James M. Brown, Ph.D

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Education

Sep 2011 –
Sep 2015

Ph.D. Physical Sciences of Imaging in the Biomedical Sciences (PSIBS)
University of Birmingham, UK
Thesis: *Articulated Statistical Shape Models for the Analysis of Bone Destruction in Mouse Models of Inflammatory Arthritis*
Supervisors: Amy Naylor[†], Iain Styles[§], Andrew Filer[†], Ela Claridge[§]
[†]Institute of Inflammation and Ageing, [§]School of Computer Science

Sep 2010 –
Sep 2011

M.Sc. Physical Sciences of Imaging in the Biomedical Sciences (PSIBS)
University of Birmingham, UK
Awarded distinction

Sep 2007 –
July 2010

B.Sc. (Hons) Computer Science
University of Birmingham, UK
Class I

Elective modules: Computational Vision, Natural Computation, Graphics, Models of Computation, Principles of Programming Languages, Intelligent Robotics

Research experience

Feb '19 –
present

Senior Lecturer in Computer Science | University of Lincoln, UK
Laboratory of Vision Engineering (LoVE)

Feb 17 –
December '18

Research Fellow | Athinoula A. Martinos Center for Biomedical Imaging
Quantitative Tumor Imaging @ Martinos (QTIM) & Center for Machine Learning
Massachusetts General Hospital / Harvard Medical School, Boston, MA (USA)

- Development of deep learning algorithms for retinopathy of prematurity diagnosis, monitoring and risk modelling
- Currently seeking FDA approval of "DeepROP" for clinical use in the US
- Development of machine learning algorithms for medical imaging applications
- Involvement in multiple interdisciplinary collaborations with clinical investigators
- Practical experience in grant writing to support clinical translation and commercialization of technologies
- Organization of day-to-day lab activities, meetings with collaborators, recruitment of technical staff and students

May 2014 –
Jan 2017   **Postdoctoral Scientist | Biocomputing, Mammalian Genetics Unit**
Medical Research Council Harwell Institute, Oxfordshire (UK)
- Design of image reconstruction and processing pipelines for high-throughput embryo phenotyping, coordinating efforts at the MRC and with international collaborators
- Development of image analysis techniques based on deformable image registration and statistical shape analysis
- Development of infrastructural software to capture, process and automatically analyse image data for the International Mouse Phenotyping Consortium (IMPC)
- Analysis of large-scale phenotyping data to study the functions of genes
- Leading of workshops and teleconferences with internal collaborators and international steering committee members to discuss project progress and issues regarding data integrity, standardization and analysis

Grants awarded

2018:   **Partners Innovation Discovery Grant | Partners Healthcare**
Awarded funding for commercialization of: *DeepROP - a point-of-care system for diagnosis of plus disease in retinopathy of prematurity.* One of 11 grant awardees among 120 applicants within Partners Healthcare.

Teaching and supervision

2018:   **BMI 701 - Foundations in Biomedical Informatics**
Department of Bioinformatics, Harvard Medical School
Lecture: **"**Modern machine learning for medical image analysis"

2017-2018:   **Tutorial series on "Deep Learning for Medical Imaging"**
Design and delivery of a series of tutorials in Python programming, data science, image processing and deep learning. Course materials presented via live coding demonstrations via Jupyter Notebook / Google Colab. Regularly attended by clinical researchers, neurosurgery residents and PhD students at MGH and Brigham and Women's Hospital.

