future."

With its multi-disciplinary nature, this Bachelor of Data Science (BDatSci) degree programme involves four faculties and comprises eight focal areas. A series of compulsory Data Science modules in each focal area is offered in the Department of Statistics and Actuarial Science.

Dr Mesias Alfeus leads new **quantitative finance research team** at NITheCS

The National Institute for Theoretical and Computational Sciences (NITheCS) has recently introduced a Quantitative Finance research programme within its research cluster, which will be headed by Dr Mesias Alfeus of the Department of Statistics and Actuarial Science.

The main goal of the NITheCS Quantitative Finance Research Programme is to disseminate research that challenges classical assumptions in finance and to provide practical guidance on quantitative finance and long-term quantitative investment strategies within South Africa and beyond. Its target members range from academic researchers to industry practitioners with a keen interest in applying quantitative methods in finance.

This research programme is envisaged to have a broad spectrum of applied research streams such as modelling of new risk phenomena and new markets (electricity markets, emissions trading, liquidity risk modelling, and quantifying model risk). The applied research programme is to be supported by the development of cutting-edge tools in mathematical, statistical, and computational finance (e.g. optimisation methods, financial econometrics, machine learning, parallel computing, etc.).

Prof Daniel Polakow of the Department is also a member of this research team.

Lecturer co-hosts Geostatistics workshop

The Department of Statistics and Actuarial Science, in collaboration with the Spatial Statistics Interest Group of the South African Statistical Association (SASA), hosted a hybrid Geostatistics workshop in May.

The workshop, co-hosted by Stephan van der Westhuizen, a lecturer in the Department of Statistics and Actuarial Science, and Prof Gerard Heuvelink from Wageningen University & Research in the Netherlands, aimed to provide a comprehensive introduction to Geostatistical theory and practical applications for a diverse in-person and online audience. The primary objective of the workshop was to explore the practical applications of Geostatistics across various fields whilst also fostering a deeper understanding of its methodologies. Participants were introduced to the fundamental concepts of Geostatistics, including spatial analysis, variograms, kriging, and uncertainty assessment. The event attracted a diverse group of attendees, including students, faculty members, and professionals from both academia and industry.

Reflecting on the workshop, Stephan stated: "Geostatistics developed its roots in South Africa when its founder, Prof Danie Krige, pioneered spatial interpolation methods in the mining industry during the 1950s."

Stephan expressed delight in continuing this legacy and highlighting the significance of Geostatistics as a vital tool in spatial data analysis. Furthermore, the collaboration with Prof Heuvelink presented an opportunity for knowledge exchange and to gain insights from an international perspective. Prof Heuvelink's expertise and experience significantly enriched the workshop, enabling participants to comprehend the broader applications and advancements in the field of Geostatistics. Throughout the day, attendees actively engaged in interactive sessions, hands-on exercises, and group discussions, all of which facilitated a comprehensive understanding of Geostatistical techniques and their practical implications. Participants were actively encouraged to share their ideas, ask questions, and engage in meaningful conversations with both the workshop facilitators and their peers.

The workshop also provided a platform for networking, fostering collaborations, and establishing connections within the broader spatial statistics community. Participants had the opportunity to interact with Prof Heuvelink, who generously shared his knowledge and experiences, offering valuable guidance to those seeking to delve further into Geostatistics in their research or professional pursuits.

The success of the Geostatistics workshop exemplifies the Department's commitment to advancing knowledge and promoting the practical applications of Statistics within our Department and beyond.

The Department extends its gratitude to all the participants, co-hosts, and collaborators who contributed to this remarkable event. As we continue to build upon this foundation, we eagerly await future workshops, collaborations, and endeavours that will further enhance our understanding and utilisation of Geostatistics in various domains.

Co-hosts Prof Gerard Heuvelink (second from the left) and Stephan van der Westhuizen (back row, fifth from the left) with workshop participants. Prof Inger Fabris-Rotelli (front row, second from the left), president of SASA, also attended the workshop.

