On the optimal separating hyperplane for arbitrary sets: a generalization of the support vector machine formulation and a convex hull approach

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We generalize the existing formulation and results on separability of sets. In order to characterize the solution of the generalized problem, we use the concepts of convex hulls. For finite sets, it is well known the Support Vector Machine (SVM) technique for finding the optimal separating hyperplane. Here we consider arbitrary sets, allowing infinite, unbounded and nonclosed sets. The problem is formulated as an optimization problem with possibly infinitely many constraints. We prove existence and uniqueness of the solution. Besides, we present some examples and counterexamples to many properties discussed in the text and statements in the literature.

keywords: Linear separability, convex hull, separating hyperplane, optimal separating hyperplane, arbitrary sets, support vector machines and infinite sets.

This is a joint work with Mael Sachine.