Leanne J Dong

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Research Interest

Scientific Computing, Atmospheric Dynamics, Spatio-temporal Modelling, Stochatic Hydrodynamics, Theoretical or Statistical Machine Learning, Quantum Machine Learning/Controls, Software/Prototype Development, Algorithmic/Automated trading, Computational Social Media

Education

Jan,2016– Feb,2018	**Doctor of Philosophy: PhD in Mathematics**, *University of Sydney*, Sydney, Australia, Title: Stochastic Navier Stokes equations on 2D rotating sphere perturbed by stable Lévy noise. Supervisor: Prof. Ben Goldys; Awarded in April, conferred on 7th November
Jan,2015– July,2015	**Doctor of Philosophy: PhD in Mathematics**, *University of New England*, Armidale, Australia, Study travelling Wave solutions for equations of Fisher KPP/porous medium type . Supervisor: Prof. Yihong Du; Discontinued due to severe illness
2014–2014	**Doctor of Philosophy: PhD in Mathematics**, *University of South Australia*, Adelaide, Australia, Thesis title: Non-classical symmetry analysis of Bacterial Colony system . Supervisor: Dr Browyn Hajek; Candidature transferred
2013–2014	**Doctor of Philosophy: PhD in Mathematics**, *University of South Australia*, Adelaide, Australia, Thesis title: Existence, Regularity and Ergodicity of stochastic Navier-Stokes equations purturbed by cylindrical Lévy noise . Supervisor: Prof. John van der Hoek; Candidature transferred
August, 2012–Dec 2012	**Doctor of Philosophy: PhD in Mathematics**, *University of Technology Sydney*, The Pricing, Hedging and Calibration of VWAP options (CSIRO project), Supervisors: Prof. Alex Novikov, Prof. Pavel Shevchenko and A/Prof Juri Hinz; Candidature transferred.
March, 2008–Dec 2011;	**Bachelor of Mathematics Hons I, awarded; WAM:88.4; Thesis: 91**, *University of Technology Sydney*, The pricing of VWAP options under geometric Lévy process framework, Supervisor: Prof. Alex Novikov. Coursework: Linear Dynamical systems, Analysis and Multivariable Calculus, Intro to C, Optimisation I& II, Complex Analysis, Linear Algebra, Stochastic Models, Stochastic Processes, Real Analysis and Measure Theory, Differential Equations, Advanced Stochastic Processes, Advanced Data analysis, Derivative security Pricing, Interest Rate Models
March, 2009– October, 2009	**Master of Actuarial Science, completed 4 subjects and discontinued for Mathematical studies**, *University of NSW*, Coursework: Probability and Statistics for Actuaries, Financial Mathematics for Actuaries, Insurance Risk Models, Applied Regression Analysis.

March, 2005–March, 2008	**GraDip Commerce, Master of Finance, awarded**, *University of NSW*, 14 subjects: Communication and Ethics, Investments and Porfolio Selection, Financial Institution Management, Applied Portfolio Management and Modelling, Alternative Asset Classes, Derivative and Risk Management Techniques, Financial Risk Management, Empirical Financial Theory, Financial Theory and Policy, Research Methods in Finance, Empirical Techniques and Applications in Finance, Business Analysis and Valuation, Fixed Income Securities and Interest Rate Derivatives, Service Marketing. Project: The VaR breakdown of LTCM.
July, 2003–March, 2005	**Bachelor of Accounting (with minor in Economics), awarded**, *Macquarie University*, 25 Accounting and Finance subjects, 5 Economics subjects .

Other certificates

2008	**Passed Level I of Chartered Financial Analyst Exam**.
2012	**Obtained a full certificate of Object-Oriented C++** , *PhD coursework funded by UTS Faculty of Science.*
2018	**Numerous online certificates in Python, Git, Shell, SQL**.