Departmental alumni share their master's journeys at international universities

Two former Maties students who graduated with their honours degrees in Statistics from Stellenbosch University (SU) were given the opportunity to register for their master's degrees abroad. Dylan Maxwell is studying at Oxford University, whilst Reed Naidoo is studying at the University of Bath.

Dylan registered for a BCom degree majoring in Statistics, Economics and Investment Management at SU in 2016, and followed this up with an honours degree in Statistics in 2019. Thereafter, he spent two years working in the management consulting industry at Boston Consulting Group (BCG) in Johannesburg.

"In September 2022, I moved to Oxford University to register for an MSc in Financial Economics, and the experience has been nothing short of incredible. I studied in buildings that have stood for nearly a millennium and have made friends with incredible people from all over the world. I've also participated in all the local traditions, from donning full academic dress to punting on the Thames River.

"Whilst the curriculum at Oxford has been incredibly stimulating (and challenging), it has required a huge amount of self-guided learning. I found the lecturers to be less engaged than at SU, and much of my learning here has been self-taught, which was an unexpected challenge. Additionally, adapting to the weather has been more difficult than I expected, but having survived my first British winter I cannot wait for my return to the South African sun.

"For students who may be considering a similar path, I would suggest setting aside time to research universities and courses. I spent a full week just deciding which courses I was most interested in. Familiarise yourself with application timelines and essays/recommendations required well in advance, as they inevitably take longer than expected. Also, don't hesitate to reach out to current students or Stellenbosch alumni who have studied somewhere you are interested in – they definitely won't mind helping you out with the application process.

"Finally, my only other significant piece of advice is: don't underestimate yourself. The opportunity to study at the world's best universities is definitely within reach, no matter how daunting it may seem. My honours marks, while good, were unspectacular, yet they were sufficient to secure my place here at Oxford, where I will graduate with distinction in July. My plan is to return to South Africa, where I will be rejoining BCG in Johannesburg with a new arsenal of skills learned while studying here and an irreplaceable set of memories to carry with me."

Reed completed his BCom degree in Investment Management in 2020 and his honours degree in Statistics in 2021. He is currently studying for a master's degree in Data Science at the University of Bath.

He found the move abroad daunting at first and experienced mixed feelings of uncertainty, imposter syndrome, and excitement as he settled in a city full of completely new faces.

"Despite this, Bath and its people were incredibly welcoming, and I have nothing but positive things to say about the seamless transition into making the new environment feel like home. Despite the uncomfortable step away from home, the support and encouragement from everyone who made it possible is something I will be forever grateful for.

"Transitioning into a degree that was a bit more programming intensive than what I was used to was an initial hurdle, but my statistical background kept me on my feet for the majority of the theoretical content. As I'm sure is the case in the pursuit of a master's degree anywhere, the acceptable minimum for any piece of coursework completed was certainly a step up and has provided me with a realistic expectation of the

standard of work I will be expected to carry out further in my career."

His message to other students who want to study abroad, is: "You are so much more capable than you think you are. The biggest challenge will be getting into the university. But once you're there, heads will turn once people see what an alumnus from the Department of Statistics and Actuarial Science has up their sleeve."

Reed is extremely grateful that he has been offered a studentship for a PhD position at the Institute of Cancer Research in London.

"Here, I will be part of a team as a PhD data scientist with other PhD candidates, specialising in cell division biology and genetics. I will carry out research focusing on Multimodal AI for personalised cancer diagnosis."

Winning poster opens doors
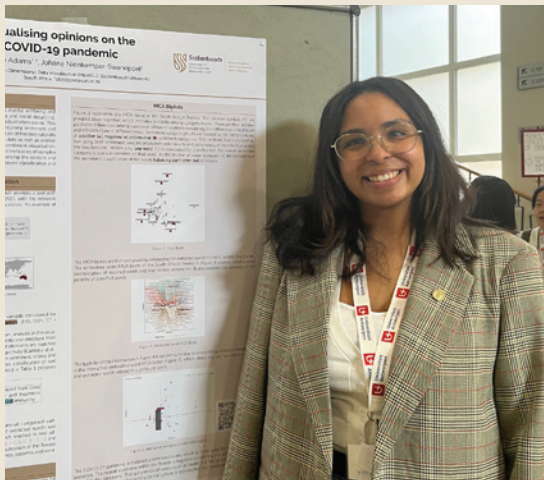
Zoë-Mae Adams with her winning poster

