Title of the thesis	ARTIFICial intelligence in radiolarian fossil identification; taxonomic, biostratigraphic and Evolutionary implications
Acronym	ARTIFICE
Reference number	023

Hosting institution	**Employer**
Université de Lille Website: https://www.univ-lille.fr/home/	Université de Lille Website: https://www.univ-lille.fr/home/
Hosting research unit 1	**Hosting research unit 2**
Name: Evolution, Ecologie et Paléonthologie Acronym: Evo-Eco-Paleo Identification number: UMR 8198 Address: Université de Lille Cité Scientifique campus Batiment SN2 F-59655 Villeneuve d'Ascq Website: http://eep.univ-lille.fr/	Name: Centre de Recherche en Informatique, Signal et Automatique de Lille Acronym: CRIStAL Identification number: UMR 9189 Address: Université de Lille – Cité scientifique Bâtiment ESPRIT Avenue Henri Poincaré 59655 Villeneuve d'Ascq Website: http://cristal.univ-lille.fr
Principal supervisor	**Co-supervisor**
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Thesis information

Keywords	Micropaleontology, Machine learning, Neuron networks, Taxonomy, Macroecology
Abstract	Paleontological data are essential to obtain insights on changes in paleobiodiversity through the geological time and the biotic response to past events of global change. Investigations are usually carried out through the analysis of large databases, in which the record of species level occurrences is of prime importance. However, the collection of numerous data at species level is labour intensive; also, taxonomic occurrence data may be influenced to some extent by the opinion of taxonomists. The use of neural networks may be the solution to study big datasets more rapidly and objectively. This PhD project entitled "*Artificial Intelligence in microfossil identification; taxonomic, biostratigraphic and evolutionary implications*" will apply neuromorphic modelling in radiolarian identification. The project will be jointly supervised by Prof. Taniel Danelian, a radiolarian micropaleontologist, working at the laboratory Evolution-Ecology-Laboratory (UMR 8198, ULille/CNRS), and Prof. Pierre Boulet, a computer scientist specialist of neuromorphic computing, working at CRISTAL (UMR 9189, ULille/CNRS/Centrale Lille). The project will focus in exploring two main scientific questions: (1) How can neural network learning achieve equal accuracy in the identification of Middle Eocene radiolarian species as an Eocene specialist in radiolarian taxonomy? (2) How does neural network identification compare with the results of classical morphometric studies? We will compare deep learning and spiking neural networks for these tasks. Deep learning is the mainstream technology and spiking neural networks have the potential for unsupervised learning and ultra low power hardware implementation allowing the building of autonomous classifying microscopes.

	The possibility exists for a month's visit at the Natural History Museum in Berlin and possibly a month's internship in the Biostratigraphy Department of TOTAL. The PhD student will also be involved in the humAIn artificial intelligence alliance of the Hauts-de-France region. The research results will be published in the best conferences and journals of both paleontology and artificial intelligence.
Expected profile of the candidate	We expect the candidate to have a strong background in paleontology/biology and an interest in computer science. Proficiency with at least one computer programming language and an understanding of neural networks or image and numerical classification would be an asset.
Application procedure	The application procedure is detailed on the European programme PEARL website www.pearl-phd-lille.eu. The funding is managed by the I-SITE ULNE foundation which is a partnership foundation between the University of Lille, Engineering schools, research organisms, the Institut Pasteur de Lille and the University hospital. The application file will have to be submitted before April 15, 2020 (10h Paris Time) and emailed to the following address : international@isite-ulne.fr.
Net salary and Lump Sum	A net salary of about €1,600 + €530 per month to cover mobility, travel and family costs.