Investigating Monte-Carlo Tree Search Approach for the Job Shop Scheduling Problem

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1 Abstract

Job shop scheduling is the question of scheduling tasks on a set of machines in order to optimize a criterion as completing these tasks as fast as possible. It plays an important role in many industries, including manufacturing, transportation and healthcare. This problem has a long history and many methods, mostly coming from operations research or meta heuristics have been proposed. Here, we propose to investigate the use of a Monte-Carlo tree search-type method (MCTS) in order to handle large-scale instances. MCTS works by simulating multiple iterations of random moves, creating a tree structure representing possible actions and outcomes. The algorithm balances exploration and exploitation, selecting nodes based on their estimated value. After selecting a node, it expands the tree by adding child nodes for possible moves. Our analysis includes the design of the state-space and the action-space in order to represent the job-shop scheduling problem in a way that can fit MCTS approaches. We report computational results on large-scale instances coming from the industry.