Computational Geometry and Linear Programming

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Abstract

Computational geometry has developed many efficient algorithms for geometric problems in low dimensions by considering the problems from the unified viewpoint of geometric algorithms. It is often the case that such geometric problems may be regarded as special cases of mathematical programming problems in high dimensions. Of course, computational-geometric algorithms are much more efficient than general algorithms for mathematical programming when applied to the problems in low dimensions. For example, a linear programming problem in a fixed dimension can be solved in linear time, while, for a general linear programming problem, only weakly polynomial time algorithms are known. Although not so much attention has been paid to combine techniques in computational geometry and those in mathematical programming, both of them should be investigated more from each side in future.

In this talk, we will demonstrate how computational geometry and mathematical programming may be combined for several geometric problems in low and high dimensions. Efficient sequential and parallel geometric algorithms are shown, where recent interior-point methods for linear programming are partly used.