Paulette Lieby PhD

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Education

1999	**Doctorate of Philosophy** (**Mathematics**) at the (formerly) Northern Territory University – now Charles Darwin University (CDU), DARWIN NT.
1994	**First Class Honours** in Mathematics & Computer Science at CDU.

Professional Profile

I am an experienced ICT research engineer with a 16 year career working in research environments. Before commencing my academic career, I held a great variety of roles in the public service and industry over a span of 14 years.

Over the 10 years 2004–2013 working with National ICT Australia (NICTA) –where I was twice promoted– I have developed strong and broad technical and relationship management skills; I have a proven ability in solving complex cross-disciplinary problems using creative and analytical approaches. I like operating at both the strategic and operational levels, and I am highly adaptable. I am seeking a position where I can display and broaden my technical and leadership skills.

Key Strengths

- Software development
- Researcher (Mathematics, Engineering, Medical Bionics)
- Work well under pressure
- Proactive and fast learner
- Academic lecturing
- Multi-skilled approach
- Leadership and mentorship
- Working within a team
- Project management
- Outcome focused
- Professional writing and communication
- Outreach activities and community engagement

Key Achievements

- Project Leader: Analysing MRI images in the context of Alzheimer's disease, which produced one software platform, two PhD theses, six research abstracts/papers.

- Project Coordinator: Simulated Bionic Vision to evaluate algorithms in the context of low vision. Outcomes were several software platforms and seven research abstracts/papers.

Brief Employment History

Jul 2014 – Jun 2015	**Research Engineer** with the Australian National University (ANU).
Jul 2011 – Oct 2013	**Principal Research Engineer** with National ICT Australia (NICTA), Canberra Laboratory (CRL).
2012	**Project Coordinator** for the *Simulated Prosthetic Vision Visual Acuity Trials*, for NICTA CRL and Bionic Vision Australia (BVA).
2011 – 2012	**Coordinator** of the NICTA CRL contribution to BVA.
Jun 2010 – 2011	**Project Coordinator** for the *Simulated Prosthetic Vision Human Mobility Trials*, for NICTA CRL and BVA.
Jul 2008	**Senior Research Engineer** with NICTA CRL.
2007 – Jul 2008	**Research Engineer** with NICTA CRL.
May 2006 – 2009	**Project Leader** for the *Automated Anatomical Structure Extraction for Diagnosis and Population Norms* project, CRL.
2004 – to-date	Part-time **Lecturer** for the College of Computer Science and Engineering the (CECS), ANU.
2004 – 2006	**Scientific Programmer** with NICTA CRL.
1999 – 2003	**Research Assistant/Associate** with the Magma Computational Algebra Group at the University of Sydney.
1997 – 1999	Part-time **Research Assistant** at the Menzies School of Health Research (Darwin).
1993 – 1997	**Associate Lecturer** and part-time **Tutor** in Mathematics and Computer Science (CDU).
1987 – 1990	**Programmer/Analyst - Programmer** at the National (PARIS) and Departmental (STRASBOURG) Headquarters of the French Postal Service.
1976 – 1986	**Public Servant** (French Postal Service), **Factory Worker** (France).

IT Technical Competencies

- – **Platforms**
    - - Linux: I have a 7 year experience of Ubuntu system administration.
    - - Windows and Mac literate (office tools and software development).

- – **Languages**
    - - High proficiency with C++/C (22 years+).
    - - High proficiency with bash scripting and awk.
    - - Good working knowledge of Python, Java, Cobol, Pascal, Basic, R (statistical programming), Magma (computational algebra software), and Matlab.
    - - Good working knowledge of cluster programming and cloud computing (OpenStack).
    - - Working knowledge of functional programming (Scheme), and of logic programming (Prolog).
    - - Working knowledge of Arduino programming.
    - - Working knowledge of Apache, PHP, HTML, and setting up a web server.

- – **Development framework**
    - - Good working knowledge of git, CMake, Doxygen, JIRA.
    - - Some experience with the agile methodology, the testing framework, the Jenkins integration server.

Referees available upon request.

(July 2014 – June 2015)

Project funded by the Australian Renewable Energy Agency (ARENA), an ANU and NICTA collaboration. Machine-learning-based forecasting of distributed solar enery production.

– **Engineering**
  - Imaging (Ubuntu) of several NUC boxes for full sky imaging.
  - Implementation and monitoring of image files transfer from these boxes.
  - Maintenance and development of camera capture code.
– **Research**
  - Photometric camera calibration.
  - Estimation of exposure times for an optimal high dynamic range image.
  - Deploying an optimal algorithm for high dynamic range image construction.

NICTA Research

Bionic Eye Project (VIBE) (late 2008 – October 2013)

Investigating how Computer Vision could help restore functional vision to wearers of the Bionic Vision Australia retinal implant.