Zoë-Mae Adams, Prof Niël le Roux, Prof Sugnet Lubbe, and Mr Peter Manefeldt in Antwerp

PhD student Zoë-Mae Adams and Dr Johané Nienkemper-Swanepoel, a lecturer in Statistics, achieved first place in the IASC Data Analysis competition with their poster entitled "Visualising opinions on the COVID-19 pandemic". The poster was based on their research on embedded word MCA biplots.

In summary, the research behind the poster employed sentiment analysis and interactive embedded word MCA biplots to gain insights into public sentiment toward the COVID-19 pandemic. The study revealed a predominantly negative sentiment among Twitter users, reflecting the fear and uncertainty surrounding the crisis. The application of sentiment analysis and multivariate visualisation techniques offers valuable tools for understanding public opinions and can inform decision-making processes during similar global events.

"By further exploring this research area, we can enhance our understanding of societal responses and develop more effective strategies to address public concerns in the future," state the researchers.

They were awarded a €1500 travel grant as part of their prize, enabling Zoë-Mae to participate in the Data Science, Statistics, and Visualisation conference held in Antwerp, Belgium, from 5-7 July.

Speaking about this conference, Zoë-Mae says: "I had the privilege of attending interesting presentations centred around Statistics and Data Science. The topics covered various fascinating areas, including multidimensional data visualisation, psychometrics, artificial intelligence, and reinforcement learning. Antwerp boasts a multitude of tourist attractions and delightful restaurants. The University of Antwerp's local organising committee thoughtfully arranged a dinner at the exquisite Horta Art Nouveau restaurant and a reception held at the splendid town hall the following day. I am very proud of this research and thankful for this experience."

Department congratulates
third-year prize winners of 2022

The Department is immensely proud of its third-year prize winners for 2022. They are Haydn de Kock (for both Actuarial Science and Mathematical Statistics), Maxine Klinkenberg (Financial Risk Management) and Sarah Woolard (Statistics). From left to right are Dr Mesias Alfeus, Prof Ingrid Woolard (Dean of the Faculty of Economic and Management Sciences), Sarah Woolard, Prof Garrett Slattery, Haydn de Kock, Prof Justin Harvey, and Maxine Klinkenberg.

Honours student wins 'Lunar Rover' insurance pricing hackathon

Richard Shadwell, an honours student in Mathematical Statistics, recently won the 'Lunar Rover' insurance pricing hackathon sponsored by Naked Insurance, which ended on 31 May.

Honours students were invited to participate in a hackathon where the assignment was to price Lunar Rover quotes, given the expected cost of claims and other quote characteristics. Participants were given a dataset with the prices and quote characteristics and had to predict new prices to maximise expected profit. Their prices were submitted to Naked Insurance's AI model which computed the total expected profit. The winner was the participant who calculated the most profit, combined with how impressive and creative their solution was.

Says Richard: "The solution itself didn't necessarily take that long but innovating different solutions required more time. I probably spent a good 30 hours trying and testing all solutions (but this is just a guess). I stopped trying to improve my solution around 20 May when I innovated my final approach.

"I realised that the response variable (prices) was gamma distributed (textbook insurance prices) and the relationship was very linear. So I combined two ideas. My first model was a generalised linear model using the Gamma family and identity link function (modelling the mean of gamma distribution) which I used to price claims with costs at the upper and lower end of the scale. My second model in the final approach was engineering a markup variable and removing prices and profit to decorrelate the predictors. I then ran logistic regression and chose markups that equate the probability of purchase to the probability of not purchasing. From here, I algebraically solved for the markup that puts the client at the decision boundary. I then used the maximum of this logistic regression and gamma regression."

There were 969 submissions in total but only eight students managed to score high enough to be on the leaderboard. Students were allowed to submit more than one solution. As the winner, Richard received R20 000 cash.

