

Sofia C. Olhede

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Employment

University College London	Honorary Professor of Computer Science	June 2008 – present.
University College London	Professor of Statistics	Oct. 2007–present.
Imperial College London	Senior Lecturer in Statistics	Oct. 2006–Sept. 2007.
Imperial College London	Lecturer in Statistics	Oct. 2002–Sept. 2006.
Imperial College London	Beit Scientific Research Fellowship	Oct. 2001–Sept. 2002.

Academic History

Imperial College London	PhD in Mathematics	Viva Jan. 8th 2003.
Imperial College London	MSci in Mathematics	Aug. 2000.

Research Funding

<i>Body</i>	<i>Type</i>	<i>Duration</i>	<i>Value</i>	<i>Role</i>
EPSRC	Responsive mode (EP/L025744/1)	Juni 2014–Dec 2014	£43,607	PI
EPSRC	EPSRC New Directions Call 2013 (EP/L001519/1)	July 2013–June 2015	£152,209 (193,361 fec)	PI.
EPSRC	Leadership Fellowship (EP/I005250/1)	Oct. 2010–Sept. 2015	£990,010 (1,220,055 fec)	PI.
NERC	Studentship (NE/F013051/1)	Oct. 2008– Sept. 2012	£71,343	S.
EPRSC	Network Grant (EP/F031157/1)	Jan. 2008–Dec. 2010	£81,923 (102,403 fec)	Co-I.
EPSRC	Springboard Fellowship (EP/E031536/1)	Oct. 2007–Sept. 2008	£102,090 (127,613 fec)	PI.
EPSRC	London Taught Course Centre (EP/E504485/1)	Feb. 2007 – Nov. 2011	£422,847 (pre-fec)	Co-I.
EPSRC	First Grant (GR/S64059/01)	May 2004 – April 2006	£115,380 (pre-fec)	PI.

Co-I=Co Investigator, PI=Principal Investigator and S=Supervisor. fec=Full Economic Cost, whereof the research council provides 80%.

Research Interests

Mathematical underpinning of Big Data, network modelling, nonstationary time series and inhomogeneous random fields, multiple time series and random fields, multiscale methods, nonparametric estimation, sparsity and high dimensional data. Applications in ecology, finance, geoscience, oceanography, neuroscience and medical imaging.

Journal papers

In review or revision

1. S. Olhede. Learning the Ambiguity function.
2. S. C. Olhede and P. J. Wolfe. Order Statistics of Observed Network Degrees.
3. S. C. Olhede and P. J. Wolfe. Degree-based network models.
4. A. M. Sykulski, S. C. Olhede, J. M. Lilly and J. J. Early. The Whittle Likelihood for Complex-Valued Time Series.
5. A. M. Sykulski, S. C. Olhede, J. M. Lilly and E. Danioux. Lagrangian Time Series Models for Ocean Surface Drifter Trajectories.
6. P. J. Wolfe and S. C. Olhede. Nonparametric graphon estimation.

Bioinformatics and Neuroscience

7. Bartlett, T. et al., 2014. A DNA methylation network interaction measure, and detection of network oncomarkers, PLOS, One, 9, e84573.

8. Bartlett, T. et al., 2013. Corruption of the Intra-Genome DNA Methylation Architecture Is a Hallmark of Cancer, *PLOS, One*, 8, e68285.
9. L. Fabrizi et al., 2013. Cortical activity evoked by an acute painful tissue-damaging stimulus in healthy adult volunteers, *J Neurophysiol*, 109, 2393–2403.
10. S. C. Olhede and H. Ombao. 2013. Modelling and Estimation of Covariance of Replicated Modulated Cyclical Time Series, *IEEE Transactions on Signal Processing* 61, 1944–1957.
11. L. Fabrizi, R. Slater, A. Worley, J. Meek, S. Boyd, S. Olhede, and M. Fitzgerald. 2011. A Shift in Sensory Processing that Enables the Developing Human Brain to Discriminate Touch from Pain, *Current Biology*, 21, 1552–1558.
12. S. Olhede and Whitcher. 2011. Nonparametric Tests of Structure for High Angular Resolution Diffusion Imaging in Q-Space, *Annals of Applied Statistics*, 5, 1293–1327.
13. S. Olhede and A. T. Walden. 2003. Noise reduction in quadrature Doppler ultrasound using multiple Morse wavelets. *IEEE Transactions on Biomedical Engineering*, 50, 51–57.

