Asymptotic Confidence Sets for General Nonparametric Regression and Classification by Regularized Kernel Methods

Robert Hable

Vortrag im Rahmen des Institutskolloquiums
25. April 2012, 17:15 Uhr
Seminarraum, Ludwigstraße 33 I

Regularized kernel methods such as, e.g., support vector machines and least-squares support vector regression constitute an important class of standard learning algorithms in machine learning. Theoretical investigations concerning asymptotic properties have manly focused on rates of convergence during the last years but there are only very few and limited (asymptotic) results on statistical inference so far. As this is a serious limitation for their use in mathematical statistics, the goal is to fill this gap. Based on asymptotic normality of many of these methods [1], a strongly consistent estimator for the unknown covariance matrix of the limiting normal distribution is derived. In this way, we obtain asymptotically correct confidence sets for $\psi(f_{P,\lambda_0})$ where f_{P,λ_0} denotes the minimizer of the regularized risk in the reproducing kernel Hilbert space H and $\psi : H \to \mathbb{R}^m$ is any Hadamard-differentiable functional. Applications include (multivariate) pointwise confidence sets for values of f_{P,λ_0} and confidence sets for gradients, integrals, and norms.

Keywords: Asymptotic confidence sets, asymptotic normality, least-squares support vector regression, regularized kernel methods, support vector machines.

References:

[1] Hable, R.: Asymptotic Normality of Support Vector Machine Variants and Other Regularized Kernel Methods. *Journal of Multivariate Analysis*, 106:92-117, 2012.

[2] Hable, R.: Asymptotic Confidence Sets for General Nonparametric Regression and Classification by Regularized Kernel Methods. `http://arxiv.org/abs/1203.4354`