– **Research**
  - Human mobility with simulated low vision
    - Assessing the impact of image processing techniques on human mobility performance.
    - Preliminary results from pilots presented to the Association for Research in Vision and Ophthalmology's (ARVO) 2011 conference and to the 2011 Vision Sciences Society (VSS) conference [11, 12].
    - Descriptive of trial and software presented at the IEEE Engineering in Medicine and Biology Society (EMBC) conference [10].
    - Full studies in 2012, with first results presented at ARVO 2012 [7, 8, 9].
  - Visual acuity trial with simulated low vision
    - Assessing the impact of image processing techniques on the visual acuity performance.
    - One study in 2012, with results presented at ARVO 2013 [6].
  - Simulation of the visual pathway under electrical retinal stimulation
    - Built a first model to align with experimental data obtained by the Visual Sciences Group, RSBS, ANU.
– **Human Mobility trials**
  - Leadership
    - Project coordinator June 2010 – 2011.
    - Hired and trained research assistants (20+); oversaw all implementation details; monitored the proper conduct of the studies.
    - With collaborators, drafted a full set of protocols and ensured that the trials were conducted in accordance with the human ethics proposal submitted to the ANU Research Office.
    - Ran one pilot ($n = 4$) in November 2010, two pilots ($n = 11$ and $n = 3$) and three studies ($n = 11, 4$ and 2 respectively) in 2011.
  - Software
    - With two research engineers under my supervision, delivered the software platform (simulation of prosthetic vision) for the trials.
    - Ensured the code integrity for the Human Mobility trials.
    - Also developed specialist software for randomised generation of the trials.
    - Performed some of the statistical analysis.

Bionic Eye Project (VIBE) (late 2008 – October 2013)

- **Visual Acuity trials**
  - Project coordinator (2012) with collaborators for ethics and methodology, research, and software.
  - Wrote the software interface for the trials and the scripts for a completely automated data collection.
  - Performed the statistical analysis.
- **The Vibromat: a study in sensory substitution**
  - Mentorship of the student implementing the hardware.
  - Oversaw the development of the project documentation (validation and verification, software and hardware journals).
  - Wrote the software interface.
- **Software Pipeline for Bionic Vision Australia (BVA)**
  - Closely involved in integration work across three distinct BVA teams.
  - Consisted of establishing and maintaining effective working relationships, as well as enabling technical integration [5].

Bionic Eye Project (VIBE) (late 2008 – 2012)

- **Supervision** of three research engineers:
  - Oversaw the development of a linux image and environment to provide all VIBE staff with a standardised development environment.
  - Oversaw the development of a robust, modular, traceable software platform:
    - The platform is the core on which research modules are integrated,
    - The platform is the tool to which we build interfaces to enable cross-discipline collaboration and impact.
- **Relationship with Bionic Vision Australia (BVA)**
  - Outcomes and financial reporting to BVA.
  - Participated in milestones discussion.
  - Involved in the BVA-Boston Retinal Implant Project joint discussion to establish international guidelines for visual function testing for implantees.
  - I was a party in writing up the VIBE project proposal engaging BVA.

Automated Anatomical Structure Extraction for Diagnosis and Population Norms Project (AASEDP) (2005 – 2009)

Analysis of MRI brain images to aid in the early diagnosis of Alzheimer's disease.

- **Project Leader** (two PhD students and two part-time researchers).
- Shape analysis of the hippocampus for early detection of Alzheimer's disease.
- AASEDP server setup and management: server hosts data and software for access to team members (approx. 2TB):
  - Software engineering with research code development;
  - Data management: data consists of approximately 1300 Magnetic Resonance Imaging (MRI) scans and their corresponding hand-tracings;
  - Data processing and statistical analysis (using scripts developed to that end).
- Own research:
  - 3D shape extraction as a genus zero voxel-based mesh ([18]).
  - Scale-space localised analysis of surface shape index ([13]).
- Significant results:
  - Ability to discriminate for sex on the basis of shape alone ([16, 15]);
  - Ability to discrimate for pathology (AD) on the basis of shape alone ([14]).
  - A new shape descriptor to predict memory decline in young-old adults ([13]).

