

Unsupervised sequence learning in 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. Unsupervised learning in SNNs is mainly based on spike-timing-dependent plasticity (STDP) a simple local synaptic plasticity rule. Winner-take-all (WTA) architectures can learn to cluster spatial input patterns.

In this project, we will investigate the unsupervised clustering of spatio-temporal input sequences. Here, it is not only important which input-neuron spikes, but also in what spatio-temporal sequence these spikes appear. We will investigate new network architectures and plasticity rules that lead to the clustering of spatio-temporal input patterns. The model will be implemented in Python and simulations will be performed in order to evaluate the capabilities of the model.

Goals & Tasks

- Review literature on learning of input sequences in SNNs.
- Implement a model that is capable to learn input sequences
- Perform simulations on benchmark tasks.

Qualifications

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

Contact

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