Chas Nelson

Computational Microscopy and Bioimage Analysis

Research Interests

Computational Microscopy, The development and adaptation of bioimaging technologies at the hardware-software-wetware interface designed to provide answers to specific biological questions.

Bioimage Analysis, State-of-the-art image processing & analysis, including machine learning solutions, to extract quantitative answers from complex, muilti-dimensional bioimaging data.

Education

2013–2017 **PhD in Computer Science**, *Durham University*, Durham, UK.
Mathematical Morphology for Quantification in Biological & Medical Image Analysis

2009–2013 **Master of Science**, *Durham University*, Durham, UK, *First Class Honours*.
Biology & Physics within the Natural Sciences Programme

PhD Thesis

Title *Mathematical Morphology for Quantification in Biological & Medical Image Analysis*

Supervisor Dr. Boguslaw Obara

Description - Segmentation - Object Detection - Signal Processing - MATLAB - Java
- Developing, validating & disseminating image analysis & processing solutions
- Vesel enhancement based on morphological operations
- Automated and accurate nuclei detection in fluorescent micrographs
- Brain vasculature segmentation and aneurysm highlighting in MRA images

Masters Thesis

Title *The Scratch Wound Assay: Scratching Away at Cancer with Image Analysis*

Supervisor Professor Chris Hutchison

Description - Phase Contrast Microscopy - Fluorescence Microscopy - Segmentation - Shape Analyses
- Developed a scratch wound assay analysis solution capable of tracking individual cells & of analysing wound area

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Experience

Key Experiences

2016 **Strategy & Policy Intern**, Biotechnology and Biological Sciences Research Council (BBSRC), Swindon, UK.

- part of the Exploiting New Ways of Working science strategy group
- contributed to the BBSRC UK-wide direction & strategy for bioimaging and related technologies
- produced the public BBSRC Review of Bioimaging
- developed quantitative & qualitative data analysis along with exciting visualisations
- delivered findings at various high-profile meetings, *e.g.* with members of BIS, the UK governmental department in charge of science research funding

2016 **Senior Researcher**, Durham Bioimage Informatics Laboratory, School of Engineering and Computing Sciences, Durham, UK.

- Led independent research projects both central to my PhD and as part of collaborations with other academics and industrial partners
- Involved in other research projects within the group with major contributions across the board
- Helped to build the Durham Bioimage Informatics Laboratory through recruitment, retainment and training of young, enthusiastic researchers
- Integrated various research tools into the laboratory, including communication, versions and collaborative tools

Key Responsibilities

2015–Current **Trustee**, Ustinov College Graduate Common Room, Durham, UK.

- Trustee of a registered charitable body (no. 1164865)
- Part of Durham's historic listed collegiate system, one of only three such systems in the UK
- Ensured charity carried out its purpose for the benefit of the college members
- Complied with charity law and The Charity Commission
- Ensured accountability of the charity and its executive board

2016–Current **Founding Director** · **Chief Financial Officer**, intogral limited, Durham, UK.

- Founding director of intogral limited, a Durham University spin-out
- Intogral limited delivers advanced image analysis solutions to customers across the world
- Play a key strategic & management role as interim Chief Financial Officer
- Heavily involved in state-of-the-art research & development within the technical team

2013–Current **Student-Staff Consultative Committee (Research) Chair** · **Member**, School of Engineering & Computing Sciences, Durham, UK.

- Chair and member of school committee dealing with student and staff issues relating to research and research students

Other Research Experience

2016–Current **Researcher & Member**, Teeside Aneurysm Group, North East England, UK.

- Member of the Teeside Aneurysm Group, a collaborative team aiming to bring together research from multiple disciplines
- Research aims to collate multiple predictive factors to improve the understanding, diagnosis and treatment of aneurysms
- Leading image processing and analysis into MRI data for detection, measurement and characterisation of aneurysms and the wider brain vasculature

2015–Current **Founder Vision Journal Club** · **Junior Seminars Chair**, School of Engineering & Computing Sciences, Durham, UK.

- Founded the Vision Journal Club to help postgraduates develop their critical analysis skills
- The club focusses on image processing, computer vision & visualisation papers
- Chair the club, organising papers & leading discussions
- Chaired the Computer Science Junior Seminar series of lectures
- Invited speakers & organised sessions across various areas of interest

2014–Current **Junior Fellow · Steering Committee**, Biophysical Sciences Institute, Durham, UK.
- Awarded Junior Fellowship to Durham University's Biophysical Sciences Institute
- Motivated other students to be involved in interdisciplinary science
- Engaged in the Biophysical Sciences Institute Steering Committee

2013 **iARC Research Intern**, Institute for Advanced Computing, Durham, UK.
- delivered publication quality research on 3D active mesh segmentation[2]

2012 **MURN Researcher**, Matariki Undergraduate Research Network, Durham, UK.
- established a global research plan into interdisciplinary science in teaching & research
- produced an internal report for Durham University that has been used for internal strategy
- collaborated with a global team including researchers from Australia and New Zealand
- undertook training in qualitative research & education research

Teaching & Education Experience

2016 **Bioimage Analysis Lecturing**, School of Biological & Biomedical Sciences, Durham, UK.
- Lectured on Bioimage Analysis as part of level 3/4 undergraduate course *Biological Imaging*
- Developed digital imaging & image analysis curriculum & content for multidisciplinary cohort

2016–Current **Undergraduate Co-Supervisor**, School of Engineering & Computing Sciences, Durham, UK.
- Supervised the undergraduate level 3 research projects of two students
- Designed a coherent research programme looking at automated aneurysm detection in MRA data
- Led research into feature extraction, graph extraction, graph analyses and object detection
- Guided students through experimental design, literature analyses, research and reporting