2013
-present: **Supervision of high school, undergraduate and masters research projects**
Summer "Capstone" project (Harvard Medical School)
MS Biomedical Informatics:
- Development of a deep neural network for optic disk segmentation
- Design of a novel pre-training method to reduce the manual annotation burden

Summer internships for high school students (Mass. General Hospital)
- Fundamentals of image processing and machine learning for image classification
- Development of an automated eye diagnosis application for Android

South East Physics Network (SEPnet) programme (MRC Harwell)
- Optimisation of image registration for creating a mouse embryo atlas
- Implementation of image normalisation methods and voxel-wise statistics

Assessing the role of CD248 in the aging bone (University of Birmingham)
- Micro-CT image processing in studies of arthritis

2012-2014:	**Lab demonstrator**

Imaging and Image Analysis (M.Sc. PSIBS, University of Birmingham)
Optical systems, image reconstruction, segmentation, cell tracking, spectral unmixing

Computational Vision (B.Sc. Computer Science, University of Birmingham)
Edge detection, denoising, hough transform, object/face recognition, ROC analysis

Computer Graphics (B.Sc. Computer Science, University of Birmingham)
Coordinate systems, meshes, transformations & projections, lighting, raster conversion

Foundation course (University of Birmingham)
Fundamental principles of algorithm design, control flow and data structures

Public engagement

2016:   **Medical Research Council Science Festival**
MRC Harwell, Oxfordshire, UK
- Received training in public engagement strategy from Wellcome Trust
- Designed and coordinated activities for the public related to bioinformatics

2013-2014:   **Meet the Scientist**
ThinkTank Birmingham Science Museum, UK
Team leader for optics based demonstrations aimed at both children and adults

2013:   **Redesigning the ThinkTank Medical Futures Gallery**
ThinkTank Birmingham Science Museum, UK
- Workshop to brainstorm ideas for a new gallery at the science museum
- Discussed ideas with scientists, teachers and school children

Roles and responsibilities

2015 -
Present: **Peer review duties**
- NeurIPS Machine Learning for Health (ML4H)
- PeerJ
- Biomedical Signal Processing Control, Elsevier
- EBioMedicine, Elsevier

2013:   **Conference organiser: Medical Image Understanding and Analysis (MIUA)**
- Design of conference website, proceedings and promotional materials
- Management of CMT website for delegate registration
- Organisation of day-to-day conference activities

2013:   **PSIBS Student Seminar Series Organiser**
- Organisation of seminars for the student cohort
- Forum for discussions between MSc and PhD students

2008	**Summer studentship in Systems Biology (University of Birmingham, UK)**
	• Developed simulations of bacterial adaptation to heavy metal stress
	• Utilised software written in Python, Perl, Java and SBML
2008/09:	**Computer Science Society (CSS) President**
	• Re-branded the society to appeal to a broader group of students across all years
	• Organised social events for both students and staff throughout the academic year

Technical skills

Platforms: Linux: Ubuntu, CentOS; Windows: XP – 10
Programming: Python (4+ years), MATLAB (4+ years), Java (3 years), C# (rudimentary)
Web: HTML, CSS, JavaScript, jQuery, PHP, Flask, Celery, Bootstrap
Databases: MySQL, CouchDB
Machine learning: Keras, TensorFlow, Theano, PyTorch, scikit-learn
Medical imaging: Slicer, ImageJ, ITK/VTK, elastix, scikit-image, DICOM/Nifti formats
Version control: Git, Subversion
Project management: Slack, Asana, JIRA (2+ years Scrum experience)
Document preparation: LaTeX, Microsoft Office, Google Docs/Sheets/Slides
Graphics: Inkscape, Photoshop, GIMP, yEd

Software contributions

DeepROP: automated diagnosis of plus disease in retinopathy of prematurity
KneeDeep: automated localization of knee osteoarthritis from radiographs
DeepNeuro: automated segmentation of glioblastoma from multi-modal MRI
Shapeshifter: software for creation and visualisation of 3D statistical shape models
HARP: batch image processing tool for automatic cropping, scaling and compression
IEV: web-based comparative visualisation tool for 3D imaging and voxel-based morphometry
MArthA: automated quantification of bone destruction in micro-CT images