He concludes: "It was an enjoyable Data Science project and provided me the opportunity to not only connect with actuarial and AI professionals in industry but also to use a prediction algorithm that I innovated which uses inflexible probabilistic classifiers on non-separable data to model an upper bound by attempting to create decision boundaries and predicting towards the boundary."

Bursary awards and industry partnerships in 2023

The Department of Statistics and Actuarial Science continues to embrace its partnership with industry and the continuous generous financial support through the provision of bursaries to our students. We hope this will be a long-lasting and sustainable partnership for many years ahead.

In 2023:
- one bursary was awarded from the donation by the Faantjie and Lettie Pretorius Trust to a third-year student;
- two bursaries were awarded to honours students from Departmental funds; and
- 25 honours and master's students were awarded bursaries from the donations provided by FirstRand and Correlation Risk Partners.

Thank you to these entities for their continued support in making this possible.

Master's graduates

The Department of Statistics and Actuarial Science is extremely pleased to have produced 10 master's degrees at the recent December 2022 and March 2023 graduation ceremonies. We congratulate the following students:

ZOË-MAE ADAMS. Sentiment classification and an approach to sentiment visualisation. Supervisor: Dr Johané Nienkemper-Swanepoel

LISA-MARIE BOSMAN. A comparison of value at risk and expected shortfall models in cryptocurrencies. Supervisor: Justin Perrang

KIRSTEN DENNIS. Old age mortality rates and improvement in South Africa. Supervisor: Stephen Burgess

LARA DENNIS. Considerations for implementing vaccination status as an underwriting factor in life insurance. Supervisor: Simon Louw

JAUNÉ GOUWS. Comparison of classification techniques to review the plausibility of adjustments to multiples-based equity valuations: empirical study for South Africa. Supervisor: Prof Sugnet Lubbe

MICHAEL MEYER. Meta-labelling architecture. Supervisor: Dr Mesias Alfeus

JACO HARM PRETORIUS. Economic capital allocation to market and survival risk for pure endowment products. Supervisor: Simon Louw

MICHAEL ANDREW PURCHASE. Analysing GARCH models across different sample sizes. Supervisor: Prof Willie Conradie

WILMARI VAN DYK. Visualising data through biplots using categorical PCA and clustering. Supervisor: Dr Carel van der Merwe

EDELA VON AHLFTEN. Roll-over risk in the South African interest rate market. Supervisor: Dr Mesias Alfeus

Master's graduates in Financial Risk Management Wilmari van Dyk, Michael Meyer and Edela von Ahlften with Dr Mesias Alfeus (second from left).

We asked the graduates to tell us about their experience and what they are doing now. Here's what some of them said:

Lara (left) and Kirsten Dennis (right) with Mr Stephen Burgess

Lara Dennis (photo includes Kirsten Dennis): "I decided to pursue a master's degree as I wanted to challenge myself by completing the research component of the degree. I enjoyed the honours degree research component and wanted to get more exposure to and experience in this regard. I enjoyed the collaboration with my supervisor and although research is a challenging process, it is an extremely rewarding journey. The master's programme also provided me the opportunity to benefit from the well-structured F100 modules provided by the University. This enabled me to prepare for and write the F100 ASSA exams. I am currently working at PwC in the Actuarial, Risk and Quants team as an actuarial associate and I'm enjoying the variety of work I am exposed to. I'm looking forward to learning a lot more in the next few years."

Kirsten Dennis: "I completed my master's degree in March 2023. I particularly enjoyed the more informal F100 lectures and interacting with students while lecturing on Theory of Interest. In my second year, I worked on my research project. It was by far the most challenging component; however, it was extremely rewarding to complete it. I am grateful to have had the opportunity to undertake this degree as well as the support to complete it. I am currently working at PwC. I love being part

of the actuarial team and enjoy interacting with colleagues and clients."

