Study on Enumeraton of Graphs Which Have Geometric Characterization

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In the research field of graph algorithms, there are several researches which achieve efficiently solving problems that it is difficult to solve for general graphs by restricting input graph. In the situation to design/implement such algorithms, it is useful for testing algorithms if there is catalog of elements of the target graph class. Furthermore, since the graphs which are isomorphic are essentially the same, it is ideal if those catalogs contain isomorphic graph exactly once. On the other hand, since it is widely known that graph isomorphism problem is GI-complete for many graph classes, it is thought that it is difficult to solve efficiently. However, there are exist some graph classes that graph isomorphism problem can be solved efficiently for whose elements.

From the viewpoint of graph enumeration, there are several preceding researches which achieve efficient enumeration by restricting the target graph class. Two of these researches, they proposed algorithms which enumerate proper interval graphs and bipartite permutation graphs efficiently each. However, since these researches use characteristics of the target graph classes to achieve efficiency, it is difficult to extend the algorithms for the other graph classes. Then, in this research, we focus on the graph classes that we can solve graph recognition problem and graph isomorphism problem for its elements, and propose the general framework to construct algorithms which efficiently enumerate elements of the target graph class with certain number of vertices. For the graph classes that we can solve graph recognition problem and graph isomorphism problem efficiently, there are many cases that there is tree structure which corresponds to a graph in the graph class, and then, we can solve graph isomorphism problem efficiently by solving tree isomorphism problem instead of general.

As the graph classes that we can efficiently solve graph recognition problem and graph isomorphism problem, interval graphs and permutation graphs are known. There are many applicative researches for these graph classes, however, there are never been graph catalogs for them.

In this research, first, we propose the general framework to construct enumeration algorithm for the graph class that we can efficiently solve graph recognition problem and graph isomorphism problem. Next, as concrete applications of the framework, we construct enumeration algorithms for interval graphs and permutation graphs. And finally, we implement the algorithms on a real computer and show the experimental results.