Paul Robert GRIFFIN

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Education

PhD, Imperial College of Science, Technology & Medicine,University of London, Great Britain, 1997

Master of Science, Imperial College London,University of London, Great Britain, 1994

Bachelor of Science, Imperial College of Science, Technology & Medicine,University of London, Great Britain, 1984

Academic Appointments

Associate Professor of Information Systems (Practice), School of Computing and Information Systems, SMU, Jul 2016 - Present

Academic Administrative Positions

Director, Master of IT in Business (Financial Technology), School of Information Systems, SCIS PG by Course Work, SMU, Jul 2017 - Jun 2020

Assistant Director (Master of IT in Business (Financial Technology) Programmes), School of Information Systems, SCIS PG by Course Work, SMU, Jul 2016 - Jun 2017

RESEARCH

Research Interests

My primary research interest is in disruptive technology, in particular in the finance industry. The two technologies I focus on is blockchain, or distributed ledger technologies (DLT), and quantum computing. The use of blockchain and smart contracts is increasing amongst corporations and governments and will be at least as significant as VOIP was for telephony and likely to be as far reaching as web applications have become. Whilst first uses are being driven from the financial sector, any industry can also benefit from its use. Recently, quantum computing is emerging from being theoretical and quantum hardware is becoming increasingly larger, of higher quality and more accessible. The properties of quantum computing are uniquely different than conventional computing and the potential for disruption is huge in many areas especially for solving non-deterministic problems.

While there are many applications of quantum computing in many industries, I am particularly interested in the application of these technologies for the finance sector. My current work focusses on simulations in financial markets, optimization such as for trade settlement, quantum machine learning applications in credit rating and, also exploring quantum versions of DLT consensus. The work is mainly in collaboration with industry partners on externally funded projects.

Publications

Journal Articles [Refereed]

QuantumEyes: Towards better interpretability of quantum circuits, by RUAN, Shaolun; GUAN, Qiang; GRIFFIN, Paul; MAO, Ying; WANG, Yong. (2023). *IEEE Transactions on Visualization and Computer Graphics,* 1-13. https://doi.org/10.1109/TVCG.2023.3332999 (Advance Online)

Review of some existing QML frameworks and novel hybrid classical-quantum neural networks realising binary classification for the noisy datasets, by Schetakis, N.; Aghamalyan, D.; Griffin, Paul; Boguslavsky, M.. (2022). *Scientific Reports,* *12* (1), 1-12. https://doi.org/10.1038/s41598-022-14876-6 (Published)

Binary classifiers for noisy datasets: A comparative study of existing quantum machine learning frameworks and some new approaches, by SCHETAKIS, Nikolaos; AGHAMALYAN, Davit; GRIFFIN, Paul; BOGUSLAVSKY, Michael. (2021). *Scientific Reports,* 1-14. https://doi.org/10.21203/rs.3.rs-1440760/v1 (Published)

Can we classify cashless payment solution implementations at the country level?, by NG, Dennis; KAUFFMAN, Robert J.; GRIFFIN, Paul; HEDMAN, Jonas. (2021). *Electronic Commerce Research and Applications,* *46* 1-22. https://doi.org/10.1016/j.elerap.2020.101018 (Published)

Smart contracts: will Fintech be the catalyst for the next global financial crisis?, by DURAN, Randall; GRIFFIN Paul R.. (2021). *Journal of Financial Regulation and Compliance,* *29* (1), 104-122. https://doi.org/10.1108/JFRC-09-2018-0122 (Published)

Automated theme search in ICO whitepapers, by FU, Chuanjie; KOH, Andrew; GRIFFIN, Paul. (2019). *Journal of Finance and Data Science,* *1* (4), 140-158. https://doi.org/10.3905/jfds.2019.1.011 (Published)

The wider impact of a national cryptocurrency, by NG, Dennis; GRIFFIN, Paul. (2018). *Global Policy,* 1-18. (Published)

The application of quantum well solar cells to thermophotovoltaics, by GRIFFIN Paul R.; Ballard, I.; Barnham, K.; Nelson, J.; Zachariou, A.; Epler, J.; Hill, G.; Button, C.; Pate, M.. (1998). *Solar Energy Materials and Solar Cells,* *50* (1-4), 213-219. http://dx.doi.org/10.1016/S0927-0248(97)00150-5 (Published)

