

先端科学技術研究科 修士論文要旨

所属研究室 (主指導教員)	大規模システム管理 (笠原 正治 (教授))		
学籍番号	1911203	提出日	令和 3年 1月 21日
学生氏名	長谷 洋斗		
論文題目	Variable Ordering for Fast Top-Down ZDD Construction Using Novel Beam Search-Based Algorithms and Local Search ビームサーチ型アルゴリズムと局所探索法を用いた高速なトップダウン型ZDD構築のための変数順序付け		
要旨			
<p>In graph problems, special care must be taken to enumerate subgraphs of a given graph such as paths, spanning trees, and spanning forests. A frontier-based search is a framework to enumerate subgraphs and to store them into a data structure called a Zero-suppressed binary decision diagram (ZDD). The frontier-based search enumerates subgraphs by processing each edge one by one following a given variable order. The efficiency of the search depends on the given variable order. Therefore, we want to find a good order to run the frontier-based search efficiently. A previous study proposed a beam search-based heuristic algorithm for variable ordering. However, frontier-based search with the variable order obtained from the existing method fails to construct ZDDs on some graphs mainly due to memory shortages.</p> <p>In this thesis, we present the design of novel beam search-based algorithms and local search for variable ordering. The design directions of our beam search-based algorithms are as follows. First, we give three theorems that reveal the characteristic of variable ordering. Second, we propose an approach based on dynamic programming (dp) for variable ordering, where each state of dp has a set of edges and has a future state generated by edges that will be selected in the future from a current state. Third, in the process of a beam search, we introduce the upper bound and lower bound of the beam width to enable solution candidates to have diversity. We also propose two local search-based algorithms for variable ordering. One discovers variable orders hard to obtain by only beam search-based algorithms. The other reorders a variable order to enhance pruning effects in frontier-based search keeping the variable order good. We show that frontier-based search with the variable order that the proposed methods output provides more efficient performances than frontier-based search with the variable order that the existing method outputs for almost all instances.</p>			