Continuous Time Processes

14. W. Yip, D. A. Stephens and S. Olhede. 2010. The Explicit Chaotic Representation of the Powers of Increments of Lévy Processes, *Stochastics*, 82, 257–290.
15. S. C. Olhede, A. Sykulski and G. Pavliotis. 2009. Frequency domain estimation of integrated volatility for Itô processes in the presence of market-microstructure noise, *Multiscale Modeling and Simulation: A SIAM Interdisciplinary Journal*, 8, 393–427.
16. W. Yip, D. A. Stephens and S. C. Olhede. 2010. Hedging strategies and minimal variance portfolios for European and exotic options in a Levy market, *Mathematical Finance*, 20, 617–646.

Environmental Statistics

17. A. Flügge, D. Murrell and S. Olhede. Detecting sub-communities in ecosystems from multivariate spatial associations, *Methods in Ecology and Evolution*, in press.
18. V. Harris, M. Edwards, and S. Olhede. 2014. Multidecadal Atlantic Climate Variability and its Impact on Marine Pelagic Communities, *Journal of Marine Systems*, 113, 55–69.
19. S. Elipot, C. Hughes, S. Olhede and J. Toole. 2013. Coherence of western boundary pressure at the rapid WAVE array: boundary wave adjustments or deep western boundary current advection? *Journal of Physical Oceanography*, 43, 744–765.
20. F. J. Simons and S. C. Olhede. 2013. Maximum-likelihood estimation of lithospheric flexural rigidity, initial-loading fraction, and load correlation, under isotropy. *Geoph. J. Int.*, 193, 1300–1342.
21. A. J. Flügge, S. C. Olhede, and D. J. Murrell. 2012. The memory of spatial patterns – changes in local abundance and aggregation in a tropical forest, *Ecology*, 93, 1540–1549.
22. Lilly, J. M., R. K. Scott, and S. C. Olhede. 2011. Extracting waves and vortices from Lagrangian trajectories. *Geophysical Research Letters*, 38, L23605.

Networks

23. S. C. Olhede and P. J. Wolfe. Network histograms and universality of blockmodel approximation, to appear in the *Proceedings of the National Academy of Sciences*.

Time series and Random Fields

24. S. C. Olhede, D. Ramirez and P. J. Schreier. Measuring Directionality in Random Fields Using the Monogenic Signal, *IEEE Transactions on Information Theory*, 60, 6491–6510.
25. S. C. Olhede. 2013 Modulated Oscillations in Many Dimensions, *Phil. Transactions*, 371, no 1984, 20110551.
26. J. M. Lilly and S. C. Olhede. 2012. Generalized Morse Wavelets as a Superfamily of Analytic Wavelets. *IEEE Transactions on Signal Processing*, 60, 6036–604.
27. J. M. Lilly and S. C. Olhede. 2012. Analysis of Modulated Multivariate Oscillations. *IEEE Transactions on Signal Processing*, 60, 600–612.
28. J. Lilly and S. C. Olhede. 2010. On the Analytic Wavelet Transform, *IEEE Transactions on Information Theory*, 56, 4135–4156.
29. H. Hindberg and S. C. Olhede. 2010. Estimation of Ambiguity Functions With Limited Spread, *IEEE Transactions on Signal Processing*, 58, 2383–2388.
30. J. Lilly and S. C. Olhede. 2010. Bivariate Instantaneous Frequency and Bandwidth, *IEEE Transactions on Signal Processing*, 58, 591–603.
31. S. C. Olhede and G. Metikas. 2009. The Monogenic Wavelet Transform. *IEEE Transactions on Signal Processing*, 57, 3426–3441.
32. J. Lilly and S. Olhede. 2009. Higher-Order Properties of Analytic Wavelets. *IEEE Transactions on Signal Processing*, 57, 146–160.

