The Disk Covering Problem Revisited

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Abstract

It is well-known that placing disks (each of radius $r_s$) in the triangular lattice pattern is optimal for covering all the points on a plane (rigorously proved by R. Kershner in 1939). We consider the following variation on the problem: Suppose we additionally want the centers of the disks to form a connected network, where two disk centers are said to be directly connected if they are within an Euclidean distance of $r_c$ from each other. If $r_c/r_s \geq \sqrt{3}$, then the triangular lattice pattern is still optimal for achieving coverage and connectivity both. What if $r_c/r_s < \sqrt{3}$? In this work, we find an optimal pattern that provides both coverage and connectivity for general values of $r_c/r_s$ and prove its optimality. This problem has become important because of its applications to the deployment of wireless sensor networks.

This is a joint work with Xiaole Bai, Dong Xuan, Ziqiu Yun, and Ten H. Lai. This work has been accepted to appear in the proceedings of the ACM MobiHoc 2006 conference under the title “Deploying Wireless Sensors to Achieve Both Coverage and Connectivity.”