

# CHRISTOPHER PHILIP BRIDGE, D.Phil.

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Citizenship: British

Last Updated: February, 2020

## EMPLOYMENT HISTORY

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- **MGH & BWH Center for Clinical Data Science** **Boston, MA, USA**
  - Data Science Innovation Fellow* 2017 – 2018
  - Machine Learning Scientist* 2018 – 2020
  - Senior Machine Learning Scientist* 2020 – Present

The CCDS was recently founded at Massachusetts General Hospital (MGH) and Brigham and Women's Hospital (BWH) with the aim of leveraging the medical expertise and clinical data available at the hospitals in order to bring latest advances in artificial intelligence into clinical practice. I work with clinicians to develop deep learning models for analysis of data within a range of medical specialisms, and conduct and enable original research into deep learning for healthcare.

Projects include:

  - Detection and quantification of acute ischemic stroke in diffusion-weighted MRI
  - Body composition analysis from abdominal and thoracic CT
  - Hemorrhagic stroke detection and classification from non-contrast head CT
  - Automatic generation of aligned maximum intensity projections MIPs from head CT angiography
  - Brown fat detection in PET/CT
  - Development of internal software libraries for deep learning and data processing
- **Department of Engineering Science, University of Oxford** **Oxford, UK**
  - Laboratory Demonstrator* 2014 – 2016

I demonstrated for several undergraduate and postgraduate laboratory sessions in the area of biomedical image analysis, covering image segmentation and registration, and machine learning.
- **Selex Galileo (now part of Leonardo-Finmeccanica)** **Basildon, UK**
  - Software and Hardware Engineering Summer Placement Student* 2010 – 2012

Selex is an international company providing electronic solutions in a range of sectors including defence, aerospace, space and security. I undertook three summer work placements within software and electronic engineering at the company during the course of my undergraduate degree, each of around 10 weeks.

## EDUCATION

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- **University of Oxford, Balliol College** **Oxford, UK**
  - D.Phil., Engineering Science* 2013 – 2017
  - Thesis title: *Computer-Aided Analysis of Fetal Cardiac Ultrasound Videos*
  - Supervisor: Prof. Alison Noble, Associate Head of Mathematical, Physical & Life Sciences Division
  - Thesis examiners: Prof. Alejandro Frangi (University of Sheffield), Prof. Vicente Grau (University of Oxford)
  - EPSRC Doctoral Training Award – provides full tuition fees and living stipend
  - IET Travel Award 2015 – for travel to the International Symposium on Biomedical Imaging
- **University of Cambridge, Pembroke College** **Cambridge, UK**
  - M.Eng. (Distinction), Engineering* 2012 – 2013
  - B.A. (First Class Honours), Engineering* 2009 – 2012
  - Specialism in Information and Computer Engineering
  - AT&T Laboratories Prize for best overall final year performance in Electrical and Information Sciences (2013)
  - First class honours in every set of university examinations, and the research project

- Information Division prize for Best Research Presentation (2013)
- Pembroke College Scholarship (2010), Foundation Scholarship (2011, 2012), College Prize (2010, 2011, 2012), and Ronald Wynn Prize (2013), all for examination performance
- IET National Electronics Council Scholarship (2009 – 2013)

## RESEARCH EXPERIENCE

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- **Doctoral Research**

*Institute of Biomedical Engineering, University of Oxford*

My doctoral research focused on medical ultrasound video imagery, and in particular I applied techniques from Computer Vision and Machine Learning to develop software tools to assist diagnostic procedures. I built statistical models that leverage spatial and temporal context to recognise structures, viewing planes and other variables of interest in ultrasound scan videos of the fetal heart fully automatically and at real-time speeds. More information can be found on my personal website at <https://chrisbridge.science>.

- **Masters Research**

*Cambridge University Engineering Department, University of Cambridge*

My *M.Eng.* project, supervised by Dr. Andrew Gee in the Medical Imaging Group, focused on investigating and improving an existing registration methodology for femur surfaces obtained from *in vivo* computed tomography scans. I contributed to the wxRegSurf tool, which is available online at <http://mi.eng.cam.ac.uk/~ahg/wxRegSurf/>.

## PUBLICATIONS

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For an up-to-date list, please visit <https://chrisbridge.science/publications>.

### Journal & Conference Papers

- R. Gauriau, **C.P. Bridge**, L. Chen, F. Kitamura, N.A. Tenenholtz, J.E. Kirsch, K.P. Andriole, M.H. Michalski, and B.C. Bizzo, "Using DICOM metadata for radiological image series categorizations: a feasibility study on large clinical brain MRI datasets", *Journal of Digital Imaging* (to appear)
- **C.P. Bridge**, M. Rosenthal et al., "Fully-Automated Analysis of Body Composition from CT in Cancer Patients Using Convolutional Neural Networks", *Workshop on Clinical Image-Based Procedures (CLIP), MICCAI*, Granada 2018
- W. Huang, **C.P. Bridge**, J.A. Noble, and A. Zisserman, "Temporal HeartNet: Towards Human-Level Automatic Analysis of Fetal Cardiac Screening Video", *MICCAI*, Québec City 2017, pp. 341–349
- **C.P. Bridge**, C. Ioannou and J.A. Noble, "Localizing Cardiac Structures in Fetal Heart Ultrasound Video", *Machine Learning in Medical Imaging Workshop, MICCAI* 2017, pp. 246–255
- M.A. Maraci, **C.P. Bridge**, R. Napolitano, A. Papageorghiou, and J.A. Noble, "A Framework for Analysis of Linear Ultrasound Videos to Detect Fetal Presentation and Heartbeat", *Medical Image Analysis* 37, April 2017, pp. 22–36
- V. Sundaresan, **C.P. Bridge**, C. Ioannou, and J.A. Noble, "Automated Characterisation Of The Fetal Heart In Ultrasound Images Using Fully Convolutional Neural Networks", *IEEE International Symposium on Biomedical Imaging*, Melbourne, April 2017, pp. 671–674
- **C.P. Bridge**, C. Ioannou, and J.A. Noble, "Automated Annotation and Quantitative Description of Ultrasound Videos of the Fetal Heart", *Medical Image Analysis* 36, February 2017, pp. 147–161
- **C.P. Bridge** and J.A. Noble, "Object Localisation In Fetal Ultrasound Images Using Invariant Features", *Proceedings of the IEEE International Symposium on Biomedical Imaging*, New York City, 2015