Jaco Pretorius (photo below): "Completing a master's degree in Actuarial Science is not commonplace. I would, however, argue that it is beneficial to focus on the F100 and Fellowship papers full-time, which is possible when you study for a master's degree. These are papers that you will need to write in any case if you want to qualify and it is much easier to balance them with a research assignment than a full-time job. For me at least, it was worthwhile doing it in the way I did. Studying for the exams is also a discipline that can reap many benefits going forward.

"I studied for the Life and General Insurance F100 modules and Life Insurance Fellowship. I can highly recommend the classes that Stellenbosch University offers for the F100 modules. The lecturers really want to empower the students to succeed and the guest speakers from the private sector fill in the picture of the work nicely. My research ended up being quite technical with many iterations and took me two years to complete.

"I work at Sanlam in the life insurance space. This is an extremely rewarding space to be in as it holds many challenges and learning opportunities with real-world implications for the work done. There is also considerable stakeholder engagement, which is something I am still getting used to, but I enjoy the social aspect."

Jaco Pretorius

Statistics and Computer Science a **winning combination for Steve**

Prof Steve Kroon – who obtained a master's degree in Computer Science and a PhD in Mathematical Statistics from Stellenbosch University (SU) – exemplifies the mutually beneficial relationship between Statistics and Computer Science, as well as the value that can be added to both disciplines through constructive and deliberate collaboration.

Steve originally came to Stellenbosch to study Actuarial Science – because he was "good at math and people told him that he would make a lot of money".

Although initially intrigued by the idea of making a lot of money, he eventually registered for an honours degree in Mathematics, which he obtained *cum laude*, proving that he was, indeed, good at math. However, being somewhat uncertain about his career prospects as a mathematician, he switched to Computer Science, a subject that he had enjoyed as an undergraduate student.

"In 1995, Stellenbosch University had the biggest Pentium lab in the Southern Hemisphere at the time. We would play lots of games. That's how I learned much about the Computer Science world.

"As first-year students we used something called Modula-2, which was a successor of Pascal. But in our second and third year, we used C. It was before Java became a big thing. We also used something called Oberon. We did some software specification stuff in Z, but that was more like math than actual coding. We did assembly language. We also did some databases stuff – that was my worst Computer Science subject. In the big data era, I'm still avoiding databases. Let me use math to analyse the data, but don't make me store it."

Steve excelled in Computer Science and was allowed to register for a master's degree in the field, which he also obtained *cum laude.* His bursary came to an end during his master's studies, and to earn money, he became a part-time lecturer, teaching an honours module in Artificial Intelligence and a first-year Statistics module. This is where he crossed paths with Prof Sarel Steel, now an emeritus professor in Statistics.

"He was interested in support vector machines and working in Linux. I gave him advice on the Linux side because I had a Computer Science background. My previous supervisor had left, and I was looking for someone to talk to about my work. Prof Steel was willing to take me on as a PhD student. He was great. I couldn't have hoped for a better supervisor."

Steve's PhD thesis, "A Framework for Estimating Risk", considered aspects of statistical learning theory. After completing his PhD in the Department of Statistics and Actuarial Science, he joined the university's Computer Science division in 2008.

"I'm interested in machine-learning models, and in handling uncertainty. I'm interested in things like Bayesian neural networks and general computational Bayesian inference. The whole generative modeling space is interesting. Embedding prior knowledge into those systems is interesting. The problem, as you might have noticed, is that I can't be interested in just one thing!"

Early on, he was also interested in coding competitions and algorithm problem-solving under time pressure.

"One of our teams went to the World Finals in Orlando in one of the competitions, which they won. I was just the coach who tagged along for the trip."

His advice for aspiring academics is to find a specific focus: "Successful academics have a very strong tunnel vision about what they are interested in," he adds.

"Also, try and do your PhD at a different university or in a different country, if possible. Alternatively, do some postdocs before you take a job. Whilst I gained a lot by having a diversity of backgrounds

in terms of topics, I don't have a strong network of people that I met elsewhere, or that diversity of viewpoints that you often get from having been based in various places. I think that's important."

One of his career highlights was graduating his Computer Science PhD student Arnu Pretorius (a master's alumnus from the Mathematical Statistics department) and publishing with him in Neural Information Processing Systems, the flagship machine learning conference.

