Master's Thesis

Robust Support Vector Machines with Nonlinear Kernel Functions and Data Transformation

Guidance

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February 2020

Abstract

The support vector machine (SVM) is one of the most popular methods for classification in machine learning. It constructs a nonlinear classification function using the so-called kernel trick. The robust SVM is the one that can handle a noisy dataset, whose noise belongs to some bounded uncertainty set. It aims to obtain a hyperplane that seperates two classes such that it remain feasible for all pertubation of the dataset in the uncertainty set. However, most formulations of robust SVMs in literature do not allow for the use of kernel trick to perform nonlinear robust classification.

In this paper, we show that choosing an appropriate kernel function is important when performing nonlinear robust classification with p-norm bounded uncertainty set. We also propose models that allows for the use of kernel trick to perform nonlinear robust classification with SVM under an ellipsoidal uncertainty set and a polyhedral uncertainty set. These models are formulated as convex second order cone programming problems, and are solved by a state-of-the-art interior point algorithm. Finally, we present numerical results to verify the performance of the proposed models.