

Dr. Paul Alexander Bilokon

British • 4th July, 1982 • +44 (0) 7930 503 195 • paul@thalesians.com • www.thalesians.com

ARCS: Associate of the Royal College of Science (since 2005.08.01) • **MBCS:** Member of the British Computing Society (990034659, from 2005.07.20) • **MIET:** Member of the Institution of Engineering and Technology (92143210, since 2005.08.18) • **ACSI:** Associate of the Chartered Institute for Securities & Investment (203806, since 2008.05.22)

Education

University	Christ Church College, University of Oxford
Subject	Mathematical Finance
Qualifications	Master of Science (MSc)
Dates	2011.01.15 – 2017.02.17
Tutor	Prof. Sam Howison
Supervisor	Dr. Daniel Jones
Dissertation	<i>Bayesian methods for solving estimation and forecasting problems in the high-frequency trading environment</i>
Supervisor	Awarded a Distinction and Best Overall Performance Prize ; part of the dissertation published in Springer-Verlag's STRIKE – Novel Methods in Computational Finance, edited by Matthias Ehrhardt, Michael Günther and Jan ter Maten, a handbook in the Mathematics in Industry series

University	Imperial College of Science, Technology and Medicine
Qualifications	The University of London Degree of Doctor of Philosophy (PhD) ; the Diploma of the Imperial College (DIC) in Theoretical Computer Science / Mathematics
Dates	2005.09.29 – 2015.03.31
Supervisor	Prof. Abbas Edalat
Examiners	Prof. Achim Jung (external), Dr. Iain Phillips (internal)
Thesis	<i>A computable domain-theoretic approach to continuous-time stochastic processes and the Wiener measure</i>
Teaching	Assisted Prof. Abbas Edalat (Complex Systems 320) and Prof. Berc Rustem (Operations Research 343, Computational Finance 422)
Highlights	Some of my research was published in the highly prestigious Logic in Computer Science (LICS) (impact factor 1.79) and were presented as part of the Vienna Summer of Logic (VSL) 2014 (the largest event in the history of logic) and at George Boole Bicentenary Celebrations at University College Cork, Ireland, in 2015

University	Imperial College of Science, Technology and Medicine
Qualifications	The University of London Degree of Master in Science with First Class Honours MSci(Hons) in the following Field of Study: Mathematics and Computer Science; Associate of the Royal College of Science (ARCS)
Dates	2001.09.29 – 2005.08.01
Highlights	<ul style="list-style-type: none">Joint winner of the Donald Davis Prize (best final year project in Mathematics and Computer Science)Won British Computing Society Award for Student Making Best Use of IT in UK¹Shortlisted for Microsoft Research Prize for Best Computational Science Student in UK (one of top three)

Level	Name of School	City, Country	Session	Results
GCE A-level	Foley's Grammar School	Limassol, Cyprus	06/2001	AAAAAAB
Maths (A), Phys. (A), Chem. (A), Biol. (A), English Lit. (B), German (A), Russian (A). Score: 820. Edexcel.				
GCE O-level	Foley's Grammar School	Limassol, Cyprus	06/1999	8 A's
Two University of London High Achiever Awards for top results in Maths and Phys. Edexcel.				

Selected Technical Skills

- **Leadership Experience:** managing diverse, global quantitative analyst and developer teams; received extensive in-house and external training.
- **Mathematical Techniques:** regression analysis, machine learning, stochastic filtering, convex optimisation, market microstructure.
- **Programming Languages:** Advanced knowledge of C++, Java, Python, R, MATLAB, kdb+/q, Excel/VBA.
- **Libraries:** BLAS, LAPACK, NumPy, SciPy, CVXOPT, QuantLib, STL, Boost, Loki, Apache libraries, Spring.
- **Software Engineering Paradigms:** object-oriented programming, inversion of control, functional programming, agile software development, Scrum (an experienced ScrumMaster), extreme programming, test-driven development, pragmatic programming (as inspired by Andrew Hunt and David Thomas).