Quantum well solar cells, by Barnham, K.; Ballard, I.; Barnes, J.; Connolly, J.; GRIFFIN, Paul R.; Kluftinger, B.; Nelson, J.; Tsui, E.; Zachariou, A.. (1997). *Applied Surface Science,* *113* 722-733. (Published)

Study of misfit dislocations by EBIC, CL and HRTEM in GaAs/InGaAs lattice-strained multi-quantum well p-i-n solar cells, by Mazzer, M.; Grunbaum, E.; Barnham, K. W. J.; Barnes, J.; GRIFFIN, Paul R.; Holt, D. B.; Hutchison, J. L.; Norman, A. G.; David, J. P. R.; Roberts, J. S.; Grey, R.. (1996). *Materials Science and Engineering: B,* *42* (1-3), 43-51. http://dx.doi.org/10.1016/S0921-5107(96)01681-9 (Published)

Effect of strain relaxation on forward bias dark currents in GaAs/InGaAs multiquantum well p-i-n diodes, by GRIFFIN, Paul R.; Barnes, J.; Barnham, K. W. J.; Haarpaintner, G.; Mazzer, M.; Zanotti-Fregonara, C.; Grunbaum, E.; Olson, C.; Rohr, C.; David, J. P. R.; Roberts, J. S.; Grey, R.; Pate, M. A.. (1996). *Journal of Applied Physics, 80* (10), 5815-5820. http://dx.doi.org/10.1063/1.363574 (Published)

Voltage enhancement in quantum well solar cells, by Barnham, K.; Connolly, J.; GRIFFIN, Paul R.; Haarpaintner, G.; Nelson, J.; Tsui, E.; Zachariou, A.; Osborne, J.; Button, C.; Hill, G.; Hopkinson, M.; Pate, M.; Roberts, J.; Foxon, T.. (1996). *Journal of Applied Physics, 80* (2), 1201-1206. http://dx.doi.org/10.1063/1.362857 (Published)

Book Chapters

Quantum computing: Computational excellence for Society 5.0, by GRIFFIN, Paul R.; BOGUSLAVSKY, Michael; HUANG, Junye; KAUFFMAN, Robert J.; TAN, Brian R.. (2021). In K. Taneja, H.Taneja, K. Kumar, A. Selwal, & E. L.Ouh (Ed.), *Data science and innovations for intelligent systems: Computational excellence and Society 5.0* (pp. 1-32) Boca Raton: CRC Press. https://doi.org/10.1201/9781003132080-1 (Published)

A decision framework for decentralised control of distributed processes: Is blockchain the only solution?, by GRIFFIN, Paul; MEGARGEL, Alan; SHANKARARAMAN, Venky. (2019). In Shi, Nansi (Ed.), *Architectures and Frameworks for Developing and Applying Blockchain Technology* (pp. 1-27) IGI Global. (Published)

Conference Proceedings

A quantum photonic chip for binary classification, by Lin, H. X.; Zhang, H.; Cai, H.; Griffin Paul; Liu, A. Q.. (2023.0). *CLEO: Conference on Lasers and Electro-Optics: Applications and Technology 2023: San Jose, CA, 7-12 May: Proceedings,* Washington, DC: Optica. https://opg.optica.org/abstract.cfm?uri=cleo_at-2023-JW2A.64 (Published)

Quantum computing for supply chain finance, by GRIFFIN, Paul; SAMPAT, Ritesh. (2021.0). *2021 IEEE International Conference on Services Computing (SCC): Chicago, September 5-10: Proceedings,* (pp. 456-459) Los Alamitos, CA: IEEE Computer Society. https://doi.org/10.1109/SCC53864.2021.00066 (Published)

Quantum consensus, by SEET, Jorden; GRIFFIN, Paul. (2020.0). *2019 IEEE Asia-Pacific Conference on Computer Science and Data Engineering (CSDE) 2019: December 9-11, Melbourne, Australia: Proceedings,* (pp. 1-8) Piscataway, NJ: IEEE. https://doi.org/10.1109/CSDE48274.2019.9162386 (Published)

Optimisation of InGaAsP quantum well cells for hybrid solar-thermophotovoltaic applications, by Rohr, C.; Connolly, J. P.; Barnham, K. W. J.; Balland, I.; GRIFFIN Paul R.; Nelson, J.; Button, C.; Clark, J.. (1999.0). *Thermophotovoltaic generation of electricity: Fourth NREL Conference: Denver, CO, 11-14 October 1998,* (pp. 83-92) Woodbury NY: AIP Press. http://worldcat.org/isbn/9781563968280 (Published)

