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The thesis will be performed at the IBM Research-Zurich in Rüschlikon.



Master Projects

In-memory Factorizer

Introduction

Disentanglement of constituent factors of a sensory signal is central to perception and cognition and hence is a critical task for future artificial intelligence systems. In this project, we explore a compute engine capable of efficiently factorizing holographic perceptual representations by exploiting the computation-in-superposition capability of brain-inspired hyperdimensional computing and the intrinsic hardware features of analog and digital inmemory computing fabrics [1].

Goal

We aim at design and developments of new in-memory computing hardware (digital and/or analog) for extreme energy efficiency.

Tasks and Type

There are several challenges that need to be overcome at algorithmic (20%) and hardware (80%) levels. These include exploiting methods for quantization, efficient local operations, and design and simulation of new hardware. We are inviting applications from students to conduct their Master's thesis work on this exciting new topic. The work performed could span hardware design all the way to efficient implementations on the state-of-the-art digital technology node. It also involves interactions with several researchers across IBM research focusing on various aspects of the project. The ideal candidate should have a multi-disciplinary background, strong hardware design and simulations and programming skills. Prior knowledge on VLSI and architectures is a bonus but not necessary.

[1] Langenegger et al., arXiv: <u>https://arxiv.org/abs/2211.05052</u>