¹ The SET (Science, Engineering & Technology Student of the Year) awards, also known as the "Science Oscars", are organised by the World Leadership Forum and are Britain's most important awards for science and technology graduates. The presentation ceremony takes place annually at the London Guildhall. I was the first person to appear in two nominations.

Teaching Experience

Imperial College London, MSc Mathematics and Finance	MATH97119 – Data Analysis and Machine Learning	2017.10m – (Current)
<p>The course introduces the latest advances in machine learning. We start with reinforcement learning and demonstrate how it can be combined with neural networks in deep reinforcement learning, which has achieved spectacular results in recent years, such as outplaying the human champion at Go. We also demonstrate how advanced neural networks and tree-based methods, such as decision trees and random forests, can be used for forecasting financial time series and generating alpha. We explain how these advances are related to Bayesian methods, such as particle filtering and Markov chain Monte Carlo. We apply these methods to set up a profitable algorithmic trading venture in cryptocurrencies using Python and kdb+/q along the way.</p>		
Imperial College London, MSc Mathematics and Finance	MATH97112 – Computing in C++	2021.01m – (Current)
<p>We start with the foundations of C and C++ and trace the evolution of C++ to the latest standards: C++03, C++11, C++14, C++17, C++20. We demonstrate how C++ supports multi-paradigm programming: procedural, object-oriented, generic, and, to some extent, functional. We then show how to use these paradigms <i>effectively</i> (in the sense of Scott Meyers and Joshua Bloch) to create two classes of software in C++: derivative pricing systems (using QuantLib as a running example) and high-frequency trading systems, utilising principles from functional reactive programming.</p>		

Practical Experience

Thalesians Ltd.	Founder, Chairman, CEO	2009.03.11 – (Current)
<p>Thalesians are a consultancy and think tank of dedicated professionals with interests in quantitative finance, economics, mathematics, physics, computer science, and synergetics. 5000 members globally. In addition to conducting research in financial markets, especially derivatives pricing and algorithmic trading, we produce mathematical software and organise research seminars, workshops and study groups on modern areas of research in quantitative finance, algorithmic trading, and machine learning. Organise industry-leading summer schools on machine learning. Consulting clients include BNP Paribas, Alfa Capital, and Machine Learning Institute (MLI).</p>		

Deutsche Bank	Director, Head of Credit and Core E-Trading Quant Teams	Markets Electronic Trading (MET)	2013.10.28 – 2016.10.26
<p>Leading a global (London, New York, Mumbai) team of quants responsible for Deutsche Bank's electronic and algorithmic trading offering in European and US credit. Also responsible for the cross-asset electronic trading library, powering all of Deutsche Bank's electronic market making in Rates and Credit. The team's expertise includes market microstructure, alpha generation and analysis, optimal hedging across many securities and asset classes, client optimisation, low-latency, parallelisation, and functional reactive programming. Work closely with technologists, traditional trading, and compliance.</p>			

Citigroup			
Vice President, Quant Analyst	Global Algorithmic Trading, Markets Quantitative Analysis (MQA)		2010.08m – 2013.08.28
<p>A greenfield project. Research, design, and development of a new market making system in credit and rates. Focussed on single names, sovereigns, and credit indices. Seen the system through from its inception into production. Time series analysis, data mining, P&L analysis, stochastic filtering, optimisation, library architecture, high-performance computing. One of the core architects of the system. Guided junior quants and developers.</p>			
Vice President, Quant Analyst	Global FX Quant Research, Markets Quantitative Analysis (MQA)		2009.06.15 – 2010.08m
<p>Worked on all aspects of the library, especially its architecture, the Monte Carlo and PDE engines, parallelisation, volatility surface interpolation, numerical methods, empirical analysis and relative value tools. Later worked on one of the first electronic FX options trading systems.</p>			

