

# Curriculum Vitae

## **Axel LARGENT, Ph.D.**

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## EDUCATION

**Ph.D. in biomedical image processing** 2015 - 2018  
Laboratory of Signal and Image Processing (LTSI), University of Rennes 1, INSERM, Brittany (France)  
**Link:** <https://www.ltsi.univ-rennes1.fr/>

**Master's degree in mathematics for computer graphics and statistics** 2011 - 2012  
Department of Science and Technology, University of Burgundy, Dijon (France)  
**Link:** <https://sciences-techniques.u-bourgogne.fr/la-recherche>

**Master's degree in applied mathematics and modeling** 2009 - 2011  
Department of Exact and Natural Sciences, University of French West Indies, Pointe-à-Pitre (Guadeloupe, France)  
**Link:** <http://www.univ-ag.fr/>

**Bachelor's degree in mathematics and computer science (major mathematics)** 2006 - 2009  
Department of Exact and Natural Sciences, University of French West Indies, Pointe-à-Pitre (Guadeloupe, France)  
**Link:** <http://www.univ-ag.fr/>

## PROFESSIONAL EXPERIENCES

**Research scientist (biomedical image processing)** 2022 - 2023  
Center for Biomedical Image Computing and Analytics (CBICA), Perelman School of Medicine, University of Pennsylvania, Philadelphia (USA)  
**Supervisors:** Assoc. Prof. Young Fan  
**Collaboration:** Genmab and Radiation Oncology Department of the University of Pennsylvania  
**Research:** Development and evaluation of cutting-edge deep learning methods for overall and progression-free survival predictions of patients diagnosed with locally advanced non-small cell lung cancers.

**Post-doctoral fellow (biomedical image processing)** 2019 - 2022  
Developing Brain Institute, department of diagnostic imaging and radiology, Children's National Hospital, Washington DC (USA)  
**Supervisors:** Prof. Catherine Limperopoulos, Asst. Prof Josepheen De Asiz-Cruz  
**Collaboration:** Assoc. Prof. and MD Jonathan Murnick, department of radiology, Children's National Hospital  
**Research:** (1) Development of novel multi-instance deep learning algorithms for image quality assessment of

fetal brain MRIs; (2) Development of cutting-edge Bayesian deep learning methods for automatic brain segmentation of preterm infants diagnosed with post-hemorrhagic hydrocephalus (performed on MR imaging); (3) Development of Bayesian deep learning methods for automatic brain segmentation of fetuses diagnosed with ventriculomegaly (performed on MR imaging); (4) Development of deep learning methods for automatic assessment of fetuses' gestational age (performed on MR imaging).

**Research engineer (biomedical image processing)**

2018 - 2019

Laboratory of Signal and Image Processing (LTSI), University of Rennes, INSERM, Brittany (France)

**Supervisors:** Prof. Renaud de Crevoisier, Prof. Hervé Saint-Jalmes, Assoc. Prof. Jean-Claude Nunes, and Assoc. Prof. Oscar Acosta

**Research:** (1) Development and evaluation of cutting-edge deep learning, atlas patch-based, and random forest methods for pseudo-CT generation in prostate MRI-based radiotherapy treatment planning; (2) Evaluation of cutting-edge deep learning methods for pseudo-CT generation in head and neck CBCT-based adaptive radiotherapy treatment planning; (3) Development and optimization of a clinical MRI protocol for head and neck MRI-based radiotherapy treatment planning (acquisition in treatment position with a coil system dedicated to radiotherapy).

**Research engineer (computer vision and image processing)**

2013 - 2014

French alternative energies and atomic energy commission (CEA-LETI) and Pollen Metrology (startup), Grenoble (France)

**Supervisors:** Jerome Hazart, Ph.D., and Johan Foucher, Ph.D.

**Research:** (1) Development of image processing algorithms for design control of electronic transistors built on silicon; (2) Implementation of an object detection algorithm for Directed Self-Assembly (DSA) structure localization in SEM images.

## PH.D. DISSERTATION

**Thesis title: MRI-only external beam radiotherapy treatment planning**

**Supervisors:** Prof. Renaud de Crevoisier, Prof. Hervé Saint-Jalmes, Assoc. Prof. Jean-Claude Nunes, and Assoc. Prof. Oscar Acosta

**Collaboration:** Prof. Jason Dowling and Prof. Peter Greer, CSIRO Australian e-Health Research Center, Herston, Queensland (Australia)

**Committee members:** Prof. Fabrice Meriaudeau, Prof. Su Ruan, Prof. Juliette Thariat, Med Phys. Robin Garcia

**Defense date:** December 2018

This thesis demonstrated the feasibility of MRI-based dose calculation in radiotherapy using cutting-edge deep learning methods and novel atlas patch-based methods.

