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A linear-space data structure for range-LCP queries in poly-logarithmic time. (English)

Zbl 1441.68021

Wang, Lusheng (ed.) et al., Computing and combinatorics. 24th international conference, COCOON 2018, Qing Dao, China, July 2–4, 2018. Proceedings. Cham: Springer. Lect. Notes Comput. Sci. 10976, 615-625 (2018).

Summary: Let $\mathsf{T}[1,n]$ be a text of length n and $\mathsf{T}[i,n]$ be the suffix starting at position i. Also, for any two strings X and Y, let $\mathsf{LCP}(X,Y)$ denote their longest common prefix. The range-LCP of T w.r.t. a range $[\alpha,\beta]$, where $1 \leq \alpha < \beta \leq n$ is

$$\mathsf{rlcp}(\alpha,\beta) = \max\{|\mathsf{LCP}(\mathsf{T}[i,n],T[j,n])| \mid i \neq j \text{ and } i,j \in [\alpha,\beta]\}.$$

A. Amir et al. [Lect. Notes Comput. Sci. 7074, 683–692 (2011; Zbl 1350.68298)] introduced the indexing version of this problem, where the task is to build a data structure over T, so that $\mathsf{rlcp}(\alpha,\beta)$ for any query range $[\alpha,\beta]$ can be reported efficiently. They proposed an $O(n\log^{1+\epsilon} n)$ space structure with query time $O(\log\log n)$, and a linear space (i.e., $O(n)$ words) structure with query time $O(\delta\log\log n)$, where $\delta = \beta - \alpha + 1$ is the length of the input range and $\epsilon > 0$ is an arbitrarily small constant. Later, *M. Patil* et al. [Lect. Notes Comput. Sci. 8214, 263–270 (2013; Zbl 1442.68040)] proposed another linear space structure with an improved query time of $O(\sqrt{\delta}\log^{\epsilon}\delta)$. This poses an interesting question, whether it is possible to answer $\mathsf{rlcp}(\cdot,\cdot)$ queries in poly-logarithmic time using a linear space data structure. In this paper, we settle this question by presenting an $O(n)$ space data structure with query time $O(\log^{1+\epsilon} n)$ and construction time $O(n\log n)$.

For the entire collection see [Zbl 1390.68029].

MSC:

68P05 Data structures
68Q25 Analysis of algorithms and problem complexity
68W32 Algorithms on strings

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