Lehman Brothers, then Nomura			
Electronic Trading	Foreign Exchange (Nomura)		2008.11.10 – 2009.06.01
<p>Helped integrate the two businesses and launch a new suite of foreign exchange solutions, both in FX options and electronic spot trading. The latter was a top priority as Nomura had to go to the market quickly as a liquidity provider. Helped build the electronic trading offering from scratch.</p>			
Quantitative Modelling	Foreign Exchange		2008.01m – 2008.09.30
<p>Quantitative modelling and development work in the Foreign Exchange Quantitative Modelling group. Worked on various aspects of the quant library, developed relative value tools, and worked closely with the structurers on pricing structured products. Remained at Lehman Brothers until the very last day.</p>			
Quantitative Strategy	Foreign Exchange		2007.04.30 – 2008.01m
<p>Headhunted by Lehman Brothers' Foreign Exchange Research Group². Provided a multi-dimensional product aimed at helping internal (sales, traders, structurers) and external clients manage risk in spot, volatility and correlation currency markets. Produced analytics, designed and backtested trading strategies, developed relative value trading tools, worked on</p>			

² For eight years in a row, Lehman Brothers ranked No. 1 in the "All-America Fixed-Income Research Team survey" (*Institutional Investor*, 2007).

index products, helped risk-manage the systematic research portfolio.

Morgan Stanley	Associate	Prime Brokerage Risk Technology ³	2005.08.12 – 2007.04.28
Joined Morgan Stanley full-time after two summer internships (2003.05.28 – 2003.10.03 and 2004.07.05 – 2004.09.24). Completed graduate training in New York, the Distributed Systems Development track. Covered finance, advanced C++, Java, C#/.Net, Perl, Linux/Unix programming, object-oriented analysis and design, relational databases, middleware, XML technologies, including SOAP.			
Worked on risk projects for hedge fund clients. This involved development work (Java, Spring, C++, Perl, Python, R) and quantitative risk analysis (VaR, stress tests, AI classification of hedge fund strategies, backtesting). Extended the risk analytics proprietary functional language and created RiskLab, a modelling tool used by risk managers, developed the flexible CAPM beta calculation framework, added support for new products.			

Imperial College	Research Scientist	Centre for Biomolecular Electron Microscopy	2004.11m – 2005.06m
Invited by Prof. Marin van Heel, Director of CBEM, to work on final year project at his laboratory, where I had my office: <i>Visualising the Invisible: Detecting Objects in Quantum Noise Limited Images</i> . Created Horus – a novel application, which enables scientists to use visual programming to experiment with particle selection algorithms.			

Selected Publications

Please note that due to the nature of my work in the industry the majority of my publications are proprietary/classified.

- Paul Bilokon and Abbas Edalat. A domain-theoretic approach to Brownian motion and general continuous stochastic processes. In *CSL-LICS '14 Proceedings of the Joint Meeting of the Twenty-Third EACSL Annual Conference on Computer Science Logic (CSL) and the Twenty-Ninth Annual ACM/IEEE Symposium on Logic in Computer Science (LICS)*, 2014.
- Paul Bilokon. The past, present, and future of high-performance computing in finance and beyond. In *Global Derivatives*, May 2017.
- Paul Bilokon and Abbas Edalat. A domain-theoretic approach to Brownian motion and general continuous stochastic processes. In *Theoretical Computer Science*, Volume 691, August 2017, pp. 10–26.
- Paul Bilokon. From Artificial Intelligence to Machine Learning. In *Global Derivatives*, August 2017.
- Paul Bilokon. From Artificial Intelligence to Machine Learning. In *Christ Church Matters, a University of Oxford alumni publication*, Trinity Term 2017, pp. 16–18.
- Paul Bilokon, James Gwinnutt, and Daniel Jones. Stochastic filtering methods in electronic trading. Chapter in *Mathematics in Industry Handbook on Novel Methods in Computational Finance* edited by Matthias Ehrhardt, Michael Günther and Jan ter Maten. Springer Verlag, 2017.
- Paul Bilokon and Jan Novotny. *Data Analysis in Q for Quants and Data Scientists*. Wiley, 2018. (In preparation.)
- Paul Bilokon. M5MF48/M5MR2 Data Analysis and Machine Learning, a Masters course taught as part of the MSc in Mathematics and Finance programme in the Department of Mathematics of Imperial College in 2017–2018, 2018–2019, 2019–2020, 2020–2021.
- Jan Novotny, Paul Bilokon, Aris Galitos, Frederic Deleze. *Machine Learning and Big Data with kdb+/q*. Wiley, 2019.
- Paul Bilokon, Matthew F. Dixon, Igor Halperin. *Machine Learning in Finance: From Theory to Practice*. Springer, 2020.
- Paul Bilokon. *Python, Data Science, and Machine Learning*. World Scientific, 2021.