Prizes, Awards and Grant

2012	**Dean Merit of Academic Excellence, UTS**, *1st rank in honour year.*
2013-2015	**Australian Postgraduate Awards**.
2012-2015	**Industrial Doctoral Training Stipend**.
2018	**MAGIC ECR travel grant**, `https://www.science.org.au/news-and-events/events/mentoring-and-guidance-careers-magic-workshop`.
2019	**Postdoctoral Fellowship at UTS (Sydney)**, *Institute for Data Science/Analytics.*
2019	**Postdoctoral Fellowship at Concordia (Montreal)**, *Gina Cody School of Engineering and Computer Science.*

- Workshops: GPU computing with Artemis HPC (1st March, 2019, Sydney Informatics Hub)
- Conferences
  - Stochastic PDE workshop (26th-28th August 2019, The University of Sydney)
  - MAGIC 2018 – Mentoring and guidance in careers workshop for early career female researchers in Mathematics and Physics (29th Oct – 2nd Nov 2018, Australian National University, Canberra)
  - Analysis and PDE seminar (July, 2016, UNSW)
  - AMSI/AustMS 2014 Workshop in Harmonic Analysis and its Applications (21st-25th July 2014, Macquarie University)
  - Simon centre lectures in "Mathematical Aspects of Quantum Field Theory"
- Attended Hons/Master Pure Mathematics courses at Uni Adelaide:
  - Functional Analysis (S2, 2014)
  - Lie groups, Lie algebras (S2, 2014)
  - Algebraic Topology (S1, 2014)
  - Abstract Algebra (S1, 2014)
  - Groups and Rings (S1, 2014)
- AMSI Summer school January 5th-30th 2014
  - Differential Geometry (Attended for credit, Mark:81)
  - Conformal Field Theory and String theory (Attended)
- Gave 2 talks in PDE seminar at UNE on the topic of travelling wave solutions,

- Gave a talk on PhD research proposal in the school of Petroleum, University of Adelaide,
- Attend regular research seminars given by peers HDR students, staff members and visiting scholars.

Professional memberships

- Australian Mathematical Society (AustMS).
- Australian and New Zealand Association of Mathematical Physics (ANZAMP).
- Women in Mathematics Special Interest Group

Academic Employment

May - December 2019 — **Postdoctoral Research Associate**, *Faculty of IT and Engineering*, The University of Technology Sydney, Sydney, Driven projects: 1) Theoretical Development of Stochastic Information Diffusion models with partially observed/interval-censored processes for social media analytics. 2) Adaptative Skills Taxonomy - A spatio-temporal Machine Learning approach to Labor economics.
Full time

Jan - Current 2019 — **Affiliate**, *Centre for Translational Data Science*, The University of Sydney, Sydney, Research focus: Bayesian Neural Network.
Unpaid Internship

2018 — **Lecturer in charge, Unit Coordinator (6-month contract)**, *Faculty of Education and Art*, Australian Catholic University.
Developed, coordinated and lectured the second year unit- Statistics and Probability using Rmarkdown; Developed presentations with RSlidy and Rmarkdown; Other duties included admin, Marking and tutoring; Help students learn statistical programming language R in a simple way

2019 — **Sessional Academic**, *Discipline of Business Analytics*, University of Sydney.
Subjects taught/ongoing: QBUS6830 (Financial Time Series and Forecasting), QBUS3820 (Machine Learning and Data mining, 2019), QBUS5001 (Quantitative Business Analytics)

2016-2019 — **Sessional Academic**, *School of Mathematics and Statistics*, University of Sydney, Subjects taught/ongoing: DATA1901 (Foundation Data Sciences Advanced, 2019), MATH2061/7 (Linear Mathematics and Vector Calculus, 2017, 2018 Summer and Semester 1, 2019 Summer), Math1015 (Biostatistics, 2018 Semester 1), DATA1001 (Foundation Data science, 2018 Semester 1), STAT3011 (Stochastic processes and time series), PHAR1811 (Statistics component, 2018 Semester 1), MATH1001 (Differential Calculus, 2017), MATH1003 (Integral Calculus, 2017), MATH2065 (PDE, 2017), MATH1011 (Applications of Calculus/Life Sciences Calculus, 2016), MATH1014 (Introduction to Linear Algebra, 2016), MATH3075/3975 (Financial Mathematics, 2016), PHAR1812 (Two sessions of Basic Pharmaceutical Sciences, Statistic component, 2018), MATH1005 (Statistical thinking with Data, 2018, 2019 Summer), MATH1021 (Calculus of one variable, 2018).
Duties: Prepare and deliver board style tutorials to first year student; Prepare and deliver mini lectures to 2nd-3rd year students; Mark first year assignments, quizzes and 3rd year final exams of analysis and stochastic processes; Provide feedback to unit coordinators

