

Introduction

RNN is a class of ANN that can receive input and provide output in the form of sequential data for pattern recognition and prediction. It is widely used for many applications, such as image captioning, speech processing, music generation, time series prediction, natural language, video analysis, and information retrieval.

The nodes on RNN have recurrent connections, which tend to have complex structures, and hyper-parameters. RNN structures can be designed and developed manually by a domain expert. However, it is time-consuming. Another approach to designing RNN structures is by NAS, which is a process of automating the search for neural network structures using an optimization algorithm.

Many algorithms have been proposed and widely used to tackle optimization problems, such as EA and Swarm Intelligence (SI).

NEAT is a method for finding neural network structures using an Evolutionary Algorithm (EA). It can outperform the reinforcement learning method to optimize the neural network structures with a fixed number of nodes. It is a constructive algorithm that takes much time if the structure has many nodes with complex connectivity. Therefore, a destructive operation is necessary to design RNN with a larger structure.

GA is another EA method that can solve optimization problems. It uses natural and genetic selection mechanism by simulating species evolution. Fixed length chromosome representation dominates the GA field, this representation is suitable for a problem with a fixed-length solution. Unfortunately, not all problems have fixed length solutions.

Finding the optimal RNN structure, the number of nodes and its connections cannot be determined. Problems like this can be solved using VLC-GA. In this paper, we propose VLCGA as the search method to find the optimal structure for RNN. VLCGA is able to evolve the structure for RNN constructively and destructively.

VLC-GA is a GA concept where each node and its connection on RNN are represented by a gene within the chromosome. The number of genes in a chromosome determines the number of connections in a structure. One chromosome represents one structure. In theory, the length of the chromosome will evolve in quality and quantity. Chromosomes in a population will add genes if additional connections are needed to find the optimum structure.