33. S. C. Olhede. 2008. Localisation of Geometric Anisotropy. *IEEE Transactions on Signal Processing*, 56, 2133–2138.
34. S. C. Olhede. 2007. Hyperanalytic Denoising. *IEEE Transactions on Image Processing*, 16, 1522–1537.
35. G. Metikas and S. C. Olhede. 2007. Multiple Multidimensional Morse Wavelets. *IEEE Transactions on Signal Processing*, 55, 921–936.
36. S. Olhede. 2006. On Probability Density Functions for Complex Variables. *IEEE Transactions on Information Theory*, 52, 1212–17.
37. S. Olhede and A. T. Walden. 2005. Local directional denoising. *IEEE Transactions on Signal Processing*, 53, 4725–30.
38. S. Olhede and A. T. Walden. 2005. A generalised demodulation approach to time-frequency projections for multi-component signals. *Proceeding of the Royal Society of London, Series A*, 461, 2159–79.
39. S. Olhede and A. T. Walden. 2005. Denoising Signals in Quadrature. *Festschrift for Enders Robinson*, in *Integrated Computer-Aided Engineering*, 12, 109–117.
40. S. Olhede and A. T. Walden. 2004. ‘Analytic’ Wavelet Thresholding. *Biometrika*, 91, 955–73.
41. S. Olhede, E. J. McCoy and D. A. Stephens. 2004. Large Sample Properties of the Periodogram Estimator of Seasonally Persistent Processes, *Biometrika*, 91, 613–628.
42. S. Olhede and A. T. Walden. 2004. The Hilbert Spectrum via Wavelet Projections. *Proceeding of the Royal Society of London, Series A*, 460, 955–975.
43. S. Olhede and A. T. Walden. 2003. Polarization phase relationships via multiple Morse wavelets - Part I: Fundamentals. *Proceeding of the Royal Society of London, Series A*, 459, 413–44.
44. S. Olhede and A. T. Walden. 2003. Polarization phase relationships via multiple Morse wavelets - Part II: Data Analysis. *Proceeding of the Royal Society of London, Series A*, 459, 641–657.
45. S. Olhede and A. T. Walden. 2002. Generalized Morse wavelets. *IEEE Transactions on Signal Processing*, 50, 2661–2670.

Conference Papers: refereed

46. S. C. Olhede, D. Ramirez and P. J. Schreier. 2012. The Random Monogenic Signal, *ICIP 2012*
47. J. M. Lilly and S. C. Olhede. 2009. Wavelet ridge estimation of jointly modulated multivariate oscillations. *43rd Asilomar Conference on Signals, Systems, and Computers*, 452–456.
48. A. Sykulski, S. C. Olhede and G. Pavliotis. 2008. High Frequency Variability and Microstructure Bias. *Proceedings of the Isaac Newton Workshop on Inference and Estimation in Probabilistic Time-Series Models*, Cambridge UK, edited by D. Barber, A. T. Cemgil and S. Chiappa.
49. S. C. Olhede and B. Whitcher. 2008. A Statistical Framework to characterise microstructure in high angular resolution diffusion imaging. *Proceedings of the 5th IEEE International Symposium on Biomedical Imaging: From Nano to Macro. ISBI 2008*, 899 - 902.
50. S. C. Olhede and B. Whitcher. 2008. Denoising HARDI coefficients using Spherical Wavelet Lifting. *ISMRM Toronto, Canada*, 2008.
51. H. Hindberg, A. Hanssen and S. Olhede. 2008. Thresholding the Ambiguity Function. *Proceedings of the 2008 IEEE International Conference on Acoustics, Speech and Signal Processing*, 3773 – 3776 .
52. S. C. Olhede. 2006. Hyperanalytic Thresholding. *Proceedings of the 6th IEEE International Conference on Image Processing*, volume I, 1421 – 1424.
53. G. Metikas and S. Olhede. 2005. Multiple wavelet analysis of amplitude/ frequency modulated images. *Proceedings of the 5th IEEE International Symposium on Signal Processing and Information Technology*, Dec. 18 - 21, 284 – 288.

Conference Papers: not refereed

54. S. C. Olhede and J. M. Lilly. 2007. Multiscale Inference of Lagrangian Ocean Turbulence, *Proceedings of ISI2007*.
55. S. Olhede and G. Metikas. 2006. Multiple wavelet coherence analysis, in: E. R Dougherty, J. T. Astola, K. O. Egiazarian, (editors), *Proceedings of SPIE, Image Processing: Algorithms and Systems, Neural Networks, and Machine Learning*, SPIE, Jan. 15–18, 31 – 42.

Current Administrative Commitments

Scientific Director of the Big Data Institute August 2014–
 Deputy Director of CoMPLEX April 2013–Sept 2014.
 Member of EPSRC peer review college since August 2010.
 Isaac Newton Institute correspondent for the Royal Statistical Society since 2008.
 Member of the ICMS Programme Committee since September 2008.

Past Administrative Duties

Associate Editor for the IEEE Trans. Signal Proc October 2009–October 2013.
Associate Editor for the J. Royal Statistical Society Series B August 2007–August 2011.
Member of the Research Section of the Royal Statistical Society July 2005– Dec. 2009.
Director of Research (August 2010–August 2013) & Deputy Director of Research (July 2009–July 2010) of the Department of Statistical Science at UCL.
Member of the Statistical Science Departmental Research Committee October 2007–October 2013.
External Examiner for the Statistics Department at the University of Kent at Canterbury July 2009–August 2013.
Seminar Organizer for the Statistics Group at Imperial College London, Aug. 2004–Oct. 2007.
Technical Report Organizer for the Statistics Group at Imperial College London, Jan. 2004– May 2005.
Co-Founder of the London Taught Course Centre, and member of the management committee.
Member of the Mathematics Teaching Strategy Committee, Oct. 2003–Oct. 2006.

