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# Algorithmic Height Compression of Unordered Trees

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**Abstract**

By nature, tree structures frequently present similarities between their subparts. Making use of this redundancy, different types of tree compression techniques have been designed in the literature to reduce the complexity of tree structures. A popular and efficient way to compress a tree consists of merging its isomorphic subtrees, which produces a directed acyclic graph ($DAG$) equivalent to the original tree. An important property of this method is that the compressed structure (i.e. the $DAG$), has the same height as the original tree, thus limiting partially the possibility of compression. In this paper we address the problem of further compressing this $DAG$ in height. The difficulty is that compression must be carried out on substructures that are not exactly isomorphic as they are strictly nested within each-other. We thus introduced a notion of quasi-isomorphism between subtrees, that makes it possible to define similar patterns along any given path in a tree. We then proposed an algorithm to detect these patterns and to merge them, thus leading to compressed structures corresponding to $DAGs$ augmented with return edges. In this way, redundant information is removed from the original tree in both width and height, thus achieving minimal structural compression. The complete compression algorithm is then illustrated on the compression of various plant-like structures.

*Keywords:* Plants modeling, branching structures, self-nestedness, quasi-isomorphism, height redundancy.

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