# Robust Nonlinear Support Vector Machine based on Difference of Convex Functions

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The training data of some classification problems can present systematic errors, or outliers, that limit the learning process. In this case it might be desirable to derive variations of usual classification models that can deal with the errors. One example is the robust support vector machines introduced by Xu, Crammer and Schuurmans. It is based on the idea of ignoring the samples with the largest errors. There is also another model suggested by Tsyurmasto, Zabarankin, and Uryasev, that uses ideas of value-at-risk. Both models, however, could only be used in the case of linear separation as they lack a strong duality theory that allows for the use of the kernel trick.

In this work we present a variation of the robust support vector machine that can be recast as a difference of convex optimization with linear constraints. Such problems that have a rich strong duality theory. We then succeed to build a dual problem whose data depend only on inner products of the original sample vectors, opening the path to use kernels for nonlinear separation. We also show how the nonlinear classifiers can be obtained from dual solutions and present some preliminary numerical results that exemplify the theory.

This is a joint work with Raquel Serna.