Beth Jelfs

Contact Details

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Research Interests

Adpative Signal Processing; Statistical Signal Processing; Machine Learning; Signal Modality Characterisation; Multichannel and Multimodal Signal Processing; Blind Source Separation/Extraction; Biomedical/Neural Applications.

Education

09/2005–03/2010 **PhD Electrical & Electronic Engineering**, Imperial College London, UK.

Thesis Title: *Collaborative Adaptive Filtering for Machine Learning*

09/2001–06/2005 **MEng Electronic & Software Engineering** (1st Class Honours), University of Leicester, UK

Research Experience

03/2017–Present **Vice-Chancellor's Research Fellow**: School of Engineering, RMIT University

Developing adaptive signal processing methods for signal characterisation with particular focus on biomedical applications.

06/2015–10/2016 **Research Fellow**: Dept. Electronic Engineering, City University of Hong Kong

Project coordinator for "Fingers Working in Coordination: Hierarchy of EEG, EMG and Kinematics"

Secondary project as part of the Centre for Biosystems, Neuroscience, and Nanotechnology on computational methods for neural synchronization and information transfer.

08/2013–05/2015 **Postdoctoral Fellow**: Dept. Electronic Engineering, City University of Hong Kong

Project "Fingers Working in Coordination: Hierarchy of EEG, EMG and Kinematics"

06/2011–06/2013 **Postdoctoral Research Associate**: Dept. Medical Physics & Bioengineering, University College London

Funded by Wellcome Trust Project Grant "Integrating monitoring & modelling for real time tracking of cerebral circulation & metabolism".

06/2010–06/2011 **Postdoctoral Research Assistant**: Dept. Chemistry & Dept. Physics, University of Oxford

Using statistical signal processing techniques to investigate nanopore technology and the accuracy of classification for DNA sequencing.

10/2000–09/2001 **Test Technician**: Marconi Optical Components

Member of a team of technicians working on testing lasers and laser related products on various projects for both production and research.

Promoted to section leader before leaving to go into higher education.

TEACHING EXPERIENCE

2018–2019 **Course Coordinator**: *Biomedical Signal Analysis*, RMIT University

2014–2015 **Guest Lecturer**: *Brain Machine Interface: Technology, Culture, and Society*, City University of Hong Kong

Lecturing on BMI Technology & Neural Computation for a Gateway Education course

2013–2015 **Graduate Teaching Assistant**: *International Transition Team*, City University of Hong Kong

Providing English language support including student tutorials, proofreading of academic papers & preparation of teaching materials

2006–2008 **Study Group Tutor**: *Communications I*, Imperial College London

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RESEARCH FUNDING & GRANTS

2017–2018 Australian Academy of Technology Sciences and Engineering - Global Connections Fund Bridging Grant: *Muscle fatigue monitor* A$49,992

2017 RMIT University - Scheme for Teaching and Learning Research: *Developing the framework for problem based learning workshop style education* A$10,000

2017–2021 RMIT University - Vice-Chancellor's Research Fellowship A$588,511

2009 Funded by the €9.99m European research project Neuroprobes in collaboration with KU Leuven

2008 British Council and DAAD academic research collaboration project ARC1303 with Technische Universität München and the Max-Planck-Institute for Dynamics and Self-Organization

2007 Royal Academy of Engineering International Travel Grant

2005–2009 EPSRC Doctoral Training Award £68,000

PROFESSIONAL ACTIVITIES

Ongiong Reviewer for Signal Processing, Neurocomputing, IEEE Transactions on Signal Processing, Signal Processing Letters & International Journal of Adaptive Control and Signal Processing

2019-2021 Member Biomedical Signal Processing & Systems Technical Committee of APSIPA

2018 Special session chair at APSIPA Annual Summit & Conference

2017–2019 Vice-Chancellor's Fellows Advisory Committee, RMIT University

2012	Organising committee *"enGENEious"* conference on microbial engineering, held at University of Oxford
2007	Project Coordinator for *Signal Processing Techniques for Knowledge Extraction and Information Fusion* book
2006–2007	Student representative for the Communications and Signal Processing Research Group, Imperial College London
2004-2007	Book reviewer for IET 'Circuit' group for younger members

PUBLIC ENGAGEMENT & INVITED TALKS

2013	Event manager *"Pint of Science"* science festival for the general public
2011–2013	As part of UCL Outreach lead demonstrations and talks with school children for events including Medical Physics Masterclass, Women in Engineering Taster Day, and University Challenge Event
2008	Invited talk University of Applied Sciences Schmalkalden

AWARDS

2010	Best Student Paper Award at *International Symposium on Neural Networks*
2005	British Computer Society's prize for best graduating student

PUBLICATIONS

Journal Articles

[1] D.K. Kumar, **B. Jelfs**, X. Sui and S.P. Arjunan, "Prosthetic Hand Control: A Multidisciplinary Review to Identify Strengths, Shortcomings, and the Future", *Biomedical Signal Processing and Control*, 2019, vol. 53, no. 101588.

