Research Interests

- Spiking Neural Networks
- Machine Learning
- Computational Neurosciences
- Reinforcement Learning

Additional Research Interests

- Neurosciences
- Data Mining
- Self–Organized Systems

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Diploma Thesis

Spiking Neural Networks

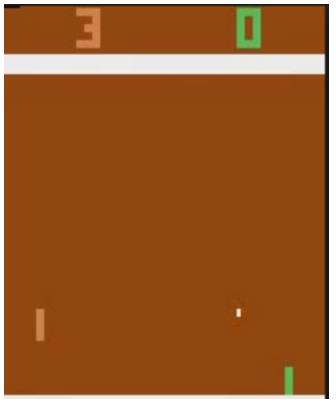
In this thesis, spiking neural networks are studied in two contexts -- one in a functional role where the network is trained with reinforcement learning, and second in a descriptive context studying the emergent self-organized criticality (SOC) property of the network.

In first case, we train a spiking neural network to play Pong - a simple video game - with reinforcement learning. After training, the spiking neural network is able to play Pong at a basic level and score against its opponent occasionally.

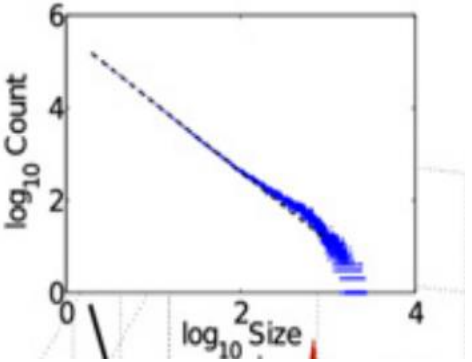
In second case, we study and implement the setup from the paper "Synaptic Plasticity Enables Adaptive Self-Tuning Critical Networks“ [1]. Particularly, the goal is to reproduce the result that a spiking neural network consisting of integrate and fire neurons and synapses with spiking timing-dependent plasticity and short-term plasticity dynamics exhibits self-organizing criticality, such that the network operates in the critical regime after the self-organization.

[1] N. Stepp, D. Plenz, and N. Srinivasa. “Synaptic Plasticity Enables Adaptive Self-Tuning Critical Networks”. In: PLoS Computational Biology (2015).

Screenshot from game Pong



Distribution of avalanches in paper [1]



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