INNOVATION WORKSHOP
Exploitation of Neuromorphic Computing Technologies
3 February 2017, Brussels (Av. Beaulieu, BU25 room S1)

Introduction

For many practical tasks, conventional computing systems cannot match the performance of biological systems. One of the reasons is that the architecture of nervous systems is based on billions of nerve cells, which communicate in parallel. Artificial brain-inspired hardware architectures (called neuromorphic computing "NMC" or sometimes cortical processing in the US) would be able to work with incomplete and noisy data, to find hidden causal relations and make predictions like the real brain does. They have also the potential to address many other challenges of modern computing such as energy consumption and systems resilience.

Few teams in the world have developed NMC systems yet. In Europe several efforts have been made at national level or European level (FET programme). Currently the Human Brain Project (HBP) is a FET Flagship related to neuroscience, which includes the building of a very large NMC Platform to allow neuroscientists and engineers to perform experiments under different configurations. The platform provides two complementary approaches using custom hardware: one located in Heidelberg, Germany (the "BrainScaleS" system, also known as the "physical model") and another one in Manchester, UK (the "SpiNNaker" system, also known as the "many core"). Both systems are remotely accessible and enable energy-efficient, large-scale neuronal network simulations with simplified spiking neuron models. The BrainScaleS system is based on physical (analogue chips) emulations of neuron models and offers highly accelerated operation (10^4 x real time). The SpiNNaker system is based on a digital many-core (ARM) architecture and allows real-time operation. Smaller versions are also available and several SpiNNaker boards are already deployed in labs in Europe.

These two NMC technologies offer promising powerful solutions not only for large systems (neuroscience research and specialized super-computing) but also for smaller data processing systems (including possibly as coprocessors or embedded processors).

Regarding the potential for non-neuroscience applications, the two HBP teams are in regular but punctual contacts with some applications researchers and developers in domains such as surveillance, automotive, machine-learning/data-mining, HPC, smartphones, monitoring systems, etc. This innovation potential is now worth to be invested further for guaranteeing a solid place of Europe while similar efforts are made in other parts of the world in particular in the US.

Purpose of the workshop

The aim of the workshop is to expose the neuromorphic technologies developments in FET and in particular in HBP to potential users as a powerful solution for future advanced computing systems, in particular in the context of applied research in various domains that could be directly benefiting from these unique characteristics. This engaging with potential take-up actors will also help HBP to refine its Innovation Roadmap. The aim is also to identify the most important aspects that need to rapidly mature to allow for an effective take-up of the NMC technology offer (performance characteristics, developments environments, interfaces, etc.).

This workshop will bring the main NMC developers in Europe together with representatives of relevant industrial partners from projects funded by the European Commission in potential application domains, in the context of the European R&I Framework Programmes (currently H2020): Robotics & AI, HPC, Big Data, IoT, Security, etc. Industry umbrella organisations in Europe are also invited.

Draft Agenda

09:00 – 09:30	Registration	
09:30 – 09:40	INTRODUCTION: Take-up of NMC technologies: the view of the EC	*CNECT C4 Flagships (EC)*

Neuromorphic computing *(presentations + 5' Q&A each time)*

09:40 – 09:55	HBP SpiNNaker offer & roadmap	*Steve Furber (HBP, U Manchester)*
09:55 – 10:10	HBP BrainScaleS offer & roadmap	*Karlheinz Meier (HBP, U Heidelberg)*
10:10 – 10:30	Other NMC Systems	
	- FET projects	*CNECT C3 FET (EC)*
	- Member States R&D	*FLAG-ERA*
	- Industry R&D	*tbc*

Advanced-computing needs of potential innovators in EU programme areas
(5' presentations + introduction of industrialists from their projects + 3' Q&As)

10:30 – 10:40	Robotics & AI	*CNECT A1 (EC)*
10:40 – 10:50	Big data	*CNECT G1 (EC)*
10:50 – 11:00	Security (DG CNECT)	*CNECT H1 (EC)*
11:00 – 11:10	Security (DG HOME)	*HOME B4 (EC)*
11:10 – 11:40	*Coffee Break*	
11:40 – 11:50	Digitising Industry	*CNECT A2 (EC)*
11:50 – 12:00	Components	*CNECT A3 (EC)*
12:00 – 12:10	Photonics	*CNECT A4 (EC)*
12:10 – 12:20	HPC & Quantum	*CNECT C3 (EC)*

12:20 – 12:30	IoT	*CNECT E4 (EC)*
12:30 – 13:30	*Networking lunch*	

EC support towards innovation

13:40 – 13:50	Key Enabling technologies KETs	
	& Standardisation	*DG GROW F3 (EC)*
13:50 – 14:00	EC tool & services to support Innovation:	
	what can we do for you?	*CNECT F3* (EC)

Breakout sessions (World café format)

14:00 – 15:00   **3-4 parallel breakout sessions around the NMC characteristics/features and applications stakeholders needs for using such a technology**
1 moderator and 1 recorder per breakout session from HBP NMC and EC

Suggested questions for the breakout sessions:

1/ How to interface NMC with classical systems and with sensors ?
2/ SW environment: how to address this new programming paradigm ?
3/ How to control NMC system and potential ethics issues with NMC ?
4/ Production of NMC system and needs for "standardisation" of NMC ?
5/ Scalability and modularity needs for NMC solutions ?
6/ Needs for an R&D Infrastructure for supporting the take-up of NMC ?
7/ IPR management issues with NMC ?
8/ Other needs and constraints of the potential NMC end users ?
9/ What is the impact of the OpenAI initiative for NMC in Europe?
10/ How to further disseminate NMC and demonstrate its added value beyond workshops such as CapoCaccia, Fuerberg or NICE?

15:00 – 15:10   *Coffee Break*

Outcome of the breakout sessions and plenary discussion

15:10 – 15:30	Outcome of the breakout sessions (5' per session)
15:30 – 16:15	Q&A and discussion
16:15 – 16:30	Conclusions (Industry, HBP, EC)

16:30	End of Workshop

To ensure an efficient use of the time during the workshop
participants will be encouraged to share in advance their presentation or related material
and also to think already about the breakout sessions questions.

A public report of the main aspects addressed and conclusions will be produced afterwards.

<u>Workshop Contacts:</u>

European Commission, DG CONNECT:
      Jerome DETHIER, HBP project officer: jerome.dethier@ec.europa.eu
      Stephanie MATT, communication officer: stephanie.matt@ec.europa.eu

Human Brain Project, Neuromorphic Computing:
      Karlheinz Meier, Heidelberg University: meierk@kip.uni-heidelberg.de
      Steve Furber, Manchester University: steve.furber@manchester.ac.uk