Summary: We consider the canonical generalization of the well-studied Longest Increasing Subsequence problem to multiple sequences, called $k$-LCIS: Given $k$ integer sequences $X_1, \ldots, X_k$ of length at most $n$, the task is to determine the length of the longest common subsequence of $X_1, \ldots, X_k$ that is also strictly increasing. Especially for the case of $k = 2$ (called LCIS for short), several algorithms have been proposed that require quadratic time in the worst case.

Assuming the Strong Exponential Time Hypothesis (SETH), we prove a tight lower bound, specifically, that no algorithm solves LCIS in (strongly) subquadratic time. Interestingly, the proof makes no use of normalization tricks common to hardness proofs for similar problems such as LCS. We further strengthen this lower bound to rule out $O((nL)^{1-\varepsilon})$ time algorithms for LCIS, where $L$ denotes the solution size, and to rule out $O(n^{k-\varepsilon})$ time algorithms for $k$-LCIS. We obtain the same conditional lower bounds for the related Longest Common Weakly Increasing Subsequence problem.

For the entire collection see [Zbl 1387.68026].

MSC:

68Q17 Computational difficulty of problems (lower bounds, completeness, difficulty of approximation, etc.)

68Q27 Parameterized complexity, tractability and kernelization

68W32 Algorithms on strings

Keywords:

fine-grained complexity; combinatorial pattern matching; sequence alignments; parameterized complexity; SETH

Full Text: DOI

References:


[16] :12

[17] :11


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