INFORMATION SHEET EC

Title EC			
Title of the EC	Neuromorphic Technologies for Spiking Neural Networks (3rd AI generation)	**ECTS**	
Title of UE	Neuromorphic Technologies for Spiking Neural Networks (3rd AI generation)		
Title of the BCC			
If applicable, other useful information (Indicate here if the CCO is subject to a CU)			

General information	
Semester in which the course is offered	**S1 ▢ S2 ▢ S3 ☒ S4 ▢**
Compulsory course / *Elective course*	**Mandatory ☒ Elective ▢**
Pre-requisite UE(s)	Connaissances de base en électronique analogique et numérique
Teaching : *Presential / Hybrid / Distance learning*	**Face-to-face ☒ Hybrid ▢ Remote ▢**
Teaching *Unique / Offered / Borrowed*	**Unique ☒ Offered ▢ borrowed ▢**
Formation is promising if the teaching is borrowed (Component, Mention, Course, Semester, UE)	
If applicable, other useful information (Indicate here if teaching is in English)	

Hourly distribution	**CM**	**C-TD**	**TD**	**TP**	**Remote**	**Total**
Supervised teaching hours	16			12		
Personal student work						
Supervised or tutored project						
Internship (range of hours)						
If applicable, other useful information (Specify *Other* category here)						

Description of the course

Objectives (in terms of know-how):

Main objective is to teach to students main Neuromorphic Technologies for Spiking Neural Networks (SNN), that will be used for the 3rd Artificial Intelligence generation to come. The student will learn basic bricks (neurons, synapses), required to deploy SNN. He will acquire a culture related to neuromorphic technologies using only CMOS either co-integrating CMOS with synapses issued from nanoelectronics: organic or non-organic, magneto-electric. The coupling with bioinspired artificial sensors (retina, cochlea, …) will also be presented.

Opening towards more exploratory approach, aiming to reproduce information processing principles occuring in biological systems with the use of emergent technologies will also be proposed. This approach notably takes interest to reproduce smart sensors networks, exploiting complex systems properties at nanoscopic scale (i.e. reservoir computing) and to explore biology / electronic coupling for the information processing.

Brief program :

1. Bioinspired information processing :
   recall : nervous impulses in biology (brain, neurons, coding, biologic membrane characteristics)

2. Artificial Neural Networks (ANN) : brief history, architectures, software/hardware approaches, plasticity, supervised/non-supervised learning

3. Spiking Neural Networks (SNN) –hardware implementations- for 3rd AI generation: (i) usefulness (response to energetic challenge, for which applications), description of neuromorphic technologies (NT) commonly used – full CMOS or CMOS combined approach with synapses issued from nanoelectronic –

4. Coupling with SNN of bioinspired artificial sensors (retina, cochlea)

5. Bioinspired computing for biology hybrid applications / technology for information processing

Skills acquired (direct/indirect):

-Consolidate the scientific culture of M2 students related to neuromorphic technologies devoted to 3rd AI generation

CNU section(s) of teaching : 63

If applicable, other useful information(s):

Person in charge of the UE (First Name, Name, Status, Component) :

François Danneville, PU, Département EEA de la FST, Laboratoires IEMN & Ircica
Fabien Alibart, CR CNRS, Laboratoire IEMN

If applicable, other useful information: Contact: francois.danneville@univ-lille.fr