# Optimizing and Approximating Geometric Covering Tours

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**Abstract**

The geometric optimal covering tour problem asks one to compute a shortest cycle that "covers" a geometric set $S$, such as a discrete set of points, a set of polygons, or a polygonal domain, where "coverage" generally means that the tour is required to visit each member of $S$ or to come within a specified distance of each member of $S$. We survey recent approximation algorithm results on computing optimal cover tours in geometric environments.

A fundamental problem in geometric network optimization is the traveling salesman problem (TSP), which is a geometric covering tour problem on a discrete point set $S$. An extension of the TSP, the TSP with Neighborhoods (TSPN), requires that we find a tour of minimum length that visits a set $S$ of *regions* (e.g., polygons). The TSPN shows up in many related geometric optimization problems, including the *watchman route problem* of computing a tour for a mobile guard to be able to see all of a given geometric domain. The TSPN also arises in the watchman route problem with limited visibility range, the *lawnmower* and *milling* problems, range scanning for model and map aquisition, and in various problems in sensor networks, including relay placement and mobile data mules for sensor network data gathering.

We survey the state of the art in approximation algorithms for geometric optimal covering tours, including recent results on watchman routes in polygonal domains, data gathering in sensor networks, and related geometric network optimization problems.