# Pattern Separation and Prediction via Linear and Semidefinite Programming

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**This paper is dedicated to Neculai Andrei on his sixtieth birthday**

**Abstract:** We present several optimization methods for separating two sets of points in the n-dimensional space that have nondisjoint convex closures. We give five methods based on linear programming techniques, and two methods based on semidefinite programming techniques. For predictive purposes, we construct two parallel hyperplanes, using linear programming, or two similar concentric ellipsoids, using semidefinite programming, so that the intersection of the convex hulls of the two sets is contained between the two hyperplanes, or the two ellipsoids, and the rest of the two sets, are separated completely. We then construct another hyperplane (or ellipsoid) situated between the two constructed hyperplanes (or ellipsoids), in order to achieve a superior pattern separation. We illustrate our methods on two breast cancer databases.

**Keywords:** pattern separation, data mining, linear programming, semidefinite programming