PNEURO

A multi-purpose energy-optimized hardware accelerator for neural networks

Current situation

GlobalSensing Technologies (GST)

- Provides innovative products and services based on neuro-inspired algorithms

- Tackles complex challenges of next-generation applications where detecting/recognizing events and objects make sense

GST needs to explore ASIC implementations of PNeuro for its product line

Joint Lab
GST and CEA
PNeuro accelerator computing architecture (FPGA target)

Applications and customers require strong improvements in computing power, power consumption, and cost for high volumes

Future situation

GST

- Specifications of CPS solutions adapted to GST future business
- Current FPGA system to an ASIC-ready platform
- Feasibility of PNeuro 28FDSDI ASIC
- Evaluation of an emulated CPS prototype

Thanks to its architecture, PNeuro will be an added value for embedded system and cloud computing (integrating in servers for coprocessing).

PNeuro will be customizable with:

- Its frameworks named N2D2, from the CEA, integrating pre-processing and deep learning,
- GST programming environment tool for application development.
PNEURO ACCELERATOR

- Fully-programmable
- Energy efficient
- Hardware accelerator

DSP and DNN Applications

Clustered SIMD Architecture

- Optimized MAC
- Optimized NL-approx

Based on CEA N2D2

Programming tools

- Dedicated exports for PNeuro

PNEURO IMPLEMENTATION

FPGA version competitive with CPU & GPU solutions

Functional demonstration (chip benchmarking):
- Embedded CNN application of faces extraction, 96% recognition rate
- Single cluster configuration (4 Neuro-Cores)

<table>
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<th>Target</th>
<th>Freq (MHz)</th>
<th>Energy Eff. (Images/W)</th>
<th>Perf (Images/s)</th>
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Commercial release on GST embedded systems mid 2018 supported by its NeuroFPGA 2 (42x55 mm)

ASIC performance profiling and feasibility test chip

Profiling result based on FDSOI 28 nm technology:

One cluster of 4 Neuro-Cores @ 1GHz: 32 GMAC/sec with 70mW power consumption, including memories and the controller.
32 Neuro-Cores @ 1GHz: 256 GMAC/sec – 560mW

Energy Efficiency: 457 GMAC.s⁻¹/W

AntX4IoT LIST SoC with internal IPs and one PNeuro compute block and its control part on the system bus by CEA LIST.

ASIC evaluation will come soon