[2] S.M. Keloth, R. Viswanathan, **B. Jelfs**, S. Arjunan, S. Raghav and D. Kumar, "Which Gait Parameters and Walking Pattern Show the Significan Differences Between Parkinson's Disease and Health Participants?", *Biosensors – Special Issue Biomedical Signal Processing for the Diagnosis and Monitoring of Motor Disorders*, 2019, vol. 9, no. 2:59.

[3] A. Bingham, S.P. Arjunan, **B. Jelfs** and D.K. Kumar, "Normalised Mutual Information of High-Density Surface Electromyography during Muscle Fatigue", *Entropy, special issue on Information Theory Applied to Physiological Signals*, 2017, vol. 19, no. 12:697.

[4] **B. Jelfs** and R.H.M. Chan "Directionality Indices: Testing Information Transfer with Surrogate Correction", *Physical Review E*, 2017, vol. 96, no. 5:052220.

[5] X. Zhai, **B. Jelfs**, R.H.M. Chan and C. Tin, "A Self-Recalibrating Myoelectric Classifier of Hand Movements Based on Convolutional Neural Networks", *Frontiers in Neuroscience*, 2017, vol. 11, no. 379.

[6] Q. She, **B. Jelfs** and R.H.M. Chan, "Modeling Short Over-Dispersed Spike-Train Data: A Hierarchical Parametric Empirical Bayes Framework", under review, 2016, arXiv preprint available, arXiv:1605.02869.

[7] B. Cao, J. Wan, M. Hasan, T.-R. Yu, **B. Jelfs**, R.H.M. Chan and Y. Li, "Vagus Nerve Stimulation Alters Phase Synchrony of the Anterior Cingulate Cortex and Facilitates Decision Making in Rats", *Scientific Reports*, 2016, vol. 6, no. 35135.

[8] B. Cao, J. Wang, X. Zhang, X. Yang, D.C.-H. Poon, **B. Jelfs**, R.H.M. Chan, J. C.-Y. Wu and Y. Li, "Impairment of Decision Making and Disruption of Synchrony between Basolateral Amygdala and Anterior Cingulate Cortex in the Maternally Separated Rat", *Neurobiology of Learning and Memory*, 2016, vol. 136, pp. 74–85.

[9] Y. Gao, G. Zhang, **B. Jelfs**, R. Carmer, P. Venkatraman, M. Ghadami, S.A. Brown, C.P. Pang; Y.F. Leung, R. Chan and M. Zhang, "Computational Classification of Different Wild-Type Zebrafish Strains Based on Their Variation in Light-Induced Locomotor Response", *Computers in Biology and Medicine*, 2016, vol. 69, pp. 1–9.

[10] J. Wang, B. Cao, T.-R. Yu, **B. Jelfs**, J. Yan, R.H.M. Chan and Y. Li, "Theta-Frequency Phase-Locking of Single Anterior Cingulate Cortex Neurons and the Synchronization with the Medial Thalamus are Modulated by Visceral Noxious Stimulation in Rats", *Neuroscience*, 2015, vol. 298, pp. 200–210.

[11] L. Mu, J. Wang, B. Cao, **B. Jelfs**, R.H.M. Chan, X. Xu, M. Hassan, X. Zhang and Y. Li, "Impairment of Cognitive Function by Chemotherapy: Association with the Disruption of Phase-Locking and Synchronization in Anterior Cingulate Cortex", *Molecular Brain*, 2015, vol. 8, no. 32.

[12] **B. Jelfs** and D. Mandic, "Unifying Framework for Proportionate NLMS Algorithms and Their Adaptive Step-Size Variants", *International Journal of Adaptive Control and Signal Processing*, 2015, vol. 29, no. 9 pp. 1073–1085.

