On the Bootstrap Approach for Support Vector Machines and Related Kernel Based Methods

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Support Vector Machines (SVMs) with a general loss function and a general kernel play an important role in statistical machine learning for many reasons. SVMs can be considered as certain Hilbert-space valued kernel based regularized M-estimators. If some weak assumptions are satisfied, SVMs are solutions of a well-posed mathematical problem in Hadamard's sense, universally consistent with good learning rates, statistically stable with respect of many notions of robustness, and attractive from a computational point of view. Last but not least, such kernel based methods have demonstrated their good generalization properties in many large scale applications with an unknown high-dimensional dependency structure.

My talk will focus on the mainly open question how to draw statistical decisions based on SVMs and related kernel based methods. This question has to my knowledge not yet attracted much consideration in the literature. From an applied point of view, this might be considered as a serious gap, because knowledge of the finite sample or asymptotic distribution of a statistical method is the basis to make statistical decisions like confidence regions, prediction intervals, tolerance intervals or tests. Some recent results on asymptotic properties of bootstrap approximations for the distribution of SVMs and related kernel based methods will be given.

The talk is based on joint work with Matías Salibián-Barrera (Vancouver, Canada), Stefan Van Aelst (Ghent, Belgium), and Robert Hable (Bayreuth, Germany).

Key Words: Support vector machines, kernel based methods, bootstrap, nonparametric statistics, consistency, robustness.