David K. E. Green - Curriculum Vitae

PhD, BE Civil (Hons I), BSc Computer Science

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Citizenship: British and Australian (Dual national)

I bridge the gap between the real world and the digital - I combine real world data and simulation techniques to deliver milestones, enhance safety, improve RoI and reduce business and technical risk.

I am an **experienced manager** who **develops strategies** for stakeholders and then **leads teams to deliver on that vision**.

I have an **extensive technical background** which I use to **bring projects in on time and under budget** while maintaining a **product focus**.

Skills

- **Programming**: Python, C/C++, C#, JavaScript (including React), HTML/CSS, GLSL, Java, ASM.

- **Tech**: SQL, NoSQL, Event Queues and Message Brokers, servers (e.g. NodeJS and NGINX), OpenGL, Jupyter notebooks, Unity, RTOS.

- **Machine learning** and **Artificial Intelligence** algorithms including Neural Networks, Kernel Methods and Support Vector Machines, Random Fields and Hidden Markov Models. Game theory-driven AI and reinforcement learning. Stable diffusion, Natural Language Processing (NLP) and Large Language Models (LLMs).

- **Cloud computing** including for high performance computing, Linux sysadmin, MLOps and IoT. Azure, AWS, GCP.

- **Adaptable:** Able to work well in different environments from startups to corporations to large government agencies.

- **Management style** that is highly effective for scientific teams that delivers measurable results.

Education

2014 - 2018	University of New South Wales: PhD • Thesis title: "Probabilistic analysis for computational mechanics with applications in Civil Engineering". • Supported by an Australian Postgraduate Award (APA) Scholarship. • Completed coursework in pure mathematics (in particular functional analysis) and computer science as part of the PhD program.
2006 - 2012	University of New South Wales: Bachelor of Engineering in Civil Engineering with Honours Class I • Completed a Higher Honours Thesis: "Probabilistic Finite Element Analysis of Soils using Spatially Autocorrelated Random Fields". • Completed final part of degree part time while working in industry.
2006 - 2012	University of New South Wales: Bachelor of Science in Computer Science • Focussed on algorithms, numerical mathematical methods, Machine Learning, Artificial Intelligence and robotics. • Completed final part of degree part time while working in industry.

Industry employment history

January 2022 - Present	Data Science Lead - Infrastructure Intelligence, DYWIDAG: • Development and delivery of roadmaps and strategy, reporting directly to the CTO. • Team leadership and management including recruitment and hiring. • Management of Data Science and Machine Learning deliverables. • Development of a company vision for the application of AI and ML in the Civil Engineering Industry. • ML ops and system architecture for delivery of AI/ML applications with on a SaaS platform. • Focus on Anomaly Detection and Forecasting in time series data and Computer Vision. • Member of Industry advisory group for ESPRC project *Revolutionising Operational Safety and Economy for High-value Infrastructure using Population-based SHM (ROSEHIPS)*. • Design, development and delivery of numerous cloud-based machine learning systems for safety-critical applications.
December 2020 - December 2021	Head of Data Science, Watcherr: • Team leadership and management including recruitment and hiring. • Development of roadmaps and strategy, interfacing with the C-suite. • Management of Data Science and Machine Learning deliverables. • Implementation of software, firmware and hardware and machine learning solutions. • Preparation of grants and patents. • Handling sensitive user medical data.
October 2020 - Present	CEO/Principle Data Scientist, DKGR Data Systems: • I own and operate a data science consultancy which provides services based on my academic and industrial experience. • Development of Data Science, machine learning and artificial intelligence solutions for companies. • Strategy development for RoI from data and R&D.
November 2008 - October 2013	Geotechnical Engineer (earlier - Geotechnician), Pells Sullivan Meynink: • Worked as a consultant engineer within a globally successful, high end engineering design firm. • Specialised in foundations, tunnel design and construction (road and rail). • Led teams on design and field work projects. • Developed custom software and hardware solutions for large industrial projects. • Developed business cases for Research & Development.
January 2008 - November 2008	Engineering Intern, RailCorp, Asset Delivery: Major Projects Division: • Project management for major civil, electrical and signals engineering projects.