Ph D Students

Dr Sandra Ogunya	joint with A. T. Walden	viva 2007	Multiscale analysis of high frequency exchange rate time series.
Dr Wing Yip	joint with D. A. Stephens	viva 2008	Lévy processes, representation and models with applications in finance.
Dr Victoria Harris	joint with SAHFOS	viva 2012	Modelling multivariate spatio-temporal structure and response to climate change in ecological datasets.
Mr Zhen Li	single supervisor	viva 2013	Methods for irregularly sampled continuous time processes.
Mr Anton Flügge	second supervisor	viva 2013	Linking pattern and process in tropical rainforests.
Mr Erik Pazos	second supervisor	started 2009.	
Mr Simon Wallace	first supervisor	started 2011.	
Mr Tom Bartlett	second supervisor	started 2011.	

Supervision of Post-Docs

Dr Georgios Metikas	2004–2006	Multiple 2-Dimensional Morse Wavelet Analysis with Applications in Geophysics
Dr Adam Sykulski	2011–	High Dimensional Models for Multivariate Time Series Analysis
Dr Pierre-André Maugis	2012–	Complex Networks
Dr James Martin	2013–	Characterizing Interactions Across Large-Scale Point Process Populations

European Visiting Students

Mr Arthur Guillaumin	2012	Ecole Centrale de Centrale Nantes
Mr Matteo Farne	2011	University of Bologna
Dr Heidi Hindberg	2007	University of Tromsø.

Reviewing

I review for 1) *Annals of Statistics*, 2) *Biometrika*, 3) *Probability Theory and Related Fields*, 4) *J. Royal Statistical Society B*, 5) *J. American Statistical Association*, 6) *J. Applied Statistics*, 7) *J. Time Series Analysis*, 8) *IEEE Transactions on Image Processing*, 9) *IEEE Transactions on Information Theory*, 10) *IEEE Transactions on Medical Imaging*, 11) *IEEE Transactions on Signal Processing*, 12) *IEEE Signal Processing Letters*, 13) *Proceedings of the Royal Society A*, 14) *Physica D*, 15) *J. of Sound and Vibration*, 16) *Photogrammetric Engineering and Remote Sensing*, 17) *Proceedings of the National Academy of Sciences*, 18) *J. Atmosphere Solar-Terr. Physics*, 19) *International J. on Wavelets, Multiresolution and Information Processing*, 20) *Studies in Nonlinear Dynamics & Econometrics*, 21) *IMA J. of Applied Mathematics*.

Invited Longer Research Visits

- Princeton University, visitor to the Geoscience Department, Feb 13th – Feb 22nd 2013, February 24th – March 10th 2012, Jan 29th – 12th February 2011, April 4th 2010–May 1st 2010, May 31st 2009 – June 24th 2009, April 4th 2008– May 4th 2008 and 18th Oct. – 20th Dec., 2006 (visits funded by the NSF).
- North West Research Associates, Seattle, 30th Aug.–6th Sept. 2013, 21st Feb.– 4th March 2011, 1st Aug.–13th Aug 2011.
- Earth and Space Research, Seattle, visitor, 26th Aug. – 7th Oct., 2006, & 10th–17th Sept. 2008.
- Applied Physics Laboratory, University of Washington, 24th June–7th Aug. 2002.
- Statistical and Applied Mathematical Sciences Institute (SAMSI), visit to the programme on Analysis of Object Data, 11th September 2010–23rd Oct 2010, funded by NSF.
- Isaac Newton Institute, visitor to the programme on Statistical Theory and Methods for Complex, High-Dimensional Data, Feb. 15th – April 1st and June 1st – June 30th 2008.

Recent Knowledge Transfer Activities

- October 2013 Bloomsbury Festival UCL Ideas Salon.
- October 2013 UCL Lunch Hour Lecture.
- October 2013 recorded pod-cast on “Patterns in Nature” <http://youtu.be/na6yqiVMicE>.