When asked about the blend of Statistics and Computer Science, Steve argues that Stellenbosch University needs a degree that combines both disciplines.

"Modern Statistics requires computing facility beyond basic programming. If statisticians don't understand computing, they are either going to be dependent on the simple models that they know or they're going to encounter computing problems due to inefficient implementation. On the Computer Science side, everyone wants to focus on machine learning. You can focus on Data Science and Computer Science, but I don't think you can do machine learning without Statistics, or at least a good dose of probability theory and distributions from it."

Steve's opinion on ChatGPT:

"It is a great resource for students to learn. I think that they should definitely be using it with that perspective. But as a degree-issuing institution, we must think very carefully about how we can sustainably assess people in a way that is a reflection of their understanding of the subject matter. Not only what they know, but what they can do."

ACADEMIC ARTICLE

A novel stochastic modelling framework for coal production and logistics through options pricing analysis

- The open access online article can be accessed **HERE**.

This paper proposes a novel stochastic modelling framework for coal production and logistics through options pricing analysis, more precisely by modelling the Real Option problem as pricing spread options of three assets under the stochastic volatility model. Real Option is the name given to assets or managerial flexibility that allow for choice and have payoffs similar to financial options such as calls or puts. Real option analysis is the application of mathematical finance techniques to value and risk manage these real options.

Basic research question: To what extent can we challenge the classical paradigm of analysing real options with discounted cash-flow analysis (DCF)?

Contributions:

- The first contribution of this paper is that we added to this literature which lacks a comprehensive study on stochastic modelling of coal production, using real options in conjunction with option pricing theory.

- We formulated a three-dimensional version of the Fourier transform method for the flexible computation of the real option prices and performed a numerical experiment to show a substantial computational gain compared to the Monte Carlo method.

- We carried out empirical analysis to provide important insights of using real options analysis in coal production to advance financial risk management for a hypothetical coal mine and this will be critical for risk assessment and business evaluation.

This paper is the first of its kind to adopt option pricing theory to model real options with stochastic volatility component.

Prof Slattery participates in
7ᵗʰ IBGA World Championships

The SA team with Prof Garrett Slattery (back, second from right)

The 2023 ISPS Handa SA Blind Golf Open and International Blind Golf Association (IBGA) World Championships were held at the picturesque Milnerton Golf Club in Cape Town at the end of March. The IBGA World Championships, usually held biennially and the first to be held on the African continent, were long overdue, having been initially planned for 2020. The outbreak of the COVID-19 pandemic resulted in several postponements before the world's best blind golfers could eventually gather in Cape Town for the event.

The SA Blind Golf Association (SABGA) entered six players into the event, which saw competitors coming from all around the world. Prof Garrett Slattery, a lecturer in Actuarial Science who is also a member of the SABGA committee and assisted in organising the event, was participating in his 7th IBGA World Championships.

In the SA Open Garrett – guided by Stellenbosch golf professional Erich Klien – finished 4th in the overall net competition. He also finished 4th in the B2 sight category gross event. The net winner (who also won the B2 gross) was Tyler Cashman (a 20-year-old student from the USA). Garrett won the awards as the top SA player (gross & net) in the Open.

After a rest day, the IBGA World Championships commenced. The conditions also became tougher, with the infamous Milnerton wind playing its part. In the overall net category, Englishman John Eakin put together two very solid rounds to claim his first world title. John finished three shots ahead of Garrett who finished as runner-up. Garrett finished 3rd in the B2 sight category gross.

Many new friends were made during the week and the many overseas competitors left with very positive impressions of South Africa.

CONGRATULATIONS to Mesias on the birth of his baby girl

Mesias and Hileni Alfeus welcomed their precious gift of life Paulina Rejoice into the world on 25 November 2022. Paulina is derived from the name Paul, meaning small and humble. She is named after Mesias's great-grandmother who raised him since he was 3 months old.