### Conference Abstracts

- G.P. Biondetti, R. Gauriau, C. Lu, **C.P. Bridge**, and K.P. Andriole, "Name the Manufacturer: A Simple Experiment to Show Image Acquisition Bias When Training Deep Learning Models", *Society for Imaging Informatics in Medicine Annual Meeting*, Austin 2020 (to appear)
- M.D. Herrmann, A. Fedorov, S. Pieper, S.W. Doyle, **C.P. Bridge**, D. Clunie, and J.K. Lennerz, "Highdicom - High-Level DICOM Abstractions for the Python Programming Language to Encode Image-Derived Annotations and Machine Learning Outputs in Standard Format", *Society for Imaging Informatics in Medicine Annual Meeting*, Austin 2020 (to appear)

- K. Magudia, **C.P. Bridge**, F.J. Fintelmann, K. Andriole, and M. Rosenthal, "CT-based Body Composition Analysis: Comparison of Single-slice Versus Multi-slice Averaging for Estimation of Change Over Time", *Society of Abdominal Radiology Annual Meeting, Maui 2020* (to appear)
- K. Magudia, **C.P. Bridge**, M. Walters, A. McCarthy, M. Michalski, K. Andriole, M. Rosenthal, "The Trials and Tribulations of Assembling Large Datasets for Machine Learning Applications", *Society for Imaging Informatics in Medicine Annual Meeting, Denver 2020*
- K. Magudia, **C.P. Bridge**, C.P. Bay, N. Tenenholtz, A. Babic, K.P. Andriole, B. Wolpin, M. Rosenthal, "Fully Automated Analysis of Body Composition from Routine Clinical Abdominal CT is Associated with Overall Survival in an Unselected Outpatient Population", *Society of Abdominal Radiology Annual Meeting, Orlando 2019*
- K. Magudia, **C.P. Bridge**, C.P. Bay, N. Tenenholtz, A. Babic, K.P. Andriole, B. Wolpin, M. Rosenthal, "Fully Automated Analysis of Body Composition from Routine Clinical Abdominal CT: Quality Assurance and Failure Analysis", *Society of Abdominal Radiology Annual Meeting, Orlando 2019*
- B. Bizzo, **C.P. Bridge**, R. Gauriau, W. Wiggins, M.T. Caton, J. Hillis, B. Wright, N.A. Tenenholtz, K.P. Andriole, M. Michalski, "Deep Learning for Acute Ischemic Stroke on Diffusion MRI: Performance Analysis in a Consecutive Cohort", *International Stroke Conference, Honolulu 2019*
- B. Bizzo, **C.P. Bridge**, S. Pedemonte, B. Wright, R.R. Almeida, S. Doyle, M. Walters, N. Tenenholtz, A. McCarthy, S. Pomerantz, K. Andriole, R. Gonzalez, M. Michalski, "Deep Learning for Acute Ischemic Stroke on Diffusion-Weighted MR Imaging", *Radiological Society of North America (RSNA) Annual Meeting, Chicago 2018*
- M.A. Maraci, **C.P. Bridge**, J.A. Noble, C. Aye, M. Molloholli, R. Napolitano, A.T. Papageorghiou, "Towards automating the ISUOG 'six-step basic ultrasound' scan", *Abstracts of the 25th World Congress on Ultrasound in Obstetrics and Gynecology, Montreal 2015*

## PROFESSIONAL ACTIVITIES

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### Peer Review:

- International Conference on Medical Image Computing and Computer Assisted Intervention (MICCAI). Reviewer Commendation 2018
- International Conference on Medical Imaging with Deep Learning (MIDL)
- IEEE Transactions on Medical Imaging
- PLoS One
- NeurIPS Machine Learning for Health (ML4H) workshop

### Professional Memberships:

- Institute of Electrical and Electronics Engineers (IEEE) 2015 – present
- Medical Image Computing and Computer Assisted Intervention (MICCAI) Society 2017 – present

### Lectures:

- Guest Lecture, *Unsupervised Learning in Medical Image Analysis*, Foundations of Machine Learning Lecture Series, Harvard Medical School, 2019

## SKILLS

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**Computing:** Python (experienced, including SciPy stack and OpenCV, Tensorflow and Keras deep learning frameworks), C++ (experienced, including C++11, OpenGL, OpenCV, OpenMP, Boost and Eigen libraries), MATLAB (competent, including Image Processing, Optimisation and Computer Vision toolboxes), bash (competent), Docker, GPU programming with CUDA and associated libraries, Linux-based operating systems,  $\LaTeX$ , Git