MULTI-OBJECTIVE EVOLUTIONARY ALGORITHMS OF SPIKING NEURAL NETWORKS FOR CLASSIFICATION PROBLEMS

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ABSTRACT
Multi-Objective Optimization (MOO) methods have been getting serious attention in solving Artificial Neural Networks (ANNs) structure and learning problems. Most of ANNs applications involve tasks with a high computational cost for feasible network structure. Typically, these applications involve the selection of the network structure and network accuracy. Hence, many optimization methods have been introduced to overcome the salient weaknesses of ANNs particularly on the learning and network structure. These include MOO learning to improve the generalization of ANNs. The methods aim at finding a set of solutions called the Pareto-optimal set from which the best one is selected. In this study, various Multi-Objective Evolutionary Algorithms (MOEAs) with Spiking Neural (SN) network have been proposed for better learning structure and generalization accuracy. The SN network has certain advantages over other types of ANNs in terms of the inherent time-based behaviour and faster learning algorithms. However, the construction of a SN Networks have slow convergence. Therefore, methods are used to speed up the convergence and improve the performance of the network by augmenting MOEAs with a local search such as Back Propagation. This study addresses optimization of SN Networks simultaneously using MOEAs. The proposed methods were developed to evolve towards Pareto-optimal set that is defined by three objective functions simultaneously with the classification accuracy and structure complexity. Subsequently, various algorithms have been developed that include Multi-Objective Non dominated Sorting Genetic Algorithm 2 based SN Networks (NSGA2N), Multi-Objective Particle Swarm Optimization based SN Networks (MOPSON) and Elitist Multi-Objective Differential Evolution based SN Networks (MEMODEN) to improve SN Networks structure and accuracy rates.

KEYWORD
Artificial intelligent, spiking neural network