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."