Statistical Learning Theory

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Course Description

This course will provide an introduction to advanced topics in statistical learning theory for the modeling of complex, multivariate data. The focus will be on the development of theoretical concepts to support the usage of a number of popular machine learning algorithms such as boosting, support vector machines, least squares method, etc.

Topics

This course will cover the following selected topics in statistical learning theory: risk minimization in classification and regression, consistency, rate of convergence, nearest neighbor methods, reproducing kernel hilbert space and kernel methods, ensemble learning methods such as bagging and boosting, VC theory, concentration inequalities, elements of empirical process and M-estimators, generalization error, and model selection.

Reference

[1] Luc Devroye, Laszlo Gyorfi, Gabor Lugosi. *A Probability Theory of Pattern Recognition.* Springer, 1996.

[2] Trevor Hastie, Robert Tibshirani, Jerome Friedman. *The Elements of Statistical Learning.* Springer, 2001.

[3] Sara van der Geer. *Empirical Processes in M-Estimation.* Cambridge University Press, 2000.

Prerequsites

The prerequisites for this course include a course in machine learning or data mining (e.g. STAT-598N/CS-590) and a graduate-level probability or statistics course (e.g. STAT-517 or STAT-528). Although not required, it is desirable that students are familiar with Matlab or R programming language.

Grading

Class participation (10%), bi-weekly homework (40%), and a course project (50%).