Other

Teaching

2007 – to-date	–	Part-time lecturer in Graph Algorithms and Complexity Theory (COMP1140 & COMP4600), College of Computer Science and Engineering (CECS), Australian National University (ANU).
2004 & 2010	–	Part-time lecturer in Advanced Algorithms (Honours level), CECS, ANU.
1997	–	Tutor in Mathematics and Computer Science, Charles Darwin University (CDU): Graph Theory, Programming in C++, Technical Communication.
1996	–	Lecturer in Information Technology, CDU: Fundamentals of Information Technology.
	–	Tutor in Programming (Cobol and C), and in Fundamentals of IT.
1995	–	Tutor in Mathematics and Computer Science, CDU: Introduction to Discrete Mathematics, Number Theory, Programming in C/C++.
1994	–	Tutor in Discrete Mathematics, CDU .
	–	Co-Author, with I. Roberts, CDU, of "Tutorials in Logic", a booklet intended for students from a non-English speaking background.

Student Supervision

2011	One PhD student, CECS and NICTA.
2009	Two PhB (Bachelor of Philosophy) students, CECS.
2007	Two Honours students, CECS, and Centre for New Media Arts, ANU.
2005 – 2010	Two PhD students, CECS and NICTA; theses submitted and accepted.
2004 – 2007	One PhD student, CECS, thesis submitted and accepted.

Administration/Other

2011 – 2013	Supervised the student developing the Vibromat hardware.
2011 – 2013	Supervised three research engineers and three casual programmers.
2011	Supervised 7 research assistants and 13+ technical assistants.
2009 – 2013	Various outreach activities, in particular for the National Youth Science Forum (2012 and 2013).
2011 – 2012	Oversaw the purchase of computer hardware for VIBE.
2011 – 2012	Coordinator for the BVA Visual Acuity trials.
2011 – 2012	Coordinator for the NICTA CRL contribution to BVA.
2010 – 2011	Coordinator for the BVA Human Mobility trials.
2009 – 2012	Various admin support (e.g. milestones and IT) to VIBE and BVA.
2006 – 2009	Project leader, AASEDP.
2009 – 2012	Member of the IT Steering Group Committee.
2004 – 2013	Fire warden, member of the Work Health and Safety Committee, member of the Affirmative Action Group Committee.

Magma Computational Algebra Group (1999 – 2003)

– Implementation of several flow algorithms and their application to general connectivity [19].
– Implementation of a very simple linear graph planarity tester and linear obstruction isolator (copyright The University of Sydney, distributed with the `nauty` package, `http://pallini.di.uniroma1.it/`)
– Implementation of the Hopcroft & Tarjan linear triconnectivity tester and splitting algorithm.
– Implementation of fast generic algorithms for group structure and discrete log computation in abelian groups.
– Implementation of a fast algorithm that computes the solution to a conic with almost no factorization.
– Implementation of the Weil-Pairing computation for elliptic curves.
– Implementation of a fast algorithm for computing the height of an elliptic curve without factorization.

Theses

Postgraduate Program (1995 - 1999)

Thesis title: *Extremal Problems of Finite Sets.*
The thesis investigated and proved a fundamental result required to solve the following problem:
Given an antichain $\mathcal{A}$ over a set $\{1, \ldots, n\}$ and with total number of elements $V = \sum_{A \in \mathcal{A}} |A|$ does there exist an antichain $\mathcal{B}$ over $\{1, \ldots, n\}$ of size $|\mathcal{B}| = |\mathcal{A}|$ and with total number of elements V such that any set $B \in \mathcal{B}$ has size k or $k + 1$ for some k?
See [20, 22].

Bachelor of Science, Mathematics and Computer Science (Honours) (1994)

– Major thesis on a combinatorial problem (*The Separation Problem*).
The thesis consisted of a literature survey and some original research which investigated one necessary condition for the existence of separating systems. This investigation then led to the conjecture explored and partially solved in the PhD thesis.
– A minor thesis on Modal Logic (*From Modal Logic to Temporal Logic*, *TR 1-95*, 1994, School of IT, Faculty of Science, Northern Territory University).

Selected Publications

[1] C. McCarthy, J.G. Walker, P. Lieby, A.F. Scott, and N. Barnes. Mobility and low contrast trip hazard avoidance using augmented depth. Accepted for publication in *Journal of Neural Engineering*, 2015.

[2] H.C. Stronks, P. Lieby, D. Parker, J.G. Walker, and N. Barnes. The Feasibility of Coin Motors for Use in a VibroTactile Display for the Blind. Accepted for publication in *Artificial Organs*, 2015.

[3] H.C. Stronks, P. Lieby, D. Parker, J.G. Walker, and N. Barnes. The feasibility of vibration motors for a tactile display for the blind. In *ARVO*, 2014.

[4] N. Barnes, A.F. Scott, A. Stacey, C. McCarthy, P. Lieby, L.N. Ayton, M.A. Petoe, N.C. Sinclair, M.N. Shivdasani, and J.G. Walker. Lanczos2 Image Filtering Improves Performance on Low Vision Tests in Implanted Visual Prosthetic Patients. In *ARVO*, 2014.

