Concurrent search for distributed CSPs

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Abstract

A distributed concurrent search algorithm for distributed constraint satisfaction problems (DisCSPs) is presented. Concurrent search algorithms are composed of multiple search processes (SPs) that operate concurrently and scan non-intersecting parts of the global search space. Each SP is represented by a unique data structure, containing a current partial assignment (CPA), that is circulated among the different agents. Search processes are generated dynamically, started by the initializing agent, and by any number of agents during search.

In the proposed, ConcDB, algorithm, all search processes perform dynamic backtracking. As a consequence of backjumping, a search space can be found unsolvable by a different search process. This enhances the efficiency of the ConcDB algorithm. Concurrent Dynamic Backtracking is an asynchronous distributed algorithm and is shown to be faster than former algorithms for solving DisCSPs. Experimental evaluation of ConcDB, on randomly generated DisCSPs demonstrates that the network load of ConcDB is similar to the network load of synchronous backtracking and is much lower than that of asynchronous backtracking. The advantage of Concurrent Search is more pronounced in the presence of imperfect communication, when messages are randomly delayed.

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