Conference Presentations

I have given 25 presentations at conferences and workshops since January 2006, note in particular:

- April 2013. Presentation at Data analysis for cyber security, “Network structure and scaling”.
- January 2013. Presentation at the IPAM (Los Angeles) workshop on Adaptive Data Analysis and Sparsity, “Inference for Nonstationary Processes.”
- December 2012. Presentation at ERCIM 2012 invited special session on Statistical problems with complex data, “Oscillations observed in multiple dimensions.”
- March 2012. Presentation at the Royal Society meeting on Signal processing and inference for the physical sciences, “Multivariate oscillations.”
- February 2012. Presentation at the MBI programme (Ohio) on Recent Advances in Statistical Inference for Mathematical Biology, “Temporal inhomogeneity and dependence of brain networks”.
- September 2011. Presentation at the IMA Programme on Instantaneous Frequencies and Trends for Nonstationary Nonlinear Data, “Inference for Harmonizable Processes.”
- August 2010. Presentation at Invited Paper Session at the European Meeting of Statisticians 2010, “Brain Imaging and Multiscale Inference”.
- July 2009. Presentation at Invited Paper Session at the European Meeting of Statisticians 2009, “Multiscale methods in statistics”.
- June 2008. Workshop on Inference and Estimation in Probabilistic Time-Series Models, Isaac Newton Institute, Cambridge, UK. “High frequency variability and microstructure bias”, at the programme for “Statistical Theory and Methods for Complex, High-Dimensional Data ”.
- August 2007. Invited presentation to the session on “Locally Stationary Time Series” at the 56th session of the International Statistical Institute in Lisbon.
- May 2007 Seconding the Vote of Thanks for Ramsay, Hooker, Campbell and Cao, on “Parameter Estimation for differential equations: a generalized smoothing approach,” at the Royal Statistical Society.

Training Courses

- *Non-Stationary Time Series*, training session at the INSPIRE conference, September 22nd 2009.
- *Multiscale Methods and Statistical Modelling of Non-Stationary Phenomena*, Royal Statistical Society Graduate Training Course, Summer 2007, with Emma McCoy (ICL).
- *Wavelet Workshop*, School of Geography, Leeds, 2005, with Chris Keylock (Leeds).

Invited Research Seminars

I have spoken at Analysis, Applied Mathematics, Electrical and Computer Engineering, Geoscience, Signal Processing and Statistics seminars at the following groups:

UK: Bath, Bristol (4 times), Cambridge (4 times), Cass Business School, Edinburgh (2 times), EMS, Glasgow, Imperial College London (5 times), Isaac Newton Institute, Kent at Canterbury (2 times), Leeds, LSE, Newcastle, Nottingham (2 times), Oxford (2 times), QMUL (2 times), Southampton, University College London (2 times), Warwick (5 times), York,
Mainland Europe: Athens University of Economics and Business, Bologna, École Polytechnique Fédérale de Lausanne, Heidelberg, Institut Telecom, Karlsruhe Institute of Technology (KIT), KU Leuven, Telecom ParisTech (ENST) Paris, Potsdam, Tromsø, Umeå, Université Libre de Bruxelles,
US & Canada: Caltech, Georgia Tech, Johns Hopkin, McGill, Polytechnic NY, Princeton (3 times), Rice, Stanford (2 times), Yale, UMASS Dartmouth, University of Washington.

Examined PhD Theses

Dr Badr Missaoui, Imperial College London, 2013.

Dr Diwei Zhou, Statistical Analysis of Diffusion Tensor Imaging, Nottingham, 2010.

Dr Loic Baboulaz, Feature Extraction For Image Super-Resolution using Finite Rate of Innovation Principles, Imperial College London, 2008.

Meetings Organized

- o *INSPIRE Annual Meeting*, Sept 2010, Statistics and Signal processing conference, co-organizer, see www.network-inspire.org.
- o *INSPIRE Annual Meeting*, Sept 2009, Statistics and Signal processing conference, co-organizer, see www.network-inspire.org.
- o *Lagrangian Data, Lagrangian Structure*, mini-symposium co-organizer, Capstone Conference 2009.
- o *Multiscale and Geometric Methods*, European Meeting of Statisticians, invited session organizer, 2009.
- o *Sparsity in Machine Learning and Statistics*, workshop at Cumberland Lodge, co-organizer, 2009.
- o *Workshop on Sparsity and its application to large inverse problems*, co-organizer, Cambridge, 2008.
- o *Royal Statistical Society General Conference 2008*, member of the programme committee, 2008.
- o *Multiscale Models and Methods for Inference*, Minisymposium at *ICIAM 2007*, Zürich, Switzerland, 2007.
- o *Nonlinear Processes in Geophysics: Wavelet and time-frequency analysis in the Earth sciences*, Special Session, *EGU General Assembly*, 2005, Vienna, Austria, with Jonathan Lilly.