



Benjamin Billot

Postdoc at MIT in medical image computing

Medical Vision Group
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Education

- 2018 - 2022 **PhD in medical image computing** Centre for Medical Image Computing, University College London, UK
Thesis: Bridging generative models and CNNs for domain-agnostic segmentation of brain MRI
Advisor: Juan Eugenio Iglesias
Thesis committee: John Ashburner (University College London), Ben Glocker (Imperial College London)
- 2016-2017 **MSc in biomedical engineering** Imperial College London, UK
Thesis: Physics-based generative models in low data regime: segmentation of cortical microscopies.
Advisor: Anil Bharath
- 2014-2016 **Diplôme d'ingénieur** CentraleSupélec, France
Project: Cancellation of respiratory motions for accurate chest CT reconstruction

Experience

- 2022 - now **Postdoctoral researcher** Medical Vision Group, Massachusetts Institute of Technology, USA
Equivariant networks and denoising CNNs to decouple spatial and intensity features for motion tracking in fetal MRI
Advisor: Polina Golland
- 2017-2018 **Intern, AI team** Founders Factory, London, UK
Project: R-CNN for automated navigation of HTML pages
Advisor: Jeff Ng
- Summer 2016 **Research assistant** Institute of Psychiatry and neuroscience of Paris, INSERM, France
Project: Physics-based generative models in low data regime: segmentation of cortical microscopies.
Advisors: Therese Jay and Marco Pompili

Summary of publications

10	Journal articles	3 as first author, 4 as second author
10	Conference articles (with peer-reviewed proceedings)	5 as first author, 1 as second author
1	Conference abstract	1 as first author

Honours and awards

- 2022-2023 **Outstanding reviewer, honourable mentions**
MICCAI 2022, MICCAI 2023
- 2019-2020 **Short-listed for best paper award**
MIDL 2019, MIDL 2020
- 2019 **CMIC platform grant**
£4,000 awarded for a 6-month visit at MIT as a PhD student (cancelled due to Covid)

Professional activities

SOFTWARE RELEASE, CODE MAINTENANCE, AND ACTIVE SUPPORT

SynthSeg	Domain-agnostic segmentation of brain scans	FreeSurfer surfer.nmr.mgh.harvard.edu/fswiki/SynthSeg GitHub github.com/BBillot/SynthSeg Matlab mathworks.com/products/matlab.html TorchIO torchio.readthedocs.io
SynthSR	Tool to turn any brain scan into a 1mm T1 scan	FreeSurfer surfer.nmr.mgh.harvard.edu/fswiki/SynthSR GitHub github.com/BBillot/SynthSR
Hypo_seg	Segmentation of the hypothalamic subunits	FreeSurfer surfer.nmr.mgh.harvard.edu/fswiki/HypothalamicSubunits GitHub github.com/BBillot/hypothalamus_seg

MENTORING

- 2023 - now **Ramya Muthukrishnan** - PhD student, MIT,
Equivariant networks for robust registration of fetal brain MRI time-series
Co-supervised with Polina Golland
- 2022 **Jeffrey Pagaduan** – PhD student, Palacky University, Czech Republic
Alteration in Morphology of hypothalamus with mild cognitive impairment (journal paper under review)
- 2018 – 2019 **Bo hyun Song** - MSc student, UCL, UK
Simulation of histological artefacts in medical images
Co-supervised with Juan Eugenio Iglesias

REVIEWING

Journals

IEEE Transactions on Medical Imaging, Medical Image Analysis, IEEE Transactions on Pattern Analysis and Machine Intelligence, NeuroImage, Imaging Neuroscience, Human Brain Mapping, Frontiers in Neuroscience, Neuroradiology, Journal of Neurology, NeuroImage Clinical, Journal of Nuclear Medicine

Conferences

MICCAI (2021-2023), MIDL (2022, 2023), IPMI (2023), DGM4H NeurIPS Workshop (2023)

TEACHING

- 2018 **Introductory Mathematics for Computer Science** (10x1h30) University College London, UK

WORKSHOP ORGANISATION

- 2023 **Programme chair and organisation committee**
4th Boston Medical Imaging Workshop