2011-2017	**Sessional Academic, workshop presenter, Exam invigilator and Marker, Mathematics Support Centre tutor**, *School of Mathematics and Physical Sciences*, University of Technology Sydney, Subjects tutored: 33190 (Mathematical Modelling for Science, 2011, 2017, 2018, 2019), 35010 (Foundation Mathematics, 2018) 33130 (Mathematical Modelling 1, 2011, 2016), 35102 (Introduction to Analysis and Multivariable Calculus, 2012), 33230 (Mathematical Modelling 2, 2016),33290 (Mathematics and Statistics for Sciences, 2016), 37132 (Introduction to Mathematical Analysis and Modelling, 2016, 2018), Introduction to Linear Dynamical system (2016, cover 6 classes), 37233 (Linear Algebra 2018), 68038 (Advanced Mathematics and Physics, 2016, 2017, 2018 cover all tutorials), 68413 (Quantum Physics, 2018) . Duties: Compile and demonstrate tutorials to 2nd-3rd year students; Mark assignments, quizzes and final exams (1st, 2nd/3rd year classes); Provide feedback to subject coordinators/HoS
2018:Feburary-June	**Private Tutor: Advanced Multivariable and Vector Calculus**, *Deliver one to one tutorial to a matured student over the weekend for his Master of Teaching degree*.

Professional Employment

November 2009-February 2010	**Assistant to Assistant Vice President**, *American International Assurance*, GuangZhou, GuangDong, China, Duties include Performing macroeconomic analysis on insurance industry via report writing and presentations; Performing insurance product analysis via report writing and presentations; Making investment recommendation for life insurer via report writing, spreadsheet modelling and presentation; Preparing presentation on Insurance operations management.
Intern Analyst	**November-December 2010**, *Citic securities*, GuangZhou, GuangDong, China.
Trainee Tax Accountant	**March 2005 to December 2005**, *ABL Accounting and Computing*, Sydney, Australia.
December 2005 to February 2006	**Equity Research Assistant**, *SBI E2-Capital Asia-Equity Research (Sell-Side)*, Hong Kong, China. Duties include, Supporting 3 Equity Analysts with administrative functions; Generating and distributing financial reports in MS Excel; Using main financial models, track stocks, and update valuation sheets and models; Research on worldwide stock market using Bloomberg database; Use independent judgments in completing tasks, establishing priorities, and meeting deadlines; Use financial knowledge to analyse financial reports and models

Technical skills

- Computer Programming: C, GNU C++, Python (2.7,3.6,3.7), SQL (Basic), Git, R/RStudio (Experienced), MatLab (Experienced), Maple, Mathematica (Experienced), VBA
- Tools: Git/Version Control, Linux/Unix, LaTeX, HPC

Administration

- General computer skills, including Windows, MacOS, Linux/Unix environments, and a range of software packages, including Adobe creative software and Microsoft Office suite.

Volunteering

- Participants supervisor in the Simon Marais Mathematics Competition, Saturday, Sep 2017, at the School of Mathematics and Statistics, University of Sydney

Nationality

Australian citizen (Born in China, speak fluent English, Cantonese, Mandarin)

Academic Referee

Prof. Beniamin Goldys
Position: Professor of Mathematical Finance (e-mail: beniamin.goldys@sydney.edu.au; phone: +061-293512976; address: School of Mathematics and Statistics Carslaw F07, The University of Sydney)

Dr Marian-Andrei Rizoiu
Position: Lecturer in Computer Science (e-mail: Marian-Andrei.Rizoiu@uts.edu.au; phone: +061-435247215; address: Building 11, 81 Broadway, Faculty of Engineering and IT, The University of Technology Sydney)

Dr Rohitash Chandra
Position: Chancellor Research Fellow (e-mail: rohitash.chandra@sydney.edu.au; phone: +061-293512976; address: The Centre for Translational Data Science (Madsen Building F09), The University of Sydney)