Conference presentations

2018:	**HMS and OHSI First Medical Research Summit (Boston, MA)**
	Invited speaker: *Once More, with Deep Learning: Radiology, Ophthalmology and the Machine Learning Revolution*
	University of Illinois, ROP Hot Topics Meeting (Chicago, IL)
	Invited oral presentation: *"Basics of Deep Learning"*
	SPIE Medical Imaging (Houston, TX)
	Oral presentation: *Fully automated disease severity assessment and treatment monitoring in retinopathy of prematurity using deep learning*
	Association for Research in Vision and Ophthalmology (Honolulu, HI)
	Oral presentation: *Artificial intelligence in retinopathy of prematurity: development of a fully automated deep convolutional neural network (DeepROP) for plus disease diagnosis*
	Awarded travel grant
	MGH Scientific Advisory Committee Poster of Distinction (Boston, MA)
	Poster presentation: *Diagnosis, monitoring and risk: deep learning for retinopathy of prematurity* (**Runner-up**)

2017:	**Brain Tumor Segmentation Challenge [BraTS] at MICCAI 2017 (Quebec City, Canada)**
	Poster: *Sequential 3D U-Nets for Brain Tumor Segmentation*

2016:   **The Allied Genetics Conference (Orlando, FL)**
Delivered workshop: *Gene Function Discovery within the IMPC Resource*

IMPC-Infrafrontier Annual Meeting (Illkirch, France)
Delivered workshop: *3D Imaging for the IMPC*

2015:   **International Mammalian Genome Conference (Yokohama, Japan)**
Poster: *Shape-based morphometric analysis of homozygous lethal embryos*
Delivered workshop: *3D image visualisation in the IMPC portal*

2014:   **6th International Workshop on Biomedical Image Registration (London, UK)**
Oral presentation: 3D *Articulated Registration of the Mouse Hind Limb for Bone Morphometric Analysis in Rheumatoid Arthritis*

2012:   **SkyScan User Meeting (Brussels, Belgium)**
Poster: *Micro-CT analysis of bone destruction in mouse models of rheumatoid arthritis*

Publications (inc. refereed conference papers)

Lecouat, B., Chang, K., Foo, C-S., Unnikrishnan, B., Zenai, H., **Brown, J.M.,** Chandrasekhar, V., Krishnaswamy, P., Kalpathy-Cramer, J., 2018. Semi-Supervised Deep Learning with GANs for Classification of Abnormalities in Retinal Images. *NIPS Machine Learning for Health (ML4H)*

Hu, S., Beers, A., Chang, K., Höbel, K., Campbell, J.P., Erdogmus, D., Ioannidis, S., Dy, J., Chiang, M.F., Kalpathy-Cramer, J., **Brown, J.M.,** 2018. Deep feature transfer between localization and segmentation tasks. *arXiv preprint arXiv:1811.02539*

Graziani, M., **Brown, J.M.,** Andrearczyk, V., Yildiz, V., Campbell, J.P, Erdogmus, D., Ioannidis, S., Chiang, M.F., Kalpathy-Cramer, J., Müller, H., 2019. Improved interpretability for computer-aided severity assessment of Retinopathy of Prematurity. *In Medical Imaging 2019: Computer-Aided Diagnosis. International Society for Optics and Photonics (in press)*

Redd, T.K., Campbell, J.P., **Brown, J.M.,** Kim, S.J., Ostmo, S., Chan, R.V.P., Dy, J., Erdogmus, D., Ioannidis, S., Kalpathy-Cramer, J. and Chiang, M.F., 2018. Evaluation of a deep learning image assessment system for detecting severe retinopathy of prematurity. *British Journal of Ophthalmology, pp.bjophthalmol-2018.*

Winzeck, S., Hakim, A., McKinley, R., Pinto, J**.,** Alves, V., Silva, C., Pisov, M., Krivov, E., Belyaev, M., Monteiro, M., Oliveira, A., Choi, Y., Paik, M., Kwon, Y., Joon, K., Won, J., Islam, M., Ren, H., Robben, D., Suetens, P., Gong, E., Niu, Y., Xu, Y., Pauly, J.M., Lucas, C., Heinrich, M.P., Rivera, L.C., Castillo, L.C., Daza, L.A., Beers, A.L., Arbelaez, P., Maier, O. Chang, K., **Brown**, **J.M.,** Kalpathy-Cramer, J., Zaharchuk, G., Wiest, R., Reyes, M., 2018. ISLES 2016 and 2017: Benchmarking Ischemic Stroke Lesion Outcome Prediction Based on Multispectral MRI. *Frontiers in Neurology*

