Job title	**PhD in Medical Image Analysis- Bayesian Deep Learning for cardiac LGE and T1 mapping images segmentation and pathology classification**
Job type (PhD, Post-doc, Engineer)	**PhD (Funded by the ANR, French National Research Agency)**
Contract duration (months)	36 months (start October 1st, 2020)
Qualifications (Master degree, PhD…)	Master degree
Job hours (full time/ part time)	Full time
Employer	UBFC – Université de Bourgogne Franche-Comté
Host Laboratory	Imagerie et Vision Artificielle (ImViA)
URL Host Laboratory	http://imvia.u-bourgogne.fr
Address Host Laboratory	ImViA Laboratory, Institut Marey et Maison de la Métallurgie (I3M) building, Université de Bourgogne, 64 rue de Sully, 21000 Dijon, FRANCE
Job description	**Context:** The PhD student will work in the ImViA laboratory at the University of Burgundy. The project ACCECIT (Automatic Classification of Cardiac Examinations after Contrast agent InjecTion) is funded by the French National Research Agency (ANR). The aim of the project ACCECIT is to combine automatically information from LGE (late gadolinium enhancement) and T1 mapping cardiac MR images, detect areas of fibrosis or abnormal tissues and to automatically classify the different cardiac pathologies. Every day a large number of cardiac MR data are acquired, generating an increasing mass of data. The manual analysis of these medical images is a long and tedious task. Thus there is a need of reliable tools to automatically segment regions of interest and extract clinical parameters from these medical images. Late gadolinium enhancement (LGE) imaging has been widely used for detection and assessment of myocardial scar and presence of fibrosis in cardiac magnetic resonance imaging (MRI). LGE is a gold standard for the quantification of focal myocardial fibrosis, but in some cardiomyopathies the fibrotic or more globally diseased process is often diffuse. To overcome this problem, T1 mapping techniques have been developed to quantify diffuse myocardial fibrosis and to characterize tissues.

	The combination of both LGE and T1 mapping techniques might be of clinical interest to better define the prognosis of the patients. **Position description:** the recruited PhD student will develop new methods to automatically segment LGE and T1 cardiac images and classify the different cardiac pathologies. Bayesian deep learning methods combining Bayesian statistics with deep networks to obtain true network uncertainty estimates will be investigated [Kendall2017]. First a review of methods combining Bayesian statistics and deep learning will be carried out. Then Bayesian deep learning method will be developed to segment LGE and T1 mapping images and classify the different pathologies or identify normal cases. Proposed method will also provide a model confidence to the user representing uncertainty. References [Burt2014] Burt JR , Zimmerman SL, Kamel IR, Halushka M, Bluemke DA, "Myocardial T1 mapping: techniques and potential applications", Radiographics. 2014, 34(2):377-95. doi: 10.1148/rg.342125121 [Doltra2013] Doltra A, Amundsen BH, Gebker R, Fleck E, Kelle S, "Emerging Concepts for Myocardial Late Gadolinium Enhancement MRI", Curr Cardiol Rev 2013, 9(13): 185–190. doi: 10.2174/1573403X113099990030 [Gal2017] Gal Y, Islam R, Ghahramani Z, "Deep Bayesian Active Learning with Image Data", ICML'17 Proceedings of the 34th International Conference on Machine Learning 2017. arXiv:1703.02910 [Haaf2016] Haaf P , Garg P, Messroghli DR, Broadbent DA, Greenwood JP, Plein S, "Cardiac T1 Mapping and Extracellular Volume (ECV) in clinical practice: a comprehensive review", J Cardiovasc Magn Reson 2016, 18:89. doi: 10.1186/s12968-016-0308-4 [Kendall2017] Kendall A and Gal Y, "What uncertainties do we need in Bayesian deep learning for computer vision?", NIPS 2017 Proceedings of the Advances in Neural Information Processing Systems, arXiv:1703.04977
Supervisor(s)	Bricq Stéphanie (stephanie.bricq@u-bourgogne.fr), co-supervisor Meriaudeau Fabrice (fabrice.meriaudeau@u-bourgogne.fr), supervisor
Candidate profile	- Master degree in image processing with interest in medical imaging - Machine Learning, deep learning - Programming skills - Dynamism, rigor and teamwork abilities - Good level in English
Keywords	Medical Image Analysis, Deep Learning
Application deadline	April 30th, 2020

Application *Depending on the type of position*	Please send the following documents by e-mail to stephanie.bricq@u-bourgogne.fr 1) For EU candidates: Copy of your national ID card or of your passport page where your photo is printed. For non-EU candidates: Copy of your passport page where your photo is printed. 2) Curriculum Vitae 3) Letter of motivation relatively to the position 4) Copy of your higher degree. 5) Copy of your final marks and ranks 6) Coordinates of reference persons: Title, Name, organization, e-mail. If you have questions regarding the application, please contact the co-supervisor.