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Mixed Tabu Machine for portfolio optimization problem

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Abstract
In this paper, we introduce a novel artificial neural network to solve the portfolio optimization problem. The proposed neural network is called the Mixed Tabu Machine since its structure is similar to the Tabu Machine, but includes both discrete and continues variables. Similar to the Hopfield network, the state of the Mixed Tabu Machine is updated to find the global minimum energy state. To escape from local minimum states of the energy in the Mixed Tabu Machine, the state transition mechanism is controlled by a tabu search in both discrete and continues search spaces. The experimental results for five standard benchmark data sets show that the Mixed Tabu Machine can clearly obtain better solutions in less CPU time than the recently proposed Hopfield network.

Keywords and phrases: Tabu Machine, Hopfield network, portfolio optimization problem

1. Introduction

For the first time, the idea of using neural networks for solving optimization problems was proposed by [6]. They applied the Hopfield network to solve the travelling salesman problem which is an NP-hard combinatorial optimization problem. Starting from an initial state, updating of the Hopfield network is guided by the transition mechanism so that the energy function is reduced consecutively. The updating of the Hopfield network is continued until a stable state for the energy function is achieved. There is no rule embedded in the transition mechanism of the Hopfield network to escape from local minima. Hence, the stable state of the Hopfield network may be so far from the global minimum state. This is the main limitation of the Hopfield network for solving the optimization problems [13].

A recently successful hybridization of the Hopfield network and tabu search is the Tabu Machine proposed by [13]. Tabu Machine has the same structure as the Hopfield network. To escape from poor local minima, in the Tabu Machine, a memory based state transition mechanism is applied. The incorporated memory into the state transition mechanism is implemented using the short and long term memory processes in a tabu search.

In spite of different methods proposed for improving the performance of neural networks [5, 7, 14], most of them are discrete-valued and presented for combinatorial optimization problems. To our knowledge, few studies have focused on employing a state transition