Prof. Yihong Du
Position: Professor of Mathematics (e-mail: ydu@une.edu.au; phone: +61-267733066; address: School of Science and Technology (C26) University of New England)

Dr. Bronwyn Hajek
Position: Senior Lecturer in Mathematics (e-mail: Bronwyn.Hajek@unisa.edu.au; phone: +61-883023084; address: School of IT and Mathematical sciences, Mawson Lakes Campus (OC1-46), University of South Australia)

A/Prof. John van der Hoek
Position: Associate Professor of Mathematics (e-mail: John.VanderHoek@unisa.edu.au; phone: +61-883027196; address: School of IT and Mathematical sciences, City West Campus (Y3-73), University of South Australia)

Prof. Alex Novikov
Position: Professor in Probability (e-mail: Alex.Novikov@uts.edu.au; phone: +061-295142242; address: School of Mathematics and Physical Sciences, The University of Technology Sydney)

Teaching Referee

Dr. Ray Kawai
Position: Senior Lecturer in Statistics/Postgraduate Director (e-mail: reiichiro.kawai@sydney.edu.au; phone: +61-293513376; address: School of Mathematics and Statistics Carslaw 816, The University of Sydney)

Dr. Martin Bell
Position: Lecturer in Physics (e-mail: Martin.Bell@uts.edu.au; phone: +61-295142243; address: School of Mathematics and Physical Sciences Room 07.05.025, The University of Technology Sydney)

Research Experience

- Strong mathematical background specialising in Stochastic Analysis, Mathematical Finance, nonlinear PDE, Stochastic Processes and Stochastic PDE
- Made important contribution to stochastic hydrodynamics and turbulence.
- Knowledge in Machine Learning, Data mining and Deep Learning
- Genuine interests in software engineering and proven programming capability

Dissertations

Dong, J, Leanne: *Stochastic Navier-Stokes equation on a 2D rotating sphere with stable Lévy noise*; PhD thesis, School of Mathematics and Statistics, The University of Sydney; `http://hdl.handle.net/2123/18119`, April, 2018 (Please visit `https://github.com/leannejdong/leannejdong.github.io/blob/`

master/files/Dong_Leanne_thesis.pdf for downloading purpose)

Dong, J, Leanne: *The Pricing of VWAP Options under Lévy process framework*; Honour thesis, School of Mathematical and Physical Sciences, The University of Technology Sydney; , February, 2012 (Please visit `https://github.com/leannejdong/leannejdong.github.io/blob/master/files/L.thesis.pdf` for downloading purpose)

Publications

Dong, J, Leanne: *Stochastic Navier-Stokes equation on a 2D rotating sphere with stable Lévy noise*; in Bulletin of the Australian Mathematical Society 1-2; DOI: 10.1017/S0004972718001351, January, 2019

Dong, J, Leanne: *Strong solutions for the Stochastic Navier-Stokes equation on a 2D rotating sphere with stable Lévy noise*; Available at `https://arxiv.org/abs/1811.07885`; **Conditionally accepted for publication, Journal of Mathematical Analysis and Applications**

Dong, J, Leanne: *Random Attractors for Stochastic Navier-Stokes equation on a 2D rotating sphere with stable Lévy noise*;Available at `https://arxiv.org/abs/1811.10532`; **Submitted for publication**

Dong, J, Leanne: *Invariant Measures for the Stochastic Navier-Stokes equation on a 2D rotating sphere with stable Lévy noise*; Available at `https://arxiv.org/abs/1812.05513`, December, 2018.