**Link:** <http://www.theses.fr/2018REN1S085>

## RESEARCH INTEREST

Machine learning (deep learning), medical image analysis, uncertainty assessment for deep learning, image synthesis (generative AI, image-to-image translation), domain adaptation, semi-supervised learning, image segmentation and registration, image reconstruction, computer vision, survival analysis, pattern recognition, applied mathematics, and medical physics.

## ACADEMIC SERVICES

**Participation** in the writing of a grant from the French National Cancer Institute. This grant was written in collaboration with the Laboratory of Signal and Image Processing (LTSI) from the University of Rennes, the cancer center Eugene Marquis (Rennes, France), the CSIRO Australian e-Health Research Center, and the cancer center Centre Georges-François Leclerc (Dijon, France).

**Reviewing** for the Medical Image Analysis Journal; the International Journal of Radiation Oncology Biology Physics (red journal); the IEEE Journal of Biomedical and Health Informatics; the European Journal of Medical Physics (Physica Medica); the Computers in Biology and Medicine Journal; the Medical Image Computing and Computer-Assisted Intervention Society (MICCAI); and the International Symposium on Biomedical Imaging (ISBI)

**Participation** in the 12<sup>th</sup> IEEE EMBS International Summer School on Biomedical Imaging (Saint-Jacut-de-la-Mer, Brittany, France)

## SUPERVISION OF RESEARCH ACTIVITIES

**Mentoring** Louis Marage during this master's degree internship 2017 - 2018  
**project:** Quantification of MRI distortions for MRI-only external beam radiotherapy treatment planning

**Mentoring** Ivan Gicquiau during this master's degree internship 2017 - 2018  
**project:** MRI acquisition in treatment position for head-and-neck MRI-only external beam radiotherapy treatment planning

**Mentoring** several undergraduate students 2016 - 2018

## TRANSFER OF TECHNOLOGY

**Transfer to clinical research:** Integration of the automatic segmentation algorithms developed during my post-doctoral fellowship into the fetal and neonatal image processing pipelines of the Developing Brain Institute. These algorithms are currently used by the Developing Brain Development and Radiology Department of Children's National Hospital to monitor the brain development of preterm infants diagnosed with post-hemorrhagic hydrocephalus and fetuses diagnosed with ventriculomegaly.

## TECHNICAL SKILLS

**OS:** Linux, Windows, and Mac OS

**Programming language:** C/C++, Python, R, and Matlab

**C/C++ libraries and Python modules:** Tensorflow/Keras, Pytorch, ITK, VTK, OpenCV, Sklearn, Numpy, pandas, and HDF5

**Software and tools:** 3D Slicer, ITK-SNAP, Elastix, NiftyReg, Singularity, Docker, Slurm, qsub, and Git

## LANGUAGES

English (fluent), French (fluent)

## LIST OF PUBLICATIONS

Journal articles accepted with peer review: 10 (6 as the first author)

Conference articles with full-length peer review proceeding: 3 (2 as the first author)

**Largent, A.**, De Asis-Cruz, J., Kapse, K., Barnett, S., Murnick, J., Basu, S., Andersen, N., Norman, S., Andescavage, N., and Limperopoulos, C. Automatic Brain Segmentation in Preterm Infants with Post-Hemorrhagic Hydrocephalus using 3D Bayesian U-Net. Human Brain Mapping Journal (December 2021)

**Link:** <http://doi.org/10.1002/hbm.25762>

Zhao, L., De Asis-Cruz, J., Wu, Y., Kapse, K., **Largent, A.**, Quistorff, J., Lopez, C., and Limperopoulos, C. Automated 3-D Fetal Brain Segmentation using an Optimized Deep Learning Approach. (In press) American Journal of NeuroRadiology (December 2021)

Boulanger, M., Nunes, J.C, Chourak, H., **Largent, A.**, Tahri, S., Acosta, O., De Crevoisier, R., Lafond, C., and Barateau, A. Deep learning methods to generate synthetic CT from MRI in radiotherapy: A literature review. Physica Medica. August 2021