[13] **B. Jelfs**, M. Banaji, I. Tachtsidis, C.E. Cooper and C.E. Elwell, "Modelling Noninvasively Measured Cerebral Signals During a Hypoxemia Challenge: Steps Towards Individualised Modelling", *PLoS One*, 2012, vol. 7, no. 6:e38297.

[14] **B. Jelfs**, D. Mandic and S. Douglas, "An Adaptive Approach for the Identification of Improper Complex Signals", *Signal Processing*, 2012, vol. 92, no. 2, pp. 335–344.

[15] L. Li, Y. Xia, **B. Jelfs**, J. Cao and D. Mandic, "Modelling of Brain Consciousness based on Collaborative Adaptive Filters", invited paper *Neurocomputing, special issue from International Symposium on Neural Networks*, 2012, vol. 76, no. 1, pp. 36–43.

[16] Y. Xia, **B. Jelfs**, M. Van Hulle, J. Principe and D. Mandic, "An Augmented Echo State Network for Nonlinear Adaptive Filtering of Complex-Valued Real World Signals", *IEEE Transactions on Neural Networks*, 2011, vol. 22, no. 1, pp. 74–83.

[17] **B. Jelfs**, S. Javidi, P. Vayanos and D. Mandic, "Characterisation of Signal Modality: Exploiting Signal Nonlinearity in Machine Learning and Signal Processing", *Journal of Signal Processing Systems, special issue on Machine Learning for Signal Processing*, 2010, vol. 61, no. 1, pp. 105–115.

Book Chapters

[1] **B. Jelfs**, P. Vayanos, S.L. Goh and D. Mandic, "Collaborative Adaptive Filters for Online Knowledge Extraction and Information Fusion", in *Signal Processing Techniques for Knowledge Extraction and Information Fusion*, D. Mandic, et al. Eds., pp. 3–21, Springer, 2008.

[2] P. Vayanos, M. Chen, **B. Jelfs** and D. P. Mandic, "Exploiting Nonlinearity in Signal Processing: Qualitative Assessment of Adaptive Filtering Algorithms and Signal Modality Characterisation", in *Advances in Nonlinear Speech Processing (Lecture Notes in Computer Science)*, M. Chetouani et al. Eds., pp. 57–77, Springer 2007.

[3] **B. Jelfs**, P. Vayanos, M. Chen, S.L. Goh, C. Boukis, T. Gautama, T. Rutkowski, A. Kuh and D. Mandic, "An Online Method For Detecting Nonlinearity Within a Signal", in *Knowledge-Based & Intelligent Information & Engineering Systems (Lecture Notes in Computer Science)*, B. Gabrys, R.J. Howlett and L.C. Jain Eds., vol. 4253, pp. 1216–1223, Springer, 2006.

Peer Reviewed Conference Proceedings

[1] R. Viswanathan, A. Bingham, S. Raghav, S.P. Arjunan, **B. Jelfs**, P. Kempster and D.K. Kumar, "Normalized Mutual Information of Phonetic Sound to Distinguish the Speech of Parkinson's Disease" to appear in *Proc. International Conference of the IEEE Engineering in Medicine and Biology Society*, 07/2019.

[2] C. Gilliam and **B. Jelfs**, "Estimating Muscle Fibre Conduction Velocity in the Presence of Array Misalignment", in *Proc. Asia-Pacific Signal and Information Processing Association Annual Summit and Conference*, pp. 853–860, 11/2018.

[3] A. Bingham, **B. Jelfs**, S.P. Arjunan and D.K. Kumar, "Identifying Noisy Electrodes in High Density Surface Electromyography Recordings Through Analysis of Spatial Similarities", in *Proc. International Conference of the IEEE Engineering in Medicine and Biology Society*, pp. 2325–2328, 07/2018.

[4] C. Gilliam, A. Bingham, T. Blu and **B. Jelfs**, "Time-Varying Delay Estimation Using Common Local All-Pass Filters with Application to Surface Electromyography", in *Proc. IEEE International Conference on Acoustics, Speech and Signal Processing*, 841–845, 04/2018.

[5] S. Bhowmik, **B. Jelfs**, S.P. Arjunan and D.K. Kumar, "Outlier Removal in Facial Surface Electromyography through Hampel Filtering Technique", in *Proc. IEEE Life Sciences Conference*, pp. 258–261, 12/2017.

[6] Y. Li, **B. Jelfs** and R.H.M. Chan, "Entropy of Surface EMG Reflects Object Weight in Grasp-and-Lift Task", in *Proc. International Conference of the IEEE Engineering in Medicine and Biology Society*, pp. 2530–2533, 07/2017.

