【Grant-in-Aid for Scientific Research (S)】

Integrated Disciplines (Informatics)

Title of Project : Research on Core Algorithms for Discrete Structure Manipulation Systems

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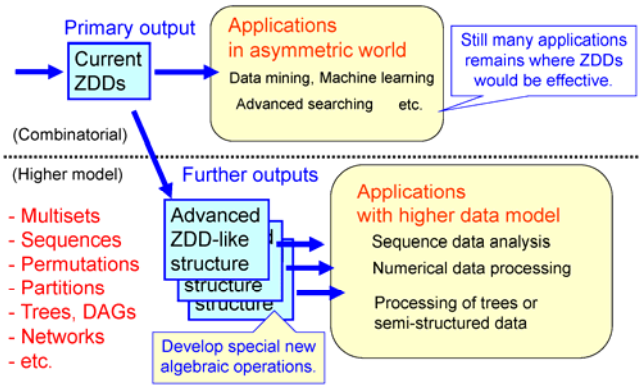
Research Project Number : 15H05711 Researcher Number : 10374612
Research Area : Informatics
Keyword : Discrete Structure Manipulation System, Algorithm

【Purpose and Background of the Research】

Discrete structures are foundational material for computer science and mathematics. Many problems solved by computers can be decomposed into discrete structures using simple primitive algebraic operations. It is very important how to represent large-scale discrete structural data and to execute their operations efficiently.

The project leader has been leading "JST ERATO Minato Discrete Structure Manipulation System Project" for five years. In this project, he has studied discrete structure manipulation systems using Zero-suppressed Binary Decision Diagrams (ZDDs) and their practical applications. As the results of the project, they developed novel techniques for enumerating, compressing and indexing large-scale data based on ZDDs, and they are very effective for real-life problems. Many researchers are now interested in these techniques, and several number of related research projects has been started. This research project focus on the core algorithms of discrete structure manipulation, and we will continue to maintain a firm research community in the center of the other related research projects.

(ZDD)



【Research Methods】

As a primary research output, we first apply the current ZDD techniques to many practical applications where ZDDs would be effective. In the other hand, we also consider the higher-level data models, such as multisets, sequences, permutationsm trees, etc. We will develop ZDD-like data structures for them, and not only the data structures but also their algebra will provide fruitful applications. This project will study such core algorithms for discrete structure manipulation systems, and will provide their efficient software implementations for related application engineers in academia and industory. More specifically, our research topics include 1) development of core algorithms for discrete structure manipulation and providing software implementation, 2) Development of efficient searching, enumerating, and indexing methods, and 3) Promoting the researcher's community and collaboration with other related national projects.

【Expected Research Achievements and Scientific Significance】

Computer science and technology consists of a layer of foundational theory and a layer of engineering customized for each application. Our research area of discrete structure manipulation is located in the middle of the two layer, called "the Art" layer, to connect "Science" and "Engineering." Our project will provide a research community where theoretical people and application people collaborate together. It may create the seeds of technology.

【Publications Relevant to the Project】

- Takeru Inoue, Hiroaki Iwashita, Jun Kawahara, and Shin-ichi Minato: "Graphillion: software library for very large sets of labeled graphs," International Journal on Software Tools for Technology Transfer (STTT), Springer, DOI 10.1007/s10009-014-0352-z, Oct. 2014.

【Term of Project】 FY2015-2019

【Budget Allocation】 103,400 Thousand Yen

【Homepage Address and Other Contact Information】

http://www-erato.ist.hokudai.ac.jp/