**Link:** <https://doi.org/10.1016/j.ejmp.2021.07.027>

**Largent, A.**, Kapse, K., Barnett, S. D., De Asis-Cruz, J., Whitehead, M., Murnick, J., Zhao, L., Andersen, N., Quistorff, J., Lopez, C., and Limperopoulos, C. Image Quality Assessment of Fetal Brain MRI Using Multi-Instance Deep Learning Methods. Journal of Magnetic Resonance Imaging. Avril 2021

**Link:** <https://doi.org/10.1002/jmri.27649>

Barateau, A., De Crevoisier, R., **Largent, A.**, Mylona, E., Perichon, N., Castelli, J., Chajon, E., Acosta, O., Simon, A., Nunes, J.C. and Lafond, C. Comparison of CBCT-based dose calculation methods in head and neck cancer radiotherapy: from Hounsfield unit to density calibration curve to deep learning. Medical Physics. July 2020

**Link:** <https://doi.org/10.1002/mp.14387>

**Largent, A.**, Marage, L., Gicquiau, I., Nunes, J.C., Reynaert, N., Castelli, J., Chajon, E., Acosta, O., Gambarota, G., De Crevoisier, R. and Saint-Jalmes, H. Head-and-Neck MRI-only radiotherapy treatment planning: From acquisition in treatment position to pseudo-CT generation. Cancer/Radiothérapie. July 2020

**Link:** <https://doi.org/10.1016/j.canrad.2020.01.008>

**Largent, A.**, Barateau, A., Nunes, J.C., Mylona, E., Castelli, J., Lafond, C., Greer, P.B., Dowling, J.A., Baxter, J., Saint-Jalmes, H., Acosta, O., and De Crevoisier, R. Comparison of deep learning-based and patch-based methods for pseudo-CT generation in MRI-based prostate dose planning. International Journal of Radiation Oncology, Biology, and Physics, 105(5), pp.1137-1150. December 2019

**Link:** <https://doi.org/10.1016/j.ijrobp.2019.08.049>

**Largent, A.**, Nunes, J.C., Saint-Jalmes, H., Baxter, J., Greer, P., Dowling, J., de Crevoisier, R. and Acosta, O. Pseudo-CT Generation for MRI-only Radiotherapy: Comparative Study Between A Generative Adversarial Network, A U-Net Network, A Patch-Based, and an Atlas Based Methods. In 2019 IEEE 16th International Symposium on Biomedical Imaging (ISBI 2019) (pp. 1109-1113). IEEE. April 2019

**Link:** <https://doi.org/10.1109/ISBI.2019.8759278>

**Largent, A.**, Barateau, A., Nunes, J.C., Lafond, C., Greer, P.B., Dowling, J.A., Saint-Jalmes, H., Acosta, O. and De Crevoisier, R. Pseudo-CT generation for MRI-only radiation therapy treatment planning: comparison among patch-based, atlas-based, and bulk density methods. *International Journal of Radiation Oncology, Biology, Physics*, 103(2), pp.479-490. February 2019

**Link:** <https://doi.org/10.1016/j.ijrobp.2018.10.002>

Zine-Eddine, K., Bensalah, K., **Largent, A.**, Shariat, S., Verhoest, G., Peyronnet, B., Acosta, O., De Crevoisier, R., and Mathieu, R. Role of quantitative computed tomography texture analysis in the prediction of adherent perinephric fat. *World journal of urology* 36, no. 10: 1635-1642. October 2018

**Link:** <https://doi.org/10.1007/s00345-018-2292-9>

**Largent, A.**, Nunes, J.C, Lafond, C., Périchon, N., Castelli, J., Rolland, Y., Acosta, O., and De Crevoisier, R. Planification à partir d'imagerie par résonance magnétique en radiothérapie. *Cancer/Radiothérapie*. December 2017

**Link:** <https://doi.org/10.1016/j.canrad.2017.02.007>

**Largent, A.**, Nunes, J.C., Saint-Jalmes, H., Simon, A., Perichon, N., Barateau, A., Herve, C., Lafond, C., Greer, P., Dowling, J., De Crevoisier, R. and Acosta, O. Pseudo-CT generation by conditional inference random forest for MRI-based radiotherapy treatment planning. 25<sup>th</sup> IEEE European Signal Processing Conference (EUSIPCO). p. 46-50. August 2017

**Link:** <https://doi.org/10.23919/EUSIPCO.2017.8081166>

Hazart, J., Chesneau, N., Evin, G., **Largent, A.**, Derville, A., Thérèse, R., Bos, B., Bouyssou, R., Dezaudier, C., and Foucher, J. Data fusion for CD metrology: heterogeneous hybridization of scatterometry, CDSEM, and AFM data. In *Metrology, Inspection, and Process Control for Microlithography XXVIII*, vol. 9050, p. 90502L. SPIE International Society for Optics and Photonics, April 2014

