

# Empirical Process Theory and Applications in Nonparametric Statistics

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## ABSTRACT.

Empirical process theory provides a rich toolbox for studying the properties of empirical risk minimizers, such as least squares and maximum likelihood estimators, support vector machines, etc. In this series of lectures, we will start with considering exponential inequalities, including concentration inequalities, for the deviation of averages from their mean. We furthermore present some notions from approximation theory, because this enables us to assess the modulus of continuity of empirical processes. We introduce e.g., Vapnik Chervonenkis dimension: a combinatorial concept (from learning theory) of the "size" of a collection of sets or functions. As statistical applications, we study consistency and exponential inequalities for empirical risk minimizers, and asymptotic normality in semi-parametric models. We moreover examine regularization and model selection.