Dong, J, Leanne and Van der Hoek, John: *An Explicit Numerical Algorithm to the Solution of Volterra Integral Equation of the 2nd Kind*; Available at `https://arxiv.org/abs/1908.02862`, August, 2019

Dong, J, Leanne and Van der Hoek, John: *Generalised Solution of the Volterra Integral Equation of the Second Kind*; Available at arXiv preprint, September, 2019

To be submitted

Li, Shidi and Rizoiu, Marian-Andrei and Dong, J, Leanne and Menon, Aditya Krishna and Xie, Lexing: *A HIPPer approach to interval-censored Hawkes processes*; To be submitted to IEEE TRANSACTIONS ON NEURAL NETWORKS AND LEARNING SYSTEMS, Special Issue on Robust Learning of Spatio-Temporal Point Processes: Modeling, Algorithm, and Applications, 2019

Technical Report

Dong, J, Leanne: *Temporal Modelling Of Job Counts Data: Regression Analysis with Copulas*; September, 2019; Demo available at `https://github.com/leannejdong/data-social-science`

Unpublished

Dong, J, Leanne: *Functional Analysis and Distribution theory: From Quantum Mechanic to Machine Learning*; 2019

Dong, J, Leanne and Van der Hoek, John.: *A semi-analytical approach to the Volterra equation of 2nd Kind*; 2019

More about my research

During my PhD, there has been fair a bit of changes in identifying who I am in research. Coming from an applied mathematical finance background, I initially wanted to be stronger in theory and hence I moved candidature from statistical finance to stochastic Navier-Stokes equations and analysis of PDE. I finally see myself at the interface of theory and implementations. My PhD thesis is much about the analysis of Stochastic PDEs, where I aim to prove estimates for solutions to linear equations that are strong enough to allow one to solve difficult non-linear equations. I study stability, asymptotic behaviour of the solutions and the generated Random Dynamical System. In my PhD project I studied the stochastic Navier-Stokes equation on the rotating sphere. I use arguments from stochastic analysis in infinite-dimensional spaces, functional analysis , elements of differential geometry and Ergodic theory of dynamical systems. I deduced several new existence theorems-for the solution, the invariant measures and random attractors.

In my current postdoctoral research I work at the interface of applied statistics and computational social science. I am a key investigator of two machine learning projects. My work is data-driven, problem driven and theoretical. I use a variety of tools from mathematics (stochastic calculus, functional analysis, numerical analysis, convex analysis) and statistical machine learning. In my first project we consider the problem of forecasting social media popularity, specifically, our goal is to predict event times under the interval-censored setting, in which it resemble the self-exciting phenomenon. To this end, we developed a novel Mathematical framework based on Hawkes Intensity process, and to estimate its parameters in interval-censored setting. This allows a transition from event data (i.e. which tweets occurs at which precise time) to interval-censored data, which enables one to make accurate forecast of popularity in online media. Two main challenges are the lack of closed-form solutions for the Volterra integral equations with Power Law and Rayleigh kernels. To overcome these, I explored several numerical algorithms in the classical scientific computing literature. Finally I developed an explicit numerical algorithms to solve the Volterra equations of the 2nd kind using simple arguments from functional analysis and distribution theory. My second project is one of the CSIRO (Data61) grand challenges: capture data about changing demand and supply of skills in a timely and efficient manner which will provide much-needed information to inform educational and employment decisions. In this project we aim to establish whether job advertisements accurately reflect sector-specific and geographic differences in demand for skills. There are multiple components of the project, including

- Validating job ads as a source of data on labor markets
- Modelling geographic and temporal variation in labor markets
- Classifying occupation and skills from the text of job ads (NLP)
- Data capture, storage and visualisation.

I am responsible for the statistical modelling part of this project. We received unstructured job ads data across the entire Australia from data provider Adzuna. I mainly concerned on temporal dependency modelling of monthly job counts. In particular, I focused on the modelling of dependency of discrete time series X_t and X_{t-1} for each job. I identified the need for a systematic dependence structure to account for autocorrelation by examining the autocorrelation plot of each univariate time series that represent each occupation. There is also a presence of overdispersion. Combining these reasons, I fitted the Gaussian copula negative binomial regression with ARMA dependence structure. The task was successfully completed with use of the R package 'gcmr'. I also initiated some investigation of spatial dependency. Starting with some data wrangling and transformation, we compute correlation across regions at occupation level. We found a strong presence of dependency exist among regions. Then I applied clustering algorithm and detected groups of pairwise correlated time series via a clustering algorithm. In the future one may continue on spatial dependency modelling with use of Gaussian random field and SPDEs via R-INLA.