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A Discretization Technique for the General Point Guarding Problem

آرش واعظی

دکترای مهندسی نرم‌افزار و الگوریتم از دانشگاه صنعتی شریف

Abstract

Given a simple polygon P, in the Art Gallery problem, the goal is to find the minimum number of guards needed to cover the entire P, where a guard is a point and can see another point q when the segment pq does not cross the edges of P.

We present a variant of the Art Gallery problem in which guards can be anywhere inside or on the boundary of P. This problem is generally called the point guarding problem. This problem has been extensively investigated in the computational geometry literature. Since it is NP-hard, attention is turned towards approximation algorithms .

The last best-known factor for the point guarding version is log (OPT) introduced by É. Bonnet in 2020. Typically, approximation algorithms decompose P into convex components and convert the problem into instances of other problems such as Set Cover or Hitting Set. Several approximation factors using the greedy algorithms approach based on solving linear programming (LP) relaxation, and other strategies have been proposed. However, the first step which is the discretization technique surely affects approximating the optimal solution.

We propose an approximation technique that decomposes P into a set of convex components denoted by S. Then, we prove that |OPT(S)|<=3/2|OPT*|, which |OPT(S)| indicates the size of the optimal solution that can be obtained from S, and |OPT*| denotes the size of the optimal solution for point guarding P.

Biography

Arash Vaezi received his M.Sc. and Ph.D. in Computer Engineering from Sharif University of Technology, in 2012 and 2021, respectively. Also, he was accepted as a PhD student at NYU, and had to come back in 2015. Now, he is a Lecturer at Sharif University of Technology. His research interests include Computational Geometry, Approximation and Randomized Algorithms, Designing Large-Scale Systems, Distributed Systems, Crypto-currency, and Deep Learning.

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