Brown, J.M., Campbell, J.P., Beers, A., Chang, K., Ostmo, S., Chan, R.P., Dy, J., Erdogmus, D., Ioannidis, S., Kalpathy-Cramer, J. and Chiang, M.F., 2018. Automated Diagnosis of Plus Disease in Retinopathy of Prematurity Using Deep Convolutional Neural Networks. *JAMA Ophthalmology*

Brown, J.M., Campbell, J.P., Beers, A., Chang, K., Donohue, K., Ostmo, S., Chan, R.P., Dy, J., Erdogmus, D., Ioannidis, S. and Chiang, M.F., 2018. Fully automated disease severity assessment and treatment monitoring

in retinopathy of prematurity using deep learning. *In Medical Imaging 2018: Imaging Informatics for Healthcare, Research, and Applications (Vol. 10579, p. 105790Q). International Society for Optics and Photonics*

Chang, K., Balachandar, N., Lam, C., Yi, D., **Brown, J.M.**, Beers, A., Rosen, B., Rubin, D.L. and Kalpathy-Cramer, J., 2018. Distributed deep learning networks among institutions for medical imaging. *Journal of the American Medical Informatics Association*

Beers, A., Chang, K., **Brown, J.M.**, Sartor, E., Mammen, C.P., Gerstner, E., Rosen, B. and Kalpathy-Cramer, J., 2017. Sequential 3D U-Nets for Biologically-Informed Brain Tumor Segmentation. *arXiv preprint arXiv:1709.02967*

Meehan, T.F., Conte, N., West, D.B., Jacobsen, J.O., Mason, J., Warren, J., Chen, C.K., Tudose, I., Relac, M., Matthews, P., Karp, N., Santos, L., Fiegel, T., Ring, N., Westerberg, W., Greenaway, S., Sneddon, D., Morgan, H., Codner, G.F., Stewart, M.E., **Brown, J.M.,** Horner, N., Haendel, M., Washington, N., Mungall, C.J., Reynolds, C.L., Gallegos, J., Gailus-Durner, V., Sorg, T., Pavlovic, G., Bower, L.R., Moore, M., Morse, I., Gao, X., Tocchini-Valentini, G.P., Obata, Y., Cho, S.Y., Seong, J.K., Seavitt, J., Beaudet, A.L., Dickinson, M.E., Herault, Y., Wurst, W., Hrabe de Angelis, M., Lloyd, K.C.K., Flenniken, A.M., Nutter, L.M.J., Newbigging, S., McKerlie, C., Justice, M.J., Murray, S.A., Svenson, K.L., Braun, R.E., White, J.K., Bradley, J., Flicek, P., Wells, S., Skarnes, W.C., Adams, D.J., Parkinson, H., Mallon, A.M., Brown, S.D.M. and Smedley, D., International Mouse Phenotyping Consortium, 2017. Disease model discovery from 3,328 gene knockouts by The International Mouse Phenotyping Consortium. *Nature Genetics, 49(8), p.1231*

Brown, J.M., Ross, E., Desanti, G., Saghir, A., Clark, A., Buckley, C., Filer, A., Naylor, A. and Claridge, E., 2017. Detection and characterisation of bone destruction in murine rheumatoid arthritis using statistical shape models. *Medical Image Analysis, 40, pp.30-43*

Brown, J.M., Horner, N.R., Lawson, T.N., Fiegel, T., Greenaway, S., Morgan, H., Ring, N., Santos, L., Sneddon, D., Teboul, L., Vibert, J., Yaikhom, G., Westerberg, H. and Mallon, A.M., 2016. A bioimage informatics platform for high-throughput embryo phenotyping. *Briefings in Bioinformatics, p.bbw101*

