IE 590: Nature Inspired Computing
Project Problem

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Training Spiking Neural Networks using an Ensemble of Nature-Inspired Algorithms

Spiking Neural Networks often called as the third generation of neural networks are bio-inspired ANN where information is encoded as discrete spikes in time[1]. The input and outputs of Spiking Neural Networks are encoded in the form of spike trains. The primary idea behind Spiking Neural Networks (SNN) is that the human brain encodes information in the form of spikes and these spikes induce potentials in the neurons which helps them fire and produce an output to a corresponding input.

The spike events are discrete in time, hence application of supervised learning algorithms are difficult. Majority of the learning algorithms in case of Spiking Neural Networks are based on the principle of Hebbian Learning. Over the years, some supervised learning algorithms like SpikeProp[2], SPAN[3], ReSuMe[4] have been developed by approximating the discrete signals to a continuous one. Since SNNs are inspired by the brain and supervised learning algorithms are difficult to implement, nature or bio-inspired algorithms can play an important role during the learning phase of SNNs. Particle swarm optimization algorithms have been used previously to learn the synaptic weights in case of Spiking Neural Networks[5].

Ensemble learning is a technique where multiple learners are used to solve some instance of a problem. Ensemble learners have been shown to outperform single classifiers [6]. Genetic algorithms have been used in the past to determine the optimal set of weights for each learning algorithm in an ensemble setting. Ensemble of various bio-inspired algorithms to solve a particular instance has never been done before, and hence a mixture of various bio-inspired algorithms to train Spiking Neural Networks is an approach that still remains to be investigated. Therefore this project would revolve about using an ensemble of various existing bio-inspired algorithms to determine the optimal sets of weights of a Spiking Neural Network and evaluating the performance of such an ensemble setting.

References

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