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RECTANGLE ENCLOSURE REPORTING IN LINEAR SPACE REVISITED [1]

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ABSTRACT

We present a new algorithm for reporting all the enclosures in a set of plane rectangles in $O(n \log n \log\log n + k \log\log n)$ time and linear space (k denotes the output size). The result is already known (it has already been achieved by two previous papers), however the proposed algorithm follows a different approach.

Keywords: Data structures, computational geometry, rectangle enclosure, space optimality

1. Introduction

The *rectangle enclosure reporting* problem, is the problem of reporting efficiently every rectangle pair within a set, so that the first rectangle of the pair, is fully enclosed by the second one. More formally the problem can be defined as following,

Problem 1 Given a set S of n iso-oriented rectangles in the plane, $S \subset \aleph^2$, report efficiently all the pairs of rectangles (R, R') where $\{R, R'\} \in S$ and R *encloses* R'

Edelsbrunner and Overmars [4] have shown that the above problem is equivalent to the so called *four-dimensional dominance searching* problem. We therefore, give a brief notion of dominance. Consider points $p, q \in \Re^4$. Point $p(p_1, p_2, p_3, p_4)$ is *dominated* by $q(q_1, q_2, q_3, q_4)$ if and only if $p_i \leq q_i, \forall i$. The pair (p, q) is also termed *dominance pair.* Hence, the dominance problem can be stated as:

Problem 2 Given a set of points $P \subset \Re^4$, report efficiently all the pairs (p, p') where $p, p' \in P$ and p is *dominated* by p'.

Under the above definition of dominance, it is easy to verify that Problem 1 can be reduced to Problem 2 by replacing, in linear time, each rectangle $R = [x_l : x_r] \times [y_l : y_r]$ with the point $p(-x_l, -y_l, x_r, y_r)$. Therefore, discovering all dominance pairs $(p, p') \in P$, is equivalent to reporting every enclosure pair (R, R').

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