Accelerating Distributed Spike-Timing-Dependent-Plasticity Learning

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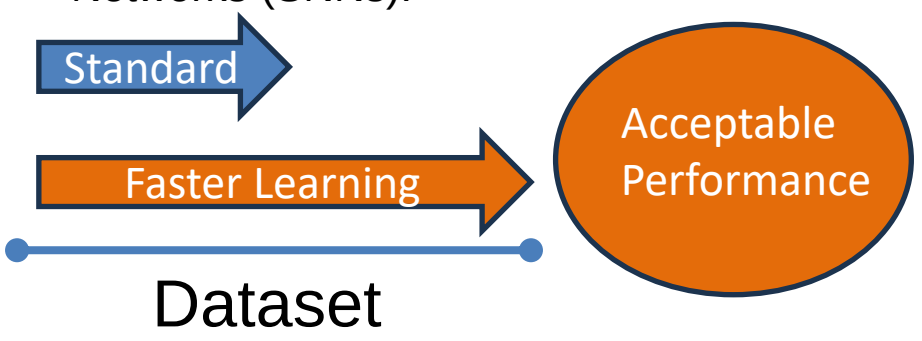
1. Summary of the Research

- The goal of this study is to accelerate the training process of Spiking Neural Networks (SNNs).

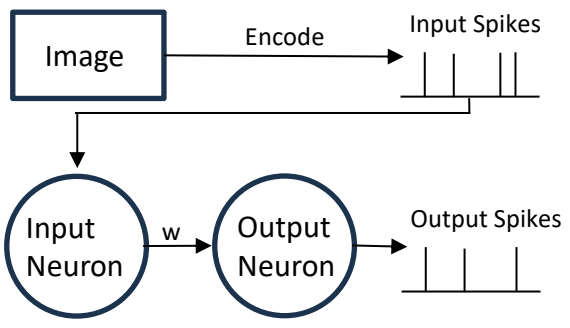


- Research objective is to separate an SNN model and dataset, train each sub-model parallelly, and finally merge into one model (Ensemble Learning).

- Merging SNN sub-models is performed by neuron similarity compression, a strategy not explored in previous SNN research.

2. Approach/Methodology

Step 1: Train sub-models by Spike-Timing-Dependent-Plasticity Learning



Weight (w) is updated based on timings of input and output spikes.

Figure 1: Learning model with relative timing

Step 2: Combine the sub-models into one

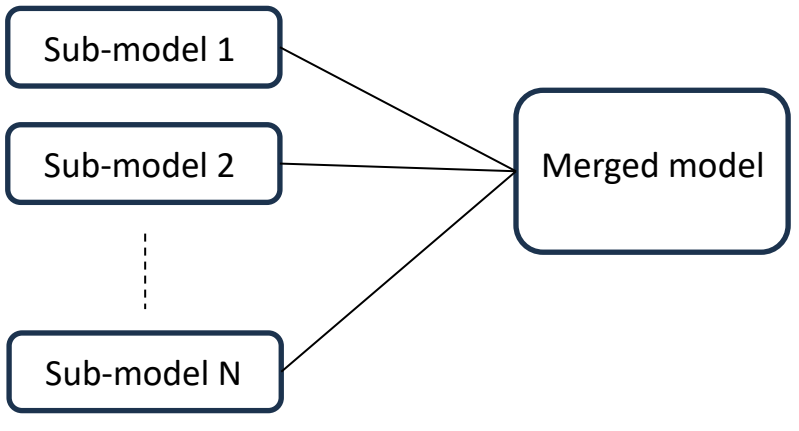


Figure 2: Common Ensemble Learning Architecture

Step 3: Compress Neurons
Neurons can be visualized as in Fig.2.
One of 2 redundant neurons is removed.

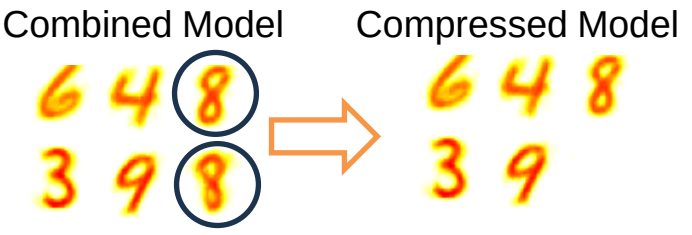


Figure 3: Example of Compressing Neurons

3. Current Results and Status

Two models are trained, combined, and compressed by observing and removing 28 redundant neurons. There is performance improvement whilst reducing the model size.

Model 1	Model 2	Merged Model
64 neurons: 75%	64 neurons: 75%	100 neurons: 77%

4. Remaining Tasks and Tentative Schedule

	10	11	12	1	2
[a]	→	→			
[b]			→	→	
[c]	→	→	→	→	

[a] Automate compressing process
[b] Test with many SNN sub-models
[c] Writing thesis

References

[1]W. Ledet and D. Himmelblau, “Decomposition procedures for the solving of large scale systems,” *Advances in Chemical Engineering*, vol. 8, pp. 185–254, 1970. [Online].

[2] P. Panda, G. Srinivasan, and K. Roy, “Ensemblesnn: Distributed assistive STDP learning for energy-efficient recognition in spiking neural networks,” *Proc. Int. Joint Conf. Neural Netw. (IJCNN)*, 2017, pp. 2629–2635.