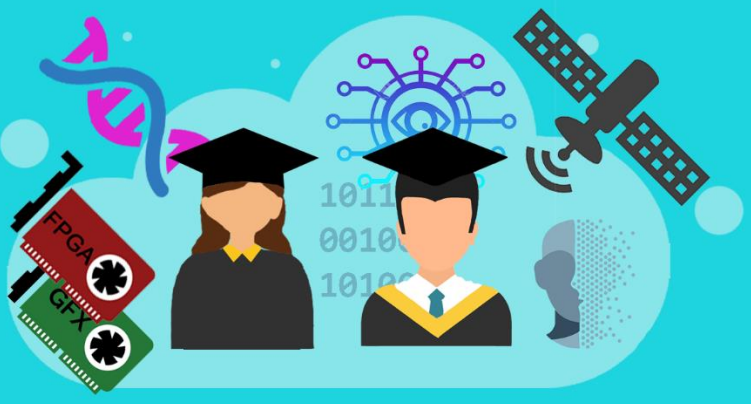
Diploma Thesis

Microproccessors and Digital Systems Laboratory



Development of an image classification algorithm to Spiking Neural Networks for SpiNNaker

Convolution Neural Networks (ConvNets or CNNs) are a category of Neural Networks that have proven very effective in areas such as image recognition and classification. ConvNets have been successful in identifying faces, objects and traffic signs apart from powering vision in robots and self driving cars. The 3rd generation of neural networks, spiking neural networks, aims to bridge the gap between neuroscience and machine learning, using biologically-realistic models of neurons to carry out computation. A spiking neural network (SNN) is fundamentally different from the neural networks that the machine learning community knows. SNNs operate using spikes, which are discrete events that take place at points in time, rather than continuous values and theoretically consume less power than CNN.

The goal of this thesis, is to develop/port an image classification algorithm (CNN) to SNN. Since SNNs are not well supported by generic frameworks and they are limited in terms of real hardware platforms, solutions are custom. Additionally, a trade-off study will be performed, in terms of power, memory and inference time, in order to compare the SNN solution against conventional CNNs running on GPU-based systems For the development of the SNN, the SpiNNaker board (specifically designed for SNN) with 48 neuromorphic chips will be utilized as a real platform.

PREREQUISITES:

C, C++, Python, Linux

READING MATERIAL:

1. Overview of the SpiNNaker System Architecture
2. SpiNNaker: A 1-W 18-core system-on-chip for massively-parallel neural network simulation
3. Neuro-evolution of spiking neural networks on SpiNNaker neuromorphic hardware

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