Approximation Algorithms for Some Geometric Optimization Problems

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Abstract. We discuss approximation algorithms for some instances of geometric optimization problems, including maximum independent set, dominating set, vehicle routing, and set cover. In all cases the problems are specified by geometric data, such as points, rectangles, polygons, and disks, and the results strongly exploit geometry to yield better results than can be achieved (or at least better than results known so far) in non-geometric settings. We are motivated by applications of computational geometry in sensor networks and mobile robotics, including classic problems on "art galleries" that need to be guarded by static or mobile guards within a polygonal domain. Almost all of these optimization problems are NP-hard even in simple two-dimensional settings. The problems get even harder when we take into account uncertain data, time constraints for scheduled coverage, and routing/connectivity problems in combination with coverage constraints. We discuss selected versions of these geometric optimization problems from the perspective of approximation algorithms and we describe some techniques that have led to new or improved approximation bounds for certain maximum independent set and routing/coverage problems.