Dickinson, M. E., Flenniken, A. M., Ji, X., Teboul, L., Wong, M. D., White, J. K., Meehan, T. F., Weninger, W. J., Westerberg, H., Adissu, H., Baker, C. N., Bower, L., **Brown**, J. M., Caddle, L. B., Chiani, F., Clary, D., Cleak, J., Daly, M. J., Denegre, J. M., Doe, B., Edie, S. M., Fuchs, H., Gailus-Durner, V., Galli, A., Gambadaro, A., Gallegos, J., Guo, S., Horner, N. R., Hsu, C-W., Johnson, S. J., Kalaga, S., Keith, L. C., Lanoue, L., Lawson, T. N., Lek, M., Mark, M., Marschall, S., Mason, J., McElwee, M. L., Newbigging, S., Nutter, L.M.J., Peterson, K. A., Ramirez-Solis, R., Rowland, D. J., Ryder, E., Samocha, K. E., Seavitt, J. R., Selloum, M., Szoke-Kovacs, Z., Tamura, M., Trainor, A. G., Tudose, I., Wakana, S., Warren, J., Wendling, O.,West, D. B., Wong, L., Yoshiki, A., The International Mouse Phenotyping Consortium, MacArthur, D. G., Tocchini-Valentini, G. P., Gao, X., Flicek, P., Justice, M., Parkinson, H. E., Moore, M., Wells, S., Braun, R. E., Svenson, K., Hrabe de Angelis, M., Herault, Y., Mohun, T., Mallon, A-M., Henkelman, R. M., Brown, S.D., Adams, D., Lloyd, K.C.K., McKerlie, C., Beaudet, A. L., Bucan, M. and Murray, S.A., 2016. High-throughput discovery of novel developmental phenotypes. *Nature, 537(7621), p.508*

Ring, N., Meehan, T.F., Blake, A., **Brown, J.M.**, Chen, C.K., Conte, N., Di Fenza, A., Fiegel, T., Horner, N., Jacobsen, J.O. and Karp, N., Lawson, T., Mason, J.C., Matthews, P., Morgan, H., Relac, M., Santos, L., Smedley, D., Sneddon, D., Pengelly, A., Tudose, I., Warren, J.W.G., Westerberg, H., Yaikhom, H., Parkinson, H. and Mallon, A.M., 2015. A mouse informatics platform for phenotypic and translational discovery. *Mammalian Genome, 26(9-10), pp.413-421*

Yaikhom, G., Morgan, H., Sneddon, D., Retha, A., Atienza-Herrero, J., Blake, A., **Brown, J.M.**, Di Fenza, A., Fiegel, T., Horner, N. and Ring, N., Santos, L., Westerberg, H., Brown, S.D.M. and Mallon, A.M.M., 2015. Comparative visualization of genotype-phenotype relationships. *Nature Methods, 12(8), p.698*

Brown, J.M., Naylor, A., Buckley, C., Filer, A. and Claridge, E., 2014, July. 3D articulated registration of the mouse hind limb for bone morphometric analysis in rheumatoid arthritis. *In International Workshop on Biomedical Image Registration (pp. 41-50). Springer, Cham*

Unpublished works

Chao, J., Badawi, A., Unnikrishnan, B., Lin, J., Chan, F., **Brown, J.M.,** Campbell, J.P., Chiang, M.F., Kalpathy-Cramer, J., Chandrasekhar, V., Krishnaswamy, P., Aung, K., 2019. CaRENets: Compact and Resource Efficient CNN for Homomorphic Inference on Encrypted Medical Images. *Information Processing in Medical Imaging 2019 (submitted)*

Coyner, A., Swan, R., Campbell, J.P., Ostmo, S., **Brown, J.,** Kalpathy-Cramer, J., Kim, S., Jonas, K., Chan, R.V.P., Chiang, M.F. Automated Fundus Image Quality Assessment in Retinopathy of Prematurity Using Deep Convolutional Neural Networks. *Ophthalmology Retina (under revision)*