Yen, William C. K.; Tang, C. Y.

An optimal algorithm for solving the searchlight guarding problem on weighted interval graphs. (English) Zbl 0915.68134


Summary: A graph problem on connected, weighted, undirected graphs, called the searchlight guarding problem, is considered. Assume that there is a fugitive who moves along the edges of the graph at a random speed. The task involves placing a set of searchlights at vertices to search the edges of the graph and to spot the fugitive. Suppose that placing a searchlight at some vertex incurs some building cost. The searchlight guarding problem is to allocate a set $S$ of searchlights at the vertices such that the total cost of the vertices in $S$ is minimized. If there is more than one set of searchlights, each with a minimum building cost, then identify the set with the minimum search time, that is, where the time slots needed to spot the fugitive is the minimum. As is well established, the problem is NP-hard on weighted bipartite graphs but is linear-time solvable on weighted trees. In this paper, the design of a linear-time optimal algorithm for the searchlight guarding problem on weighted interval graphs is presented. It entails two phases. In the first phase, a set of searchlights with minimum guarding cost is identified and the search directions of all edges are assigned. To achieve this task, a new problem, called the edge direction assignment problem, is first defined and the problem on weighted complete-split graphs is solved by the greedy strategy. Based on this computational result, the problem of finding the set of searchlights with minimum guarding cost and assigning the search directions of all edges is solved by the dynamic programming strategy. Then, in the second phase, the search time slots of each edge are determined on the basis of the results of the first phase and on some properties of interval graphs.

MSC:

68R10 Graph theory (including graph drawing) in computer science

Keywords:

searchlight guarding problem

Full Text: DOI

References:

[9] Kekkerkerker, C.G.; Boland, J.Ch., Representation of a finite graph by a set of intervals on the real line, Fund. math., 51, 45-64, (1962) · Zbl 0105.17501
[10] Liu, Y.C.; Chang, M.S., Polynomial algorithms for various weighted perfect domination problems on some classes of graphs, ()

[16] Walter, J.R., Representation of rigid cycle graphs, ()


This reference list is based on information provided by the publisher or from digital mathematics libraries. Its items are heuristically matched to zbMATH identifiers and may contain data conversion errors. It attempts to reflect the references listed in the original paper as accurately as possible without claiming the completeness or perfect precision of the matching.