Denver Loggenberg's **soccer success**

Denver Loggenberg, an admin assistant in the Department of Statistics and Actuarial Science, has been passionate about soccer since he was a young boy.

Denver in action on the pitch

In 2018, he joined the Stellenbosch University (SU) staff soccer team and in 2022, this team won the University Sport South Africa (USSA) national staff tournament. As the team prepares to defend the USSA Cup in October 2023, Denver tells us a little about his soccer success:

"As a young boy football was my hobby. I started playing football at the age of seven and I played for different clubs in Stellenbosch: Nelsons Football Club, Idas Valley Football Club, United Football Club, Mighty Peace Football Club, and Maties Football Club.

"I'm a midfield player. I like things to happen on the field. For example, I decide when to slow the game down or make the game fast. As a young boy, I followed Andre Pirlo. He has a football mind and controls the game.

"The Maties staff football team has played a few friendly games so far in 2023 and we did very well. Although there were ups and downs, we continue to work hard. We will give our best to defend our USSA Cup. It's not going to be easy as there are quality teams in the tournament who also want to win the Cup. Our squad has improved a lot since 2022. We have six new players and that will help us in the future."

Third time lucky for **Rob Clover**

Rob Clover, senior lecturer in Actuarial Science, successfully completed the Comrades Marathon. He tells us about his journey:

Rob crossing the finishing line

"I had a lot of the Comrades spectator experience when I was at school. The race goes right through Kloof, where we lived, plus most years we drove the route to support my dad as he ran. So that might explain why an otherwise sensible person, who is more of a weekend jogger than a proper runner, thought it might be fun to try to get from Maritzburg to Durban by foot. Indeed, Chariots of Fire and Shosholoza do sound that much better when you are on the runners' side of the barriers.

"But after two unsuccessful attempts (rousing anthems can only carry you so far), the motivation to go back was more to prove to myself that I could do it. 2023 was third time lucky. The route was a couple of kilometres shorter, the weather was good and the crowds of spectators lining the way were fantastic. My sister graciously ran at my pace to keep me company (and keep me away from the bailer bus) and we had the support of our parents along the way. It was still far, and I was still slow, and my knees still haven't forgiven me. But one of the great things about Comrades is that you can finish behind 13 046 other runners and still feel like a winner when you cross the line."

Well done, Rob!

Conferences and seminars
where staff presented

- Simon Louw. International Congress of Actuaries 2023. 1/6/2023. Virtual. Serving the public interest through the Public Interest Actuary. Authors: Louw, S.; Mulaudzi, L.

- Natalie van Zyl. International Congress of Actuaries 2023. 31/5/2023. Sydney, Australia. Evolving social security in South Africa: an actuarial perspective. Authors: Carswell, M; Van Zyl, N; Bezuidenhout, A; Walker, S.

- Luca Steyn. 63rd Annual Conference of the South African Statistical Association. 28/11/2022. George, South Africa. Open-set recognition using excesses of distance ratios. Authors: Steyn, ML; de Wet, T; De Baets, B; Luca, S.

- Dr Mesias Alfeus. Quantitative Finance and Risk Analysis. 22/6/2023. Crete, Greece. Dynamic roughness in the term structure of oil markets volatility. Authors: Alfeus, M.; Nikitopoulos, C.; Overbek, L.

They had this to say about their experience:
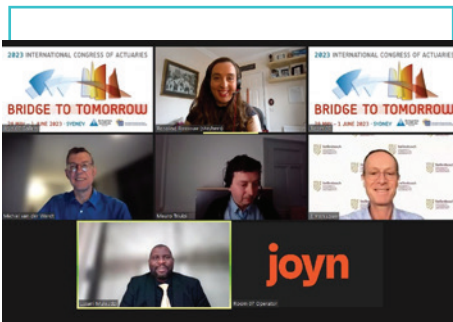
Simon: "The International Congress of Actuaries is a global actuarial convention held every four years. The 2023 event, postponed from 2022 due to COVID-19, was held in person in Sydney for three days, with streaming available to virtual attendees. The 4th day comprised online presentations only. I was not fortunate enough to attend in person, so my presentation was held on the 4th day. Fortunately for me, this was at a reasonable time in South Africa. There were three talks in one session, covering related topics. Each talk lasted 20 minutes, followed by 10 minutes of Q&A. A drawback of Zoom was that we could not see any audience or even the numbers attending. However, the presentation went well, and I am grateful for the experience and the exposure to a global actuarial audience."

