

Job Title	Marie Curie Postdoctoral Fellowship on Deep Learning for Ophthalmologic Image and Video Processing
Main Research Field	Information Science and Engineering (ENG)
Sub Research Field	Intelligence Artificielle, Deep Learning, Ophthalmologie
Key words	Deep Learning, Image Classification, Video Processing, Ophthalmologie
Job Summary	This position is proposed to scientists holding a PhD with excellent recommendations, publications and potential. The aim is to consolidate the research carried out at the Medical Information Processing laboratory (LaTIM - latim.univ-brest.fr) in the field of ophthalmic image and video analysis. The candidate will develop novel artificial intelligence tools to advance the state of the art. Convolutional neural networks, and deep learning in general, will be at the center of this research. The candidates will contribute their expertise to the design of new networks, real time video analysis methods, information fusion tools, etc. This work is expected to result in high quality scientific publications.
Job Description	The LaTIM has been working for many years on ophthalmic image and video analysis. Thanks to a long-standing partnership with the ophthalmology department of Brest University Hospital, we have worked extensively on the segmentation and classification of fundus photographs with very significant achievements in automatic retinal pathology screening [1]. In particular, we won an international competition about the detection of microaneurysms in 2009 [2]. This work has continued and the use of deep learning has enabled us to remain at the top of the international competition [3]. We have forged strong partnerships with internationally renowned manufacturers and continue to improve our algorithms on fundus images as well as other modalities. Besides the analysis of images, the analysis of ophthalmologic surgery videos allowed us to design real-time decision support tools for surgeons. We are currently focusing on cataract surgery, which is the most widely performed surgery in the world. The goal is to detect which tools are present in the field of view of the operating microscope. This allow us to determine the current phase of the surgery, in real time, with great precision [4-5]. This work will enables us to transmit relevant information and/or recommendations to the surgeon. More recently, we have also focused on endoscopic eye surgeries. Endoscopy makes it possible to operate an eye that has lost its transparency. Currently, these surgeries are rarely performed because the image quality is poor. Our aim is to improve the quality of videos using a deep super-resolution process and to build high-quality mosaics in real-time through deep unsupervised video-to-3-D techniques.

	<p>The proposed work will have to fit within this scope, with the aim to improve existing tools. Whether for image or video analysis, the candidate will have to bring his expertise to propose innovative approaches using deep learning.</p> <ol style="list-style-type: none"> <li>1. <i>Quellec G, Lamard M, Josselin PM, Cazuguel G, Cochener B, Roux C. Optimal wavelet transform for the detection of microaneurysms in retina photographs. IEEE Trans Med Imaging. 2008 Sep;27(9):1230-41.</i></li> <li>2. <i>Niemeijer M, van Ginneken B, Cree MJ, Mizutani A, Quellec G, Sánchez CI, Zhang B, Hornero R, Lamard M, Muramatsu C, Wu X, Cazuguel G, You J, Mayo A, Li Q, Hatanaka Y, Cochener B, Roux C, Karray F, Garcia M, Fujita H, Abràmoff MD. Retinopathy online challenge: automatic detection of microaneurysms in digital color fundus photographs. IEEE Trans Med Imaging. 2010 Jan;29(1):185-95.</i></li> <li>3. <i>Quellec G, Charrière K, Boudi Y, Cochener B, Lamard M. Deep image mining for diabetic retinopathy screening. Med Image Anal. 2017 Jul;39:178-193.</i></li> <li>4. <i>Charrière K, Quellec G, Lamard M, Martino D, Cazuguel G, Coatrieux G, Cochener B. Real-time analysis of cataract surgery videos using statistical models. Multimed Tools Appl. 2017 Nov;76(21):22473-91.</i></li> <li>5. <a href="https://cataracts.grand-challenge.org">https://cataracts.grand-challenge.org</a></li> </ol>
Supervisor(s)	<p><b>Gwenolé Quellec</b> received the Ph.D. degree from TELECOM Bretagne (now IMT Atlantique), Brest, France, in 2008, and the Habilitation degree from the University of West Brittany, France, both in signal processing, in 2015. He was a Postdoctoral Fellow at the University of Iowa, IA, USA, in 2008–2009 and a Visiting Scholar at the University of Bern, Switzerland, in 2013. He is currently a Research Associate at the Medical Information Processing Laboratory (LaTIM), Inserm UMR 1101, Brest. His research interests include image and video analysis, as well as machine learning, for medical applications. He has supervised 6 PhD students. Finally, he has published more than 30 papers in international peer-reviewed journals and owns 6 patents.</p> <p>List of publications :  <a href="https://scholar.google.fr/citations?user=N8ho8nQAAAAJ">https://scholar.google.fr/citations?user=N8ho8nQAAAAJ</a></p> <p><b>Béatrice Cochener</b> received the M.D. degree in 1992 and the Habilitation degree in ophthalmology in 2002, from the University of West Brittany, Brest, France, and has supervised more than ten PhD students. She has been the Head of the Ophthalmology Department of Brest University Hospital since 2000 and a Professor since 2002. She is a member of the Medical Information Processing Laboratory (LaTIM), Brest. Her main research interests include anterior segment, refractive surgery, and corneal surgery. Prof. Cochener was the President of the French Society of Ophthalmology (SFO) from 2009 to 2011. She is the Deputy President of the National Association of Ophthalmology and the President of the French Society of Cataract and Refractive Surgery. Since 2011, she has been the Head of the French Academy of Ophthalmology. She has been a Board Member and President elect of the European Society of Cataract and Refractive Surgeons since 2016. She is a Social Secretary of EuCornea and a member of the ICO</p>

	Educational Committee. List of publications : <a href="https://scholar.google.fr/citations?user=ydQQy5AAAAAJ">https://scholar.google.fr/citations?user=ydQQy5AAAAAJ</a>
Department/ Research:	Research will be conducted at LaTIM (latim.univ-brest.fr) INSERM UMR 1101 in Brest, France. The LaTIM owns numerous ophthalmic datasets containing hundred thousand images for some of them, as well as a CPU/GPU computing cluster containing several hundred cores. Our group is involved in many national projects (RetinOpTIC, SePEMeD, FollowKnee, etc.) and international collaborations (with the United States, the United Kingdom, Switzerland, Malaysia and India). Our most advanced results in ophthalmology are developed within the framework of the RetinOpTIC project ( <a href="http://www.retinoptic.fr">http://www.retinoptic.fr</a> ) and commercialized by Messidor.
Suggestion for interdisciplinary / intersectoral secondments	The candidate is expected to initiate projects with our international partners (in the United States, the United Kingdom, Switzerland, Malaysia or India) in order to strengthen this collaborations.
Skills Requirements (optional) :	Experience in image and video analysis, deep learning, TensorFlow, Python and information fusion. The candidate is expected to have at least one postdoctoral experience and to have published at least 2 papers in major journals since he or she obtained his or her PhD.