Academic employment history and teaching experience

February 2018 - January 2021	The Alan Turing Institute, London, UK: • Research Associate for the *Data Centric Engineering Program* • Main project: *Estimating System Health for Streaming Sensor Data* involving model inference, time series machine learning and anomaly detection. The goal was to develop preventative maintenance systems. • Focus on Artificial Intelligence, Machine Learning, Probabilistic Modelling, Bayesian Methods and Deep Learning (e.g. Tensorflow) • Co-Principle Investigator - *Policy improvement, jump control and reinforcement learning.* • Coordinated a series of talks for different researchers at the institute. • Attended multiple events on a broad range of topics regarding the applications of machine learning to areas such as smart battery lifetime management, automotive industry and criminal justice.
March 2018 - March 2021	University of Warwick, Coventry, UK: • Visiting Research Fellow at the Mathematics Institute.
December 2017	Technische Universität Braunschweig, Germany: • Visiting Researcher at the Institute for Scientific Computing. • Delivery of lectures of Artificial Intelligence and Machine Learning. • Collaboration on Spectral Stochastic Finite Element Method problems and filtering for material plasticity. • Work on Bayesian Artificial Neural Networks.
2016 - 2017	Lecturing at the University of New South Wales, Sydney, Australia: • Taught Applied Geotechnics (CVEN3203) - Class size approximately 500 students. • Supervised research students.
2007 - 2017	Tutoring/demonstrating/marking at the University of New South Wales: • Masters Coursework - Rock Engineering (CVEN9522). • Undergraduate tutoring - Engineering Computations, Soil Mechanics, Water Engineering, Engineering Geology and Applied Geotechnics, Rock and Slope Engineering, including field trip demonstration.

Publications, conferences, lectures and academic writing

PhD thesis, 2018, *Probabilistic analysis in computational mechanics with applications in Civil Engineering*:

- Discusses Uncertainty Quantification with relation to decision making under uncertainty (e.g. Game Theory, Markov Decision Processes).
- Demonstrates novel spatially autocorrelated simulation methodologies based on Gaussian copula random fields.
- Explores the application of deep Artificial Neural Networks to physical simulation prediction.
- Discusses Bayesian interpretations of numerical methods with relation to Uncertainty Quantification and derives efficient Markov Chain Monte Carlo algorithms.
- Demonstrates that Bayesian probabilistic numerics can be used to derive useful algorithms. An Expectation-Maximisation algorithm is used to derive an automatically adaptive Element Free Differential Equation solver.

Publications and academic writing:

- Green, DKE., Jaspan, A., "Applied Bayesian Structural Health Monitoring: inclinometer data anomaly detection and forecasting", Proceedings in Applied Mathematics and Mechanics, 2023. `arxiv:2307.00305`
- Green, DKE., Rindler, F., "Probabilistic solution of chaotic dynamical system inverse problems using Bayesian Artificial Neural Networks", preprint, 2020. `arxiv:2005.13028`
- Green, DKE., Rindler, F., "Model inference for ordinary differential equations by parametric polynomial kernel regression", *3rd Conference on Uncertainty Quantification in Computational Sciences and Engineering*, ECCOMAS, Crete, Greece, 2019. `doi:10.7712/120219.6340.18533`
- Green, DKE., "Efficient Markov Chain Monte Carlo for combined Subset Simulation and nonlinear finite element analysis", *Computer Methods in Applied Mechanics and Engineering*, January 2017, Volume 313, pages 337-361. `doi:10.1016/j.cma.2016.10.012`
- Green, DKE., Douglas, K., Mostyn, G., "The simulation and discretisation of random fields for probabilistic finite element analysis of soils using meshes of arbitrary triangular elements", *Computers and Geotechnics*, April 2015, Volume 68, pages 91-108, `doi:10.1016/j.compgeo.2015.04.004`
- Toh, J., Green, DKE., Swarbrick, GE., Fowler, MJ., Estrada, BE., "Earthquake stability assessment of open pit mine slopes", *ACG Slope Stability Conference*, Australian Centre for Geomechanics, Brisbane, Australia, 2013
- Green, DKE., "Probabilistic Finite Element Analysis of Soils using Spatially Autocorrelated Random Fields", *Higher Honours Thesis*, UNSW, 2012

Presentations and invited lectures:

- "Bayesian adaptive forecasting and filtering for predictive maintenance of earthworks using Structural Health Monitoring data", International Symposium on Forecasting, University of Virginia, Charlottesville, USA, June 2023
- "Applied Bayesian Structural Health Monitoring: inclinometer data anomaly detection and forecasting", Applied Mathematics and Mechanics, TU Dresden, Germany, June 2023
- "Model Inference for Ordinary Differential Equations by Parametric Polynomial Kernel Regression", The Alan Turing Institute, London, UK, September 2019
- "Aspects of Machine Learning for Engineering", Department of Mathematics, University of Warwick, UK, October 2018
- "Machine Learning for Infrastructure Monitoring", The Alan Turing Institute, London, UK, May 2018
- "Deep neural networks, uncertainty quantification and machine learning", Institute for Mathematics, TU Berlin, Germany, December 2017
- "Probabilistic Computational Mechanics and Uncertainty Quantification: progress in rare event simulation and surrogate models", Institute for Scientific Computing, TU Braunschweig, Germany, December 2017
- "Deep networks in uncertainty quantification: Artificial Neural Networks and machine learning", Institute for Scientific Computing, TU Braunschweig, Germany, December 2017
- Green, DKE., "Probabilistic analysis in computational mechanics with applications in Civil Engineering", Engineering Postgraduate Research Symposium, UNSW, Australia, 2016
- Green, DKE., "Markov Chain Monte Carlo for Rare Event Reliability Analysis with Nonlinear Finite Elements", *SIAM Conference on Uncertainty Quantification*, Society for Industrial and Applied Mathematics, Lausanne, Switzerland, 2016

Service, hosting and organising:

- Symposium on Machine Learning and Dynamical Systems, Imperial College and The Alan Turing Institute, London, UK, February 2019
- "Lloyd's Theory and Coffee Corner" - Talk series bridging theory and practice in Data Centric Engineering, The Alan Turing Institute, London, UK, 2019

Assorted industry projects

Country wide-rail network, UK	Developed and implemented a cloud-based forecasting and anomaly detection system early warning alert system for monitoring deformation data measured across railway embankments.
Gordie Howe International Bridge, USA	Development and supervision of a machine learning system to predict ice formation on bridge cables.
Leipzig, Germany	Led a team to develop a full computer vision software solution (back and front end) for processing data from bridge cable inspection robots.
Centenario Bridge, Seville, Spain	Team lead for productionisation and technical development of a cloud-based solution to compute cable forces from high-speed accelerometer data.
Ghent, Belgium	As head of data science, delivered machine learning firmware C code for a Bluetooth enabled smartwatch including Inertial Measurement Unit and heart rate sensor data processing.
London, UK	Probabilistic data analysis for large gas turbine preventative maintenance.
Sydney CBD, NSW	3D modelling and finite element analysis of underpinning of the foundations of a 20 storey building, adjacent to a large tunnel.
Lihir Island, PNG	Probabilistic numerical modelling of open pit mine slope stability. Modelling the effects of earthquakes on large pit slopes via finite element analysis.
M2 Tunnel, NSW	Deformation modelling and monitoring including design and construction of custom monitoring equipment for tunnel widening.
Epping to Chatswood Rail Link Tunnel, NSW	Deformation monitoring: assessment and processing of three dimensional laser point cloud data. Numerical analysis of tunnel lining deformations.
Winston Hills, NSW	Long term geotechnical investigation and inspections for earthworks consisting of three warehouse pads. Pile footing socket inspections for a multi-storey carpark.
Bondi Junction, NSW	Numerical modelling of impact of de-stressing caused by a basement excavation on adjacent railway tunnels.
Walsh Bay, NSW	Tide and piezometer data assessment for water inflow study including on-site monitoring and inspections.
Hornsby, NSW	Geotechnical investigation for railway ballast fouling assessment and platform footings.
Allawah, NSW	Geotechnical investigation of overpass bridge abutments.
Gallilee Basin, QLD	Dragline excavatability assessment from downhole wireline data.
Sutherland, NSW	Signals engineering tasks on a railway re-signalling project.
Lawson, NSW	Project management site work for the installation of over 300 piles used to construct a continuous wall and management of subsequent excavation.
Blue Mountains Railway line, NSW	Project management for the installation of new railway tracks and overhead wiring structure construction.
Darling Harbour, NSW	3D numerical modelling of group of pile foundations for large above-ground building complex construction adjacent to tunnels.