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Double-Layered Hybrid Neural Network Approach for Solving Mixed Integer Quadratic Bilevel Problems

***Abstract***

In this paper we build a double-layered hybrid neural network method to solve mixed integer quadratic bilevel programming problems. Bilevel programming problems arise when one optimization problem, the upper problem, is constrained by another optimization, the lower problem. In this paper, mixed integer quadratic bilevel programming problem is transformed into a double-layered hybrid neural network. We propose an efficient method for solving bilevel programming problems which employs a double-layered hybrid neural network. A two-layered neural network is formulate by comprising a Hopfield network, genetic algorithm, and a Boltzmann machine in order to effectively and efficiently select the limited number of units from those available. The Hopfield network and genetic algorithm are employed in the upper layer to select the limited number of units, and the Boltzmann machine is employed in the lower layer to decide the optimal solution/units from the limited number of units selected by the upper layer.The proposed method leads the mixed integer quadratic bilevel programming problem to a global optimal solution. To illustrate this approach, several numerical examples are solved and compared.