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on Semiconductor and Electronics, Information and Communications Technology and Energy

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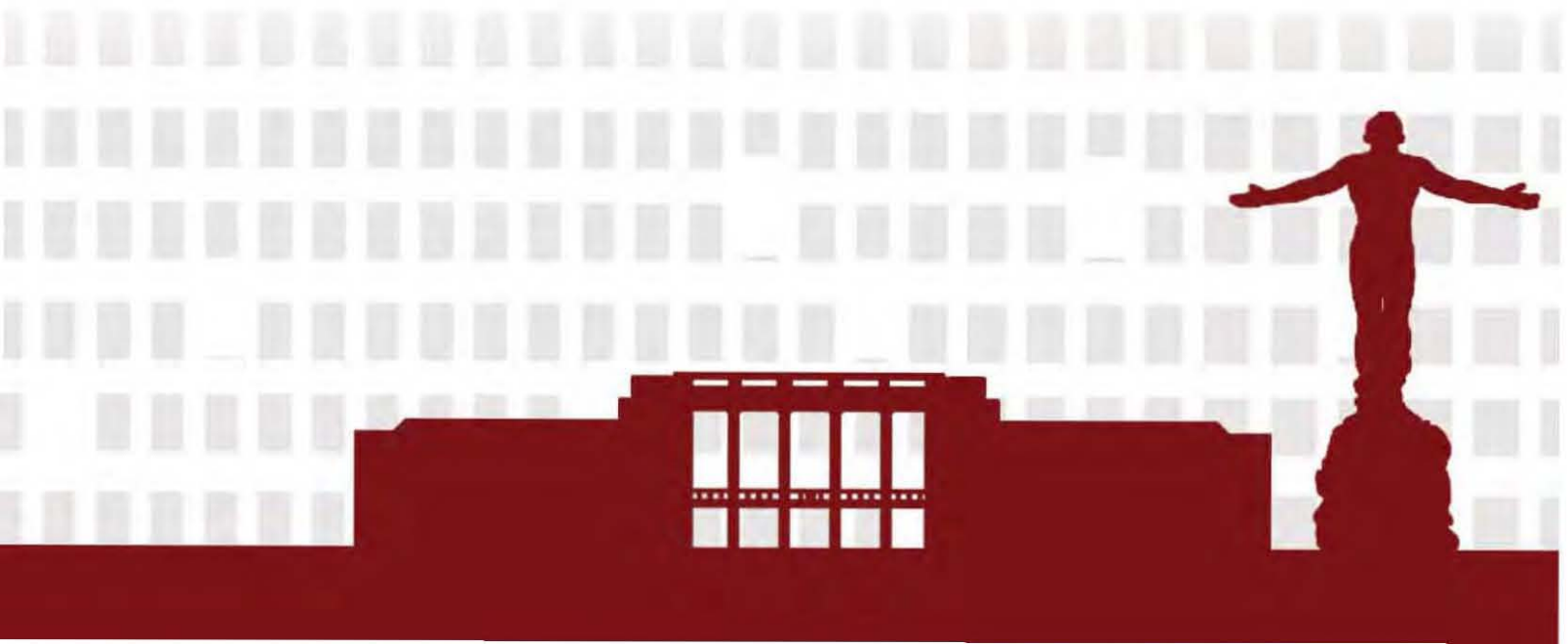
Metro Manila, Philippines



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AN EFFICIENT EXACT SOLUTION TO THE (*L, D*)-PLANTED MOTIF PROBLEM

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ABSTRACT

DNA motif finding is widely recognized as a difficult problem in computational biology and computer science. Because of the usual large search space involved, exact solutions typically require a significant amount of execution time before discovering a motif of length *l* that occurs in each sequence *Si* from an input set {*S1,…,St*} of sequences, allowing for at most *d* substitutions.

In this paper, we propose a novel algorithm that operates on a compact bit-based representation of the search space and takes advantage of distance-related patterns in this representation in order to compute the exact solution for any arbitrary problem instance up to *l*=17, *d*=6.

A Java implementation—run on synthetic datasets for various challenge instances of the (*l, d*) motif finding problem—shows the proposed algorithm to be highly competitive against PMS8 and qPMS9, two current state-of-the-art exact motif search algorithms. The proposed algorithm works extremely well for problems involving short motifs, outperforming the current best algorithm for the challenge problem instances (13,4) and (15,5) with a run-time reduction of at least 50% and 20% respectively for these instances, while ranking second to qPMS9 for test instances involving *l*=16 and *l*=17.

Keywords: DNA motif finding, exact motif search, Java