PRESS

- 2023 **Physics world article**
AI creates high-resolution brain images from low-field strength by Cynthia E Keen

SOCIETY MEMBERSHIP

- 2020 - now **MICCAI member**

Invited Presentations

2023	Domain agnostic brain MRI segmentation and equivariant networks for efficient 3D Tracking ARAMIS lab seminars	Paris, France (virtual)
2023	SynthSeg+: robust segmentation of heterogeneous clinical brain MRI scans Martinos center lab seminars LEMoN group lab seminars	Boston, USA (virtual) Boston, USA
2021	SynthSeg: domain-agnostic segmentation of brain MRI Biomedical imaging and analysis seminars (MIT) CMIC-WEISS seminars	Boston, USA (virtual) London, UK (virtual)
2020	Partial volume segmentation of brain MRI scans of any resolution and contrast LCN group seminars	Boston, USA (virtual)
2020	A learning strategy for contrast-agnostic MRI segmentation UCL/King's College/Imperial College bio-imaging symposium CMIC-WEISS seminars	London, UK (virtual) London, UK

Publications

JOURNAL PAPERS

Robust machine learning segmentation for large-scale analysis of heterogeneous clinical brain MRI datasets

B. Billot, C. Magdamo, Y. Cheng, S. E. Arnold, S. Das, J. E. Iglesias
PNAS: *Proceedings of the National Academy of Sciences* (2023)

Linking brain structure, cognition, and sleep: insights from clinical data

R. Wei, W. Ganglberger, H. Sun, P. Hadar, R. L. Gollub, S. Pieper, **B. Billot**, R. Au, J. E. Iglesias, S. S. Cash, S. Kim, C. Shin, B. Westover, R. J. Thomas
Sleep (2023)

SynthSR: a public AI tool to turn heterogeneous clinical brain scans into high-resolution T1-weighted images for 3D morphometry

J. E. Iglesias, **B. Billot**, Y. Balbastre, C. Magdamo, S. E. Arnold, S. Das, B. L. Edlow, D. Alexander, P. Golland, B. Fischl
Science Advances (2023)

SynthSeg: segmentation of brain MRI scans of any contrast and resolution without retraining

B. Billot, D. N. Greve, O. Puonti, A. Thielscher, K. Van Leemput, B. Fischl, A. V. Dalca, J. E. Iglesias
Medical Image Analysis (2023)

Quantitative brain morphometry of portable low-field-strength MRI using super-resolution machine learning

J. E. Iglesias, R. Schleicher, S. Laguna, **B. Billot**, P. Schaefer, B. McKaig, J. N. Goldstein, K. N. Sheth, M. S. Rosen, W. T. Kimberly
Radiology (2022)

In vivo hypothalamic regional volumetry across the frontotemporal dementia spectrum

N. L. Shapiro, E. G. Todd, **B. Billot**, D. M. Cash, J. E. Iglesias, J. D. Warren, J. D. Rohrer, M. Bocchetta
NeuroImage Clinical (2022)

A deep learning toolbox for automatic segmentation of subcortical limbic structures from MRI images

D. N. Greve, **B. Billot**, D. Cordero, A. Hoopes, M. Hoffmann, A. V. Dalca, B. Fischl, J. E. Iglesias, J. C. Augustinack
NeuroImage (2021)

SynthMorph: learning contrast-invariant registration without acquired images

M. Hoffmann, **B. Billot**, D. N. Greve, J. E. Iglesias, B. Fischl, A. V. Dalca
IEEE Transactions on Medical Imaging (2021)

Joint super-resolution and synthesis of 1mm isotropic MPRAGE volumes from clinical MRI exams with scans of different orientation, resolution and contrast

J. E. Iglesias, **B. Billot**, Y. Balbastre, A. Tabari, J. Conklin, R. G. Gonzalez, D. Alexander, P. Golland, B. L. Edlow, Bruce Fischl, ADNI
NeuroImage (2021)

