IGI | Institute of Theoretical Computer Science

Predictive learning with SNNs

Spiking Neural Networks (SNNs) are a neural network model closely inspired by biological neural networks. Novel neuromorphic hardware implements SNNs in order to achieve high energy-efficiency. SNNs do not communicate analog values but rather events in times (spikes). Therefore, they are well-suited to process temporal input data where timing matters. Predictive learning, i.e., learning to predict the following inputs has become a major self-supervised learning objective in deep learning, for example in transformer models such as GPT.

In this project, we will investigate predictive learning in recurrent SNNs. Using suitable datasets, we will investigate how well SNNs are suited to predict the future of input sequences. We will first start with backpropagation through time (BPTT) to train such networks and then compare the performance to e-prop, an approximation of BPTT that is well-suited for neuromorphic hardware.

Goals & Tasks

- Review literature on predictive learning in SNNs.
- Perform simulations of SNNs for predictive learning on benchmark tasks.

Qualifications

- Interest in computational neuroscience.
- Experience with Python and Tensorflow or PyTorch.
- Course Principles of Brain Computation and Deep Learning is recommended.
- Registered to one of the following:
  - ✓ **Bachelor Thesis**
  - ✓ **Seminar Project**
  - ✓ **Master Thesis**

Contact

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