2014–Current **Senior Teaching Demonstrator · Teaching Demonstrator**, School of Engineering & Computing Sciences, Durham, UK.
- Teaching demonstrator for level 1 undergraduate course *Computational Thinking*
- Enhanced self-led learning of students of the python language
- Redeveloped curriculum and content for level 1 undergraduate course *Computational Thinking*, a introductory Python programming course
- Introduced the use of PeerWise for formative student-led feedback and assessment

2015 **Postgraduate Continuing Professional Development Seminar Series Coordinator**, School of Engineering & Computing Sciences, Durham, UK.
- Developed a curriculum of CPD topics, *e.g.* delivering a conference talk, for the PhD cohort
- Delivered a seminar on the wide range of visualisation a plotting tools available to students

2014–2015 **Student Mentor**, School of Engineering & Computing Sciences, Durham, UK.
- Supervised undergraduate research project of students
- Supervised a visiting masters student from Cracow University of Technology, Poland
- Guided students through experimental design, literature analyses, research and reporting
- Students achieved a strong grades and went on to do further research

2014 **Practical Instructor**, Advanced Training Course in Fluorescence Microscopy for Environmental Researchers, Essex, UK.
- Instructor for a session on image analysis in fluorescence microscopy

Awards, Grants & Honours

2016 Wolfson Research Institute Small Grants Award (£2000)

2015 1st place Images of Technology @ Durham 2015

2014 Biophysical Sciences Institute Junior Fellowship
Awarded to researchers with significant experience in interdisciplinary life science research

2013 EPSRC PhD Studentship (3.5 years; £19,126 *per annum*)

2013 Institute for Advanced Computing Research Grant (£2000)

2013 Honor Fell/Company of Biologists Travel Award
Full registration and accommodation costs at the BSCB-BSDB Joint Spring Meeting

2012 Matariki Undergraduate Research Network Research Grant (£2000)

Publications

Peer-Reviewed Papers and Proceedings

2017 **Carl J. Nelson**, Philip T. G. Jackson, and Boguslaw Obara. Ellipse Detection by Hilbert-Edge Detection and Ranging (HEDAR). *Pattern Recognition*, Submitted

2017 Chris G. Willcocks, Philip T. G. Jackson, **Carl J. Nelson**, Amar V. Nasrulloh, and Boguslaw Obara. Interactive GPU Active Contours for Segmenting Inhomogenous Objects. *The Journal of Real Time Image Processing*, Submitted

2017

- Fifth highest ranked computer vision journal

2016 Chris G. Willcocks, Philip T. G. Jackson, **Carl J. Nelson**, and Boguslaw Obara. Extracting 3D Helix Curves from 2D Images of Helical Objects. *IEEE Transactions in Pattern Analysis and Machine Recognition*, 2016

- Highest ranked computer science journal

2015 **Carl J. Nelson**, Patrick Duckney, Timothy J. Hawkins, Michael J. Deeks, P. Philippe Laissue, Patrick J. Hussey, and Boguslaw Obara. Blobs and curves: object-based colocalisation for plant cells. *Functional Plant Biology*, 42:471–485, 2015

2015 Philip T. G. Jackson, **Carl J. Nelson**, Jens Schiefele, and Boguslaw Obara. Runway detection in High Resolution remote sensing data. In *Image and Signal Processing and Analysis (ISPA), 2015 9th International Symposium on*, pages 170–175, Sept 2015

2014 **Carl J. Nelson**, Martin Dixon, Pierre Philippe Laissue, and Boguslaw Obara. Speeding up active mesh segmentation by local termination of nodes. In *Medical Image Understanding and Analysis*, London, UK, 9–11 July 2014. with Poster

Selected Presentations, Posters and Abstracts

2016 **Carl J. Nelson**, Chris G. Willcocks, Philip T. G. Jackson, P. Philippe Laissue, and Boguslaw Obara. Application of High-Speed Level Set Segmentation to Light Sheet Fluorescence Microscopy. In *LSFM 2016*, Sheffield, UK, September 2016. Presentation

2014 **Carl J. Nelson** and Boguslaw Obara. A Bioimage Informatics QVEST: Quick, Versatile and Easy Segmentation & Tracking System. In *Society for Experimental Biology Manchester 2014*. SEB, July 2014. Poster and Short Presentation

2013 **Carl J. Nelson**, Tim J. Hawkins, Michael J. Deeks, Martin W. Goldberg, Roy A. Quinlan, Patrick J. Hussey, and Boguslaw Obara. TANGL: Bioimage Informatics Tools for Analysis of 3D/4D Network Geometries for Life Sciences. In *Actin 2013*, December 2013. Poster

Professional Bodies

2016–Current	Associate Member of the Royal Society of Biology, AMRSB
2016–Current	Member of the Royal Microscopical Society
2016–Current	Member of the European Microscopy Society
2014–Current	Member of the Society for Experimental Biology
2013–Current	Member of the British Society for Cell Biology
2011–Current	Associate Member of Institute of Physics, AMInstP

Technical Skills

Strong	Image Analysis · MATLAB · Python · git · LaTeX
Comfortable	Java · Cell & Tissue Culture · Light Microscopy · Laboratory Techniques
Intermediate	C · CMake · Optics · Instrumentation Engineering

Interests

- Cocktails
- Tea & Coffee
- Cooking
- Crime Novels
- Fantasy Fiction
- DIY Technology
- Woodwork
- Orchard Fruit
- Livestock