Academic and Professional Talks

- *Partial Stochastic Processes: towards a Domain-theoretic, Computable Approach to Stochastic Processes*. Domains X Workshop, Swansea, Dept. of Computer Science. 5-7th September, 2011.
- *Electronic Trading in Credit: A Practitioner's Overview*. Global Derivatives Trading & Risk Management 2014, the Hotel Okura, Amsterdam. 12th – 16th May, 2014.
- *A Domain-theoretic Approach to Brownian Motion and General Continuous Stochastic Processes*. Joint Meeting of The 23rd EACSL Annual Conference on Computer Science Logic and The 29th Annual ACM/IEEE Symposium on Logic in Computer Science (LICS), Vienna Summer of Logic, 14th July, 2014.
- *A Domain-theoretic Approach to Brownian Motion and General Continuous Stochastic Processes*. Domains XI International Workshop on Domain Theory and Applications, Université Paris Diderot – Paris 7.
- *Stochastic Filtering in Credit: A Practitioner's Overview*. FX Quant Talk Series, Deutsche Bank, 15th January, 2014.

³ The Morgan Stanley Prime Brokerage received top honours in *Global Custodian's* annual Prime Brokerage Survey (2005), achieving “Best in Class” recognition in client service, financing, reporting, operations, capital introductions, and technology.