Advantages of quantum well solar cells for TPV, by GRIFFIN, Paul R.; Ballard, I.; Barnham, K.; Nelson, J.; Zachariou, A.; Button, C.; Hopkinson, M.; Pate, M.. (1997.0). *Thermophotovoltaic generation of electricity: Third NREL Conference: Colorado Springs, CO, May 1997,* (pp. 411-422) Woodbury NY: AIP Press. http://worldcat.org/isbn/9781563967344 (Published)

A new approach to P-doping and the observation of efficiency enhancement in InP/InGaAs quantum well solar cells, by Zacnariou, A.; Barnham, K. W. J.; GRIFFIN, Paul R.; Nelson, J.; Button, C.; Hopkinson, M.; Pate, M.; Epler, J.. (1996.0). *Conference Record of the Twenty fifth IEEE Photovoltaic Specialists Conference, 1996: Washington DC, May 13-17, 1996,* (pp. 113-116) New York: IEEE. http://dx.doi.org/10.1109/PVSC.1996.563960 (Published)

Working Papers

Quantum machine learning for credit scoring, by SCHETAKIS, N.; AGHAMALYAN, D.; BOGUSLAVSKY, M.; REES, A.; RAKOTOMALALA, Marc; GRIFFIN, Paul. (2022). (Published)

Picking flowers in an ICO garden, by TENG, Fam Guo; GRIFFIN Paul R.; KOH, Andrew. (2019). Emerald. (Published)

Papers Submitted for Review

Working Papers

A practical comparison of quantum and classical leaderless consensus, by GRIFFIN, Paul Robert; MEVADA, Dimple . (2022). (Submitted)

Research Grants

Singapore Management University

Quantum-Enhanced Modelling of Financial Time-Series Data for Rare Event Forecasting, QEP Call for Proposals, Quantum Engineering Programme (QEP) , Co-PI (Project Level): Paul Robert GRIFFIN, Rajesh Krishna BALAN, 2022, S$1,372,272

Resource efficient quantum algorithms and applications for chemistry, route optimization and finance, Quantum Engineering Programme (QEP), National Research Foundation (NRF) , Co-PI (Project Level): Paul Robert GRIFFIN, 2022, S$1,106,400

Exploring the advantage of a quantum system for machine learning applied to credit scoring, MAS Financial Sector Development Fund - Artificial Intelligence & Data Analytics Grant (Research Track), Monetary Authority of Singapore (MAS) , PI (Project Level): Paul Robert GRIFFIN, 2020, S$1,476,900

Distributed Ledger Research, OneConnect Financial Technology (Singapore) Co. Pte. Ltd. , PI (Project Level): Paul Robert GRIFFIN, 2019, S$99,996

Other Institutions

Personalized projects and labs for Enterprise Solutions Management using AI Builder, TEL Exploratory research grant, SMU Centre for Teaching excellence PI (Project Level): Kiruthika RAMANATHAN, Co-PI (Project Level): Rafael J. BARROS, 2023, SGD6,000

TEACHING

Courses Taught

Singapore Management University

Undergraduate Programmes :

 Blockchain Applications in Financial Services

 Corporate Banking Technology and Blockchain

 Enterprise Solution Management

 Interaction Design and Prototyping

 IS Application Project

 Quantum Computing in Financial Services

Postgraduate Professional Programmes :

 Blockchain Technology

Corporate Banking and Blockchain

FinTech Essentials

Project

Quantum Computing in Financial Services

Postgraduate Research Programmes :

Empirical Research Project 3

Empirical Research Project I

Non-Graduating Programmes :

Blockchain Applications in Asia-Pacific's Financial Services

Non-SMU Programmes :

DBS - SMU STAR Case Workshop Series 2022 - Web 3.0 (Defi and the Metaverse), Non-Graduating, SMU

Hands-on Practical Applications of Blockchain, Non-Graduating, SMU

Quantum Computing and its Applications, Non-Graduating, SMU

Executive Development :

Quantum Computing and its Applications, 01 Jan 2020-Present

Financial Game Changing Series, 18 Sep 2018-18 Sep 2018

Digital Strategy to Enhance Client Satisfaction & Profitability, 04 Sep 2018-04 Sep 2018

Blockchain and Smart Contracts, SMU SIS Undergraduate enrichment, 20 Jun 2018-20 Jun 2018

UOB Leadership Academy Level 3, Module 1: Value-Driven Strategic Leadership in a Uncertain Future, UOB, 17 May 2018-17 May 2018

Teaching Publications

Cases

Eastspring Digitisation Case, (Accepted)

OTHER ACADEMIC AND PROFESSIONAL ACTIVITIES

Presentation and Talks

Presentations

Quantum Leaderless Consensus, (01 Oct 2021). *Institute of Physics Singapore IPS21,* Singapore.