Automated segmentation of the hypothalamus and associated subunits in brain MRI

B. Billot, M. Bocchetta, E. Todd, A. V. Dalca, J. D. Rohrer, J. E. Iglesias
NeuroImage (2020)

PEER-REVIEWED CONFERENCE PROCEEDINGS

AnyStar: domain randomized universal star-convex 3D instance segmentation

N. Dey, M. Abulnaga, **B. Billot**, E. Abaci Turk, P. E. Grant, A. V. Dalca, P. Golland
WCACV: Winter Conference on Applications of Computer Vision (2024)

Early accept

Domain-agnostic segmentation of thalamic nuclei from joint structural and diffusion MRI

H. Tregidgo, S. Soskic, M. D. Olchanyi, J. Althonayan, **B. Billot**, C. Maffei, P. Golland, A. Yendiki, D. C. Alexander, M. Bocchetta, J. D. Rohrer, J. E. Iglesias
MICCAI: Medical Image Computing and Computer-Assisted Intervention (2023)

Early accept

Equivariant and denoising CNNs to decouple intensity and spatial features for motion tracking in fetal brain MRI

B. Billot, D. Moyer, N. Karani, M. Hoffmann, E. Abaci Turk, E. Grant, P. Golland
MIDL: Medical Image with Deep Learning (2023), short paper track

Robust segmentation of brain MRI in the wild with hierarchical CNNs and no retraining

B. Billot, C. Magdamo, S. E. Arnold, S. Das, J. E. Iglesias
MICCAI: Medical Image Computing and Computer-Assisted Intervention (2022)

Super-resolution of portable low-field MRI in real scenarios: integration with denoising and domain adaptation

S. Laguna, R. Schleicher, **B. Billot**, P. Schaefer, B. McKaig, J. N. Goldstein, K. N. Sheth, M. S. Rosen, W. T. Kimberly, J. E. Iglesias
MIDL: Medical Image with Deep Learning (2022), short paper track

Joint segmentation of multiple sclerosis lesions and brain anatomy in MRI scans of any contrast and resolution

B. Billot, S. Cerri, K. Van Leemput, A. V. Dalca, J. E. Iglesias
ISBI: International Symposium on Biomedical Imaging (2021)

Oral presentation

Learning MRI contrast-agnostic registration

M. Hoffmann, **B. Billot**, J. E. Iglesias, B. Fischl, A. V. Dalca
ISBI: International Symposium on Biomedical Imaging (2021)

Oral presentation

Partial volume segmentation of brain MRI scans of any contrast and resolution

B. Billot, E. Robinson, A. V. Dalca, J. E. Iglesias
MICCAI: Medical Image Computing and Computer-Assisted Intervention (2020)

Oral presentation, early accept

A learning strategy for contrast-agnostic MRI segmentation

B. Billot, D. N. Greve, K. Van Leemput, B. Fischl, A. V. Dalca, J. E. Iglesias

MIDL: *Medical Image with Deep Learning* (2020)

Short-listed for best paper award, oral presentation

Image synthesis with a convolutional capsule generative adversarial network

C. Bass, T. Dai, **B. Billot**, K. Arulkumaran, A. Creswell, C. Clopath, V. De Paola, A. A. Bharath

MIDL: *Medical Image with Deep Learning* (2019)

Short-listed for best paper award, oral presentation

Deep reinforcement learning for subpixel neural tracking

T. Dai, M. Dubois, K. Arulkumaran, J. Campbell, C. Bass, **B. Billot**, F. Uslu, V. De Paola, C. Clopath, A. A. Bharath

MIDL: *Medical Image with Deep Learning* (2019)

Spotlight

CONFERENCE ABSTRACTS

Physics-based generative models in low data regime: application to segmentation of cortical microscopies

B. Billot, C. Bass, A. A. Bharath

Human Brain Project 4th summer school, Obergurgl, Austria (2017)

Oral presentation

THESES

Benjamin Billot

Bridging generative models and convolutional neural networks for domain-agnostic segmentation of brain MRI

Ph.D. Thesis, University College London, September 2022

Benjamin Billot

Physics-based generative models in low data regime: application to segmentation of cortical microscopies

MSc Thesis, Imperial College London, September 2017