[7] W.K.Y. So, L. Yang, **B. Jelfs**, Q. Shi, S.W.H. Wong, J.N. Mak and R.H.M. Chan, "Cross-Frequency Information Transfer from EEG to EMG in Grasping", in *Proc. International Conference of the IEEE Engineering in Medicine and Biology Society*, pp. 4531–4534, 08/2016.

[8] X. Zhai, **B. Jelfs**, R.H.M. Chan and C. Tin, "Short Latency Hand Movement Classification Based on Surface EMG Spectrogram with PCA", in *Proc. International Conference of the IEEE Engineering in Medicine and Biology Society*, pp. 327–330, 08/2016.

[9] **B. Jelfs**, L. Li, C. Tin and R.H.M. Chan, "Fuzzy Entropy Based Nonnegative Matrix Factorization for Muscle Synergy Extraction", in *Proc. IEEE International Conference on Acoustics, Speech and Signal Procesing*, pp. 739–743, 03/2016.

[10] **B. Jelfs**, S. Zhou, B.K.Y. Wong, C. Tin and R.H.M. Chan, "Recruitment of Small Synergistic Movement Makes a Good Pianist", in *Proc. International Conference of the IEEE Engineering in Medicine and Biology Society*, pp. 242–245, 07/2015.

[11] **B. Jelfs**, J. Panovska-Griffiths, I. Tachtsidis, M. Banaji, and C. Elwell, "Individualised Optimisation of Modelled Cerebral Oxygenation Near-Infrared Spectroscopy Signals", in *Biomedical Optics, OSA Technical Digest*, paper JM3A.32, 04/2012.

[12] S. Javidi, **B. Jelfs** and D. Mandic, "Blind Extraction of Noncircular Complex Signals Using a Widely Linear Predictor", in *Proc. IEEE Workshop on Statistical Signal Processing*, pp. 501–504, 09/2009.

[13] **B. Jelfs**, Y. Xia, D. Mandic and S. Douglas, "Collaborative Adaptive Filtering in the Complex Domain", in *Proc. IEEE Workshop on Machine Learning for Signal Processing*, pp. 421–425, 10/2008.

[14] **B. Jelfs** and D. Mandic, "Signal Modality Characterisation Using Collaborative Adaptive Filters", in *Proc. IAPR Workshop on Cognitive Information Processing*, 06/2008.

[15] D. Mandic, P. Vayanos, S. Javidi, **B. Jelfs** and K. Aihara, "Online tracking of the degree of nonlinearity within complex signals", in *Proc. IEEE International Conference on Acoustic Speech and Signal Processing*, pp 2061–2064, 03/2008.

[16] **B. Jelfs**, D. Mandic and A. Cichocki, "A Unifying Approach to the Derivation of the Class of PNLMS Algorithms", in *Proc. International Conference on Digital Signal Processing*, pp. 35–38, 07/2007.

[17] **B. Jelfs**, D. Mandic and J. Benesty, "A Class of Adaptively Regularised PNLMS Algorithms", in *Proc. International Conference on Digital Signal Processing*, pp. 19–22 07/2007.

[18] D. Mandic, P. Vayanos, C. Boukis, **B. Jelfs**, S.L. Goh, T. Gautama and T. Rutkowski, "Collaborative Adaptive Learning Using Hybrid Filters", in *Proc. IEEE International Conference on Acoustics Speech and Signal Processing*, vol. III, pp. 921–924, 04/2007.

[19] M. Chen, T. Rutkowski, **B. Jelfs**, G. Souretis, J. Cao and D. Mandic, "Assessment of Nonlinearity in Brain Electrical Activity: A DVV Approach", in *Proc. RISP International Workshop on Nonlinear Circuits and Signal Processing*, pp. 461–464, 03/2007.

[20] **B. Jelfs** and D. Mandic, "Towards Online Monitoring of the Changes in Signal Modality: The Degree of Sparsity", in *Proc. IMA International Conference on Mathematics in Signal Processing*, pp. 29–32, 12/2006.

[21] F. Schlindwein, A. Boardman, S. Vali, N. Wright, **B. Jelfs**, S. Mauger, A. Das, J. Waugh, R. Pannerai and D. Evans, "Noninvasive Determination of Fetal Heart Rate & Short Term Heart Rate Variability Using Solely Doppler Ultrasound with Autocorrelation", in *Proc. International Conference on Medical Signal & Information Processing*, 09/2004.