- *Stochastic Filtering with Applications to Algorithmic Trading: A Practitioner's Overview*. alphascope, The Thalesian Workshop (delivered with Saeed Amen), InterContinental, Geneva, Switzerland, 3rd February, 2014.
- *Stochastic Filtering in Algorithmic Trading: A Practitioner's Overview*. Global Derivatives Trading & Risk Management, The Hotel Okura, Amsterdam, 20th May, 2015. Chairman of the electronic and algorithmic trading track.
- *Stochastic Filtering in Electronic Trading: A Practitioner's Overview*. Thalesian Seminars, London Marriott Hotel West India Quay, 22nd July, 2015.
- *A Domain-theoretic Approach to Stochastic Processes as a Step towards Domain-theoretic Integration on Function Spaces*. Domains XII International Workshop on Domain Theory and Applications, Boole Conferences Cork, University College Cork, Ireland. 26th August, 2015.
- *Stochastic Filtering in Electronic Trading: A Practitioner's Overview*. The Trading Show London 2016, ETC 155 Bishopsgate, London. 23rd March, 2016.
- *(A Very Brief Overview of) The Elements of Risk Management in Finance*. Guest Lecture at the University College London (UCL). 27th April, 2016.
- (With John Aston and James Gwinnutt.) *What Do You Need to Know as an Algorithmic Market Maker*. Global Derivatives Trading & Risk Management, InterContinental Budapest, 10th May, 2016. Chairman of the electronic and algorithmic trading track.
- *Stochastic Filtering with Applications to Algorithmic Trading: A Practitioner's Overview*. The Global Derivatives Trading & Risk Management, The Thalesian Workshop (delivered with Saeed Amen), InterContinental Budapest, Hungary, 13th May, 2016.
- *Algorithmic Trading and Risk Management*. Guest Lecture to MFin Students at Cambridge Judge Business School, 28th June, 2016.
- *Stochastic Filtering in Electronic Trading*. The CQF/Wilmott/Wiley Quant Insights conference, Fitch Ratings Auditorium, 30 North Colonnade, Canary Wharf, London, E14 5GN, 14th October, 2016.
- *A domain-theoretic approach to Brownian motion and general continuous stochastic processes*. Theoretical Computer Science Seminar, University of Birmingham, 21st October, 2016.
- *Keynote: Artificial Intelligence and Machine Learning in Finance: A Practitioner's Overview*. Budapest AI Summit: Artificial Intelligence in Finance, Mosaik, Budapest, 17th February, 2017.
- *Bayesian Methods in Electronic Trading: A Practitioner's Overview*. Newsweek Event: Artificial Intelligence and Data Science in Capital Markets, The Barbican, City of London, 1st – 2nd March, 2017.
- *Kdb+/q, HFT, and Machine Learning*. The 2nd Annual QuanTech Conference, London, 26th – 28th April, 2017.
- *Kdb+/q, HFT, and Machine Learning*. Global Derivatives Trading & Risk Management, Hotel Hilton Barcelona, 8th – 12th May, 2017.
- *Algorithmic Trading, HFT and Stochastic Filtering: A Practitioner's Overview*. Mathematical Modelling in Finance (MMF) Conference 2017, SIAM / CFM – Imperial Institute of Quantitative Finance / London Mathematical Society / Department of Mathematics, Imperial College London. 31st August, 2017.
- *Machine Learning, High Frequency Trading and kdb+/q for Quants and Data Scientists*. The 13th Fixed Income Conference from WBS, Florence, Italy, 18th – 20th October, 2017.
- *Machine Learning, High-Frequency Trading and kdb+/q for Quants and Data Scientists*. WBS QuanTech Conference – London: Machine Learning & AI in Quant Finance, 17th – 18th November, 2017.
- *Kdb+/q, High-Frequency Trading, and Machine Learning*. Global Derivatives Trading & Risk Management USA, The Four Seasons Chicago, 2nd November, 2017.
- (With Ed Silantyev.) *Algorithmic Market Making in Cryptocurrencies*. WBS QuanTech Conference – London: Machine Learning & AI in Quant Finance, 17th – 18th November, 2017.
- *Particle Filtering and Markov Chain Monte Carlo: A Practitioner's Overview*. BNP Paribas Electronic Trading Seminar, London, 7th December, 2017.
- *From AI to ML, from Logic to Probability*. Thalesian Seminar, London, 21st February, 2018.
- *From AI to ML, from Logic to Probability*. WBS QuanTech Conference, New York City, 28th February, 2018.
- *From AI to ML, from Logic to Probability*. QuantMinds International, Lisbon, Portugal, 16th May, 2018.
- *The Thalesians' Two Minute Pitch*. Level39, One Canada Square, Canary Wharf, London, 31st May, 2018.

Prizes and Awards

- Winner of the Mathematical Institute, University of Oxford, Best Overall Performance Prize for those who completed the MSc in Mathematical Finance (part-time) in 2016-2017 (2018).
- Winner of the British Computer Society Award for the Student Making the Best Use of Information Technology in the UK (2005).
- Shortlisted for the Microsoft Research Award for the Best Computational Science Student in the UK (2005).
- Joint winner of the Donald Davis Prize (2005) for the best final year project in mathematics or computer science at Imperial College London. Sponsored by Farncombe Technology.

- Nominated “One To Watch” by FreshMinds (2004).
- Ward Foley Memorial Scholarship (2001) for best academic results awarded by Foley’s Grammar School.
- University of London High Achiever Award: Mathematics (1999).
- University of London High Achiever Award: Physics (1999).

Interests and Hobbies

- Music (piano), languages, science, philosophy.