Quantum Computing for Supply Chain Finance, (07 Sep 2021). *IEEE Future of Finance 2021,* Internet.

Future of Payments, (07 May 2018). *Singapore-India Business Dialogue,* India. India

Invited Seminars, Talks and Lectures

Demystifying Quantum Computing and opportunities for the Fintech industry, 02 Nov 2022. Singapore Fintech Festival

Exploring the application of quantum computing in finance, 04 Oct 2022. Keio University quantum computing, Tokyo, Japan

Quantum Leaderless Consensus, 24 Mar 2021. Blockchain Association Singapore

The Value of Quantum Computing in Finance, 26 Nov 2020. Banking on Quantum

Quantum Computing in Finance, 19 Nov 2020. Quantum Engineering Program 2.0

Quantum computing in Finance, 23 Jun 2020. TFD Initiative - evolution of credit scoring using quantum computing"

Future of Wealth Management, 16 Nov 2017. Future of Wealth Management, SMU

Consultancy

AngelQ, Oct 2023 - Present

KRenergy Partners, Jul 2018 - Present

Monetary Authority of Singapore, Aug 2017 - Present

Media Contributions and Citations

Reaching a leaderless consensus in distributed ledgers with quantum computing, research.smu.edu.sg/news, 23 May 2021
https://research.smu.edu.sg/news/2021/may/23/reaching-leaderless-consensus-distributed-ledgers-quantum-computing

OneConnect Financial Technology and Singapore Management University announce key findings from joint research on potential for quantum computing to resolve blockchain trilemma, news.smu.edu.sg/news/, 07 Apr 2021
https://news.smu.edu.sg/news/2021/04/07/oneconnect-financial-technology-and-singapore-management-university-announce-key

Entering the Quantum World, SMU Engage, 01 Nov 2019
https://engage.smu.edu.sg/entering-quantum-world

Quantum Blockchain, Business Times, 01 Nov 2019

Bitcoin price surged to 8- month high., Channel 8 News, 22 May 2019

SMU and present Perspectives 2019 - Episode 4 panellist, Channel NewsAsia, 06 Mar 2019

"Money Mind: Investing in Cryptocurrencies", ChannelNews Asia, 16 Sep 2018
https://mediacast.smu.edu.sg/media/Cryptocurrencies,+Channel+NewsAsia,+(Money+Mind,++10.30pm),+15+Sept+20182018/0_zv6fdil5/44087142

"Should a Robot Run Your Investment Portfolio?", ●SMU blog, 09 Sep 2018
http://blog.smu.edu.sg/academic/schools/smusis/should-robot-run-your-investment-portfolio/

Money Mind: Ep 10: The Winning Formula, Channel News Asia, 11 Jun 2018
https://www.channelnewsasia.com/news/video-on-demand/moneymind/the-winning-formula-10421146

Preparing the Next Generation of FinTech Innovators – Exclusive Interview with Paul Griffin, Singapore Management University (SMU), MEDICI, 01 Mar 2018 https://gomedici.com/exclusive-interview-paul-griffin-singapore-management-university/

Contracts Can be Smart, Podcast, 14 Nov 2017 https://soundcloud.com/sgsmu/contracts-can-be-smart

March of the Silent Bots, SMU Blog, 20 Jul 2017

Bold Ambition: Singapore's Quest to Become a Global Fintech Hub, fintechnews.sg and SMU blog, 03 Apr 2017 http://blog.smu.edu.sg/masters/mitb/bold-ambition-singapores-quest-global-fintech-hub/

"Turnkey Lender wants to make lending easier for SE Asia's non-bank lenders", The Edge, 20 Oct 2016 https://www.theedgesingapore.com/article/turnkey-lender-wants-make-lending-easier-se-asiaâs-non-bank-lenders

EXTERNAL SERVICE – PROFESSIONAL

Chairperson, Quantum Finance, Quantum Finance Workshop, 2023

EXTERNAL SERVICE – PUBLIC SECTOR AND COMMUNITY SERVICE

Guest Speaker, READ! Fest 2018, Nation Library Board, 2018