Compressed Suffix trees: Theory and Implementation

Research seminar

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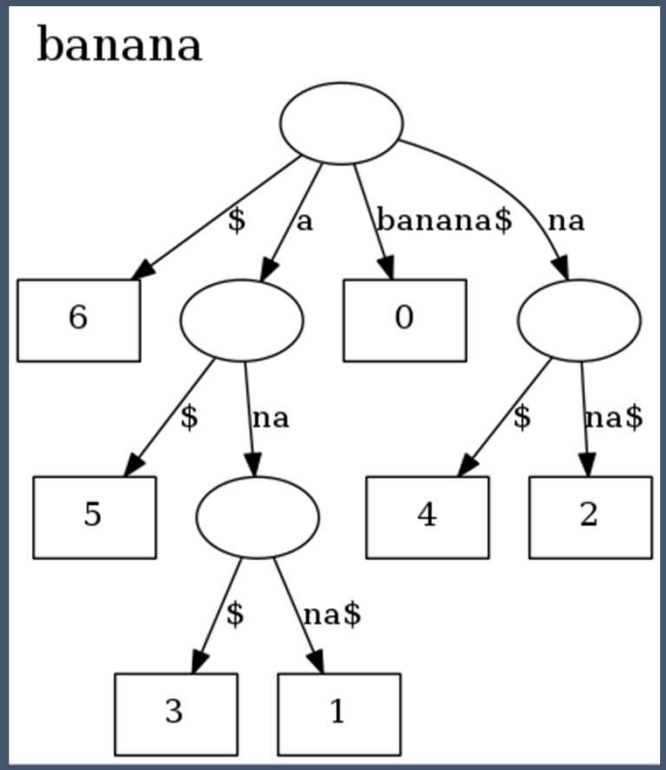
What is Suffix tree?

• A suffix tree is a clever way to organize a word you can quickly find specific parts of it.

• It’s a tree structure where each branch represents a part of the word, and the complete words are found at the leaves.

• They are commonly used in areas like genomics, where large DNA sequences need to be analysed.



A suffix tree for a text supports the following operations:

1. root()
2. isleaf (v)
3. child(v, c)
4. sibling(v)
5. parent(v)
6. edge(v, d)
7. depth(v)
8. lca(v, w).
9. sl(v)

Motivation

Paper: Compressed Suffix Trees with Full Functionality

Author: Kunihiko Sadakane, Kyushu University

Proposed novel approach to construct compressed suffix trees that retain complete functionality while achieving significant space reduction.

Compressed Suffix Trees with Full Functionality

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Abstract

We introduce new data structures for *compressed suffix trees* whose size are linear in the text size. The size is measured in *bits*; thus they occupy only $O(n \log |\mathcal{A}|)$ bits for a text of length n on an alphabet $\mathcal{A}$. This is a remarkable improvement on current suffix trees which require $O(n \log n)$ bits. Though some components of suffix trees have been compressed, there is no linear-size data structure for suffix trees with full functionality such as computing suffix links, string-depths and lowest common ancestors.

The data structure proposed in this paper is the first one that has linear size and supports all operations efficiently. Any algorithm running on a suffix tree can also be executed on our compressed suffix trees with a slight slowdown of a factor of polylog(n).

Plan

1. To implement both classical and compressed Suffix tree structure.

2. Test time and space complexities on ALGator system.

Data for testing: human genome or some lexicographical dictionary

Technology

- C++ programming language
- ALGator system

Reference

- Sadakane, K. (2007). Compressed suffix trees with full functionality. Theory of Computing Systems, 41(4), 589-607.

Thank you