A Comparison of the Triangle Algorithm and SMO for Solving the Hard Margin Problem

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Abstract

We consider the problem of testing, for two finite sets of points in the Euclidean space, if their convex hulls are disjoint and computing an optimal supporting hyperplane if so. This is a fundamental problem of classification in machine learning known as the hard-margin SVM.

The problem can be formulated as a quadratic programming problem. The SMO algorithm is the current state of art algorithm for solving it, but it does not answer the question of separability.

An alternative to solving both problems is the Triangle Algorithm, a geometrically inspired algorithm, initially described for the convex hull membership problem, a fundamental problem in linear programming.

First, we describe the experimental performance of the Triangle Algorithm for testing the intersection of two convex hulls. Next, we compare the performance of Triangle Algorithm with SMO for finding the optimal supporting hyperplane.

Based on experimental results ranging up to 10,000 points total in dimensions up to 10,000, the triangle algorithm outperforms SMO.

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