Natalie: "I presented with colleagues from ASSA's Social Security and Retirement Reform Working Group, one of whom presented in person in Australia and the others spoke via Zoom from SA. Our session covered three different presentation topics and ran from 00:40 to 02:45 SA time. The discussion time on our content and across the three topics was invigorating. One of the other presenters worked in Europe and had views which differed substantially from ours in certain areas. It was once again apparent that the actuarial profession encounters different challenges depending on socio-economic and geographic context which result in differing perspectives on the best approach to take across regions. The audience was engaged by the different topics and had many questions for the presenters."

Mesias: "The Symposium in Quantitative Finance and Risk Analysis (QFRA) was organised by Monash Business School, Monash University, Australia with the main goal of bringing experts and decision-makers from different disciplines working on similar problems together to share information on current and emerging developments and to initiate advancements toward a solution to our challenges through cross-fertilisation.

"I attended this symposium and presented a talk on dynamic roughness in the term structure of oil markets volatility, joint work with Prof Christina Nikitopoulos (from the University of Technology Sydney, Australia) and Prof Ludger Overbeck (from the University of Giessen, Germany).

The key idea behind this paper is to develop a tractable model for the term structure of crude oil volatility using multifactor rough volatility approaches and to infer roughness features from the crude oil derivatives.

This research is part of the industry-directed research project within the NITheCS Quantitative Finance Research Programme. >>

>> "In addition to attending this symposium, I had the opportunity to meet Professor Robert Faff (read more about him **HERE**) who is an Associate Dean of Research at Bond University, Australia, and one of the keynote speakers. Throughout the symposium, we had a lengthy engagement about the art of pitching finance research responsibly. He unpacked to me three remarkable pillars of responsible science. These are (1) Credible research that leads to reliable knowledge (2) Relevant research that produces useful knowledge and (3) Independent research that establishes unbiased knowledge. He also explained the Pitching Research Framework (PRF) that challenges a novice researcher to effectively communicate his/her research ideas to an academic field expert. Finally, he introduced me to the InSPiR2eS Centre for Responsible Science (IC4RS) which facilitates a conducive environment, motivations, and incentives for the next generation of researchers to deliver high-quality research that is credible, relevant, and independent. Prof Faff proposed that I be the Node Leader of IC4RS at

Stellenbosch University and my responsibility is to promote and engage in the principles and practices of responsible science.

"As an early career researcher, I am excited to have met and exchanged contacts with Prof Faff, one of the giants in finance research. I look forward to our near future engagements/collaborations and to embracing responsible science."

SEMINAR PROGRAMME: SECOND SEMESTER 2023

11 August	Richard Mullins (Wunderman and Thompson data, Cape Town)
	The intelligence advantage: Where creativity and data meet
25 August	Stephan Britz (Statistical Sciences, UCT)
	Is gcForest-CS a viable alternative to deep learning for diseased cassava leaf image classification?
8 September	Barto van der Vyver (FNB, Johannesburg)
	Credit risk with focus on credit pricing
29 September	Gina Joubert (Biostatistics, UFS)
	Statistics in Health Sciences journals: author guidelines and reviewer feedback
13 October	Schalk Engelbrecht (KPMG, Johannesburg)
	Virtue, democracy, and Data Science after Babel
27 October	Lizanne Raubenheimer (Statistics, Rhodes University)
	Bayesian accelerated life testing

Enquiries: Elizna Huysamen, krugere@sun.ac.za

All seminars start at 13:00 in room 2048 of the Van der Sterr Building, c/o Victoria and Bosman Streets, Stellenbosch, but can also be attended via Microsoft Teams by using the following link:

CLICK **HERE** TO JOIN THE MEETING

Publications from 2022

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