

On-Line Pattern Matching on D-Texts

Nadia Pisanti 

University of Pisa, Italy

Abstract

The *Elastic Degenerate String Matching* (EDSM) problem is defined as that of finding an occurrence of a pattern P of length m in an ED-text T . A *D-text* (Degenerate text) is a string that actually represents a set of similar and aligned strings (e.g. a pan-genome [5]) by collapsing common fragments into a standard string, and representing variants with sets of alternative substrings. When such substrings are not bound to have the same size, then we talk about *elastic D-strings* (ED-strings). In [6] we gave an $O(nm^2 + N)$ time on-line algorithm for EDSM, where n is the length of T and N is its size, defined as the total number of letters. A fundamental toolkit of our algorithm is the $O(m^2 + N)$ time solution of the later called *Active Prefixes* problem (AP). In [2], a $O(m^{1.5}\sqrt{\log m} + N)$ solution for AP was shown, leading to a $O(nm^{1.5}\sqrt{\log m} + N)$ time solution for EDSM. The natural open problem was thus whether the 1.5 exponent could furtherly be decreased. In [3], we prove several properties that answer this and other questions: we give a conditional $O(nm^{1.5} + N)$ lower bound for EDSM, proving that a combinatorial algorithm solving EDSM in $O(nm^{1.5-\epsilon} + N)$ time would break the Boolean Matrix Multiplication (BMM) conjecture; we use this result as a hint to devise a non-combinatorial algorithm that solves EDSM in $O(nm^{1.381} + N)$ time; we do so by successfully combining Fast Fourier Transform and properties of string periodicity.

In my talk I will overview the results above, as well as some interesting side results: the extension to a dictionary rather than a single pattern [7], the introduction of errors [4], and a notion of matching *among* D-strings with its linear time solution [1].

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