**Link:** <https://doi.org/10.1117/12.2046484>

## **ABSTRACTS IN NATIONAL AND INTERNATIONAL CONFERENCES**

Conference abstracts: 12 (7 as the first author)

**Largent, A.**, Murnick, J., Lu, Y.; Kapse, K., Andersen, N., Richmann, T., De Asis-Cruz, J.; Quistorff, J., Lopez, C., Andescavage, N., and Limperopoulos, C. Automatic Assessment of Fetal Gestational Age using Bayesian Deep learning Method. *Proceedings of the International Society for Magnetic Resonance in Medicine (ISMRM)*, 2022

Zhao, L., Feng, X., De Asis-Cruz, J., Wu, Y., Kapse, K., **Largent, A.**, Wu, D., Qing, K., Meyer, and Limperopoulos, C. 3D Fetal brain segmentation using an optimized deep learning approach. *Proceedings of the International Society for Magnetic Resonance in Medicine (ISMRM)*, 2020

Stephane, K., Houssayni, A., Cassard, U., Barateau, A., Duvergé, L., **Largent, A.**, Acosta, O., Nunes, J.C., Messai, T., Simon, A., Dowling, J., Perichon, N., and De Crevoisier, R. MRI only based planning to decrease toxicity in prostate cancer IMRT/IGRT: a dosimetric study. *European Society for Radiotherapy Oncology (ESTRO)*, 2020

Zhao, L., Kapse K., **Largent, A.**, Krishnamurthy, D., Wu, Y., Du Plessis, A.J., and Limperopoulos, C.

Automated brain segmentation for fetal ventriculomegaly using a convolutional neural network approach. Pediatric Academic Societies (PAS), 2020

**Largent, A.,** Zhao, L., and Limperopoulos, C. Automatic assessment of fetal MRI quality: A deep learning approach. International Symposium on the Fetal Brain (ISFB). 2019

**Largent, A.,** Barateau, A., Nunes, J.C., Lafond, C., Greer, P., Dowling, J., Baxter, J., Saint-Jalmes, H., Acosta, O., and De Crevoisier, R. A comparison of pseudo-CT generation methods for prostate MRI-based dose planning: deep learning, patch-based, atlas-based and bulk-density methods. French society of medical physics (SFPM), 2019

Gasmi, A., Khene, Z., **Largent, A.,** Commandeur, F., Peyronnet, B. Performance de l'analyse de texture en tomodensitométrie pour prédire la présence de graisse adhérente péri-rénale. 113<sup>rd</sup> French congress of urology, 2019

Nunes, J.C, **Largent, A.,** Barateau, A., Lafond, C., Greer, P., Dowling, J., Baxter, J., Castelli, J., Chajon, E., Périchon, N., Saint-Jalmes, H., De Crevoisier, R., and Acosta, O. Calcul de dose direct à partir d'IRM et tomographies coniques par méthodes d'apprentissage. French society of radiotherapy oncology (SFRO), 2019.

**Largent, A.,** Barateau, A., Nunes, J.C., Lafond, C., Greer, P., Dowling, J., Saint-Jalmes, H., Acosta, O., and De Crevoisier, R. Comparison of deep learning with three other methods to generate pseudo-CT for MRI-only radiotherapy. European Society for Radiotherapy Oncology (ESTRO), 2019

**Largent, A.,** Barateau, A., Nunes, J.C., Lafond, C., Greer, P., Dowling, J., Saint-Jalmes, H., Acosta, O., and De Crevoisier, R. Calcul de dose à partir d'IRM en radiothérapie de la prostate : comparaison de trois méthodes de génération de pseudo-scanographie. French society of radiotherapy oncology (SFRO), 2018

**Largent, A.,** Barateau, A., Nunes, J.C., Lafond, C., Greer, P., Dowling, J., Saint-Jalmes, H., Acosta, O., and De Crevoisier, R. Pseudo-CT generation for MRI-only radiotherapy treatment planning: comparison between patch-based, atlas-based and bulk density methods. French society of medical physics (SFPM), 2018

**Largent, A.,** Marage, L., Gicquiau, I., Gambarota, G., Chajon, H., Acosta, O., Nunes, J.C., De Crevoisier, R., and Saint-Jalmes, H. MRI acquisition in radiotherapy treatment position: Sequence optimization for head and neck cancer – European Society for Radiotherapy Oncology (ESTRO), 2018