[5] M.A. Petoe, C.D. McCarthy, N.C. Sinclair, M.N. Shivdasani, P. Lieby, A.F. Scott, A. Stacey, N.M. Barnes, and P. Blamey. Optimising Electrode Stimulation and Image Processing Parameters in a Suprachoroidal Retinal Prosthesis using a pattern Recognition Task. In *Medical Bionics*, 2013.

[6] P. Lieby, N. Barnes, C. McCarthy, A.F. Scott, A. Stacey, and J.G. Walker. Evaluating Lanczos2 Image Filtering for Visual Acuity in Simulated Prosthetic Vision. In *ARVO*, 2013.

[7] N. Barnes, J.G. Walker, C. McCarthy, V. Botea, A.F. Scott, H. Dennett, and P. Lieby. Evaluating Depth-based Visual Representations For Mobility In Simulated Prosthetic Vision. In *ARVO*, 2012.

[8] P. Lieby, N. Barnes, C. McCarthy, A.F. Scott, V. Botea, and J.G. Walker. Mobility Experiments Using Simulated Prosthetic Vision With 98 Phosphenes Of Limited Dynamic Range. In *ARVO*, 2012.

[9] C. McCarthy, P. Lieby, J.G. Walker, A.F. Scott, V. Botea, and N. Barnes. Low Contrast Trip Hazard Avoidance using Simulated Prosthetic Vision. In *ARVO*, 2012.

[10] P. Lieby, N. Barnes, C. McCarthy, N. Liu, H. Dennett, J.G. Walker, V. Botea, and A.F. Scott. Substituting depth for intensity and real-time phosphene rendering: Visual navigation under low vision conditions. In *EMBC*, 2011.

[11] N. Barnes, P. Lieby, H. Dennet, C. McCarthy, N. Liu, and J.G. Walker. Mobility experiments with simulated vision and sensory substitution of depth. In *ARVO*, 2011.

[12] N. Barnes, P. Lieby, H .Dennet, J.G. Walker, C. McCarthy, N. Liu, and Y. Li. Investigating the role of single-viewpoint depth data in visually-guided mobility. In *VSS*, 2011.

[13] N. Cherbuin, P. Lieby, N. Barnes, C. Meslin, J.J. Maller, P.S. Sachdev, K.J. Anstey. The new measure of hippocampal surface is a better predictor of memory change in young-old adults than raw volume (abstract). *NeuroImage*, 47:S39–41, 2009.

[14] L. Zhou, P. Lieby, N. Barnes, R. Hartley, C. Réglade-Meslin, J. Walker. Hippocampal Shape Analysis for Alzheimer's Disease Using an Efficient Hypothesis Test and Regularized Discriminative Deformation. *Hippocampus*, 19:533–540, 2009.

[15] L. Zhou, R. Hartley, L. Wang, P. Lieby, N. Barnes. Regularized Discriminative Direction for Shape Difference Analysis. In *Medical Image Computing and Computer Assisted Intervention MICCAI*, pages 628–635, 2008.

[16] L. Zhou, R. Hartley, P. Lieby, N. Barnes, K. Anstey, N. Cherbuin, P. Sachdev. A Study of Hippocampal Shape Difference Detween Genders by efficient hypothesis test and discriminative deformation. In *Medical Image Computing and Computer Assisted Intervention MICCAI*, pages 375–383, 2007.

[17] P. Xiao, N. Barnes, T. Caetano, and P. Lieby. An MRF and Gaussian curvature based shape representation for shape matching. In *IEEE Computer Society Conference on Computer Vision and Pattern Recognition CVPR; IEEE International Workshop on Beyond Multiview Geometry: Robust Estimation and Organization of Shapes from Multiple Cues*, 2007. (no pagination) on CD rom.

[18] P. Lieby, N. Barnes, and B.D. McKay. Topological Repair on Voxel-Based Quadrangular Meshes. Mathematical Foundations of Computational Anatomy, MICCAI 2006 Workshop Proceedings, 2006, 146–155.

[19] P. Lieby. *Colouring Planar Graphs*, in Discovering Mathematics with Magma, Reducing the Abstract to the Concrete, John Cannon and Wieb Bosma (eds). *Algorithms and Computation in Mathematics*, A.M. Cohen, H. Cohen, D. Eisenbud, B. Sturmfels (eds), Springer, 19, 2006.

[20] P. Lieby. Antichains on Three Levels. *The Electronic Journal of Combinatorics*, 11(R50), 2004. Available at `http://www.combinatorics.org/`.

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[22] L. Brankovic, P. Lieby, and M. Miller. Flattening Antichains with Respect to the Volume. *The Electronic Journal of Combinatorics*, 1(R1), 1999. Available at `http://www.combinatorics.org/`.

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