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Theoretical Challenges Arising from Empirical Observations about Boosting Algorithms.

Boosting is a theoretically inspired approach to classification in which a number of simple “base classifiers” are incorporated into an aggregate classifier. The predictions of the aggregate classifier are weighted votes over the predictions made by the base classifiers. For many applied problems, the best algorithms known use boosting. For a while, boosting algorithms appeared to run counter to the Occam’s Razor principle, which says that a learning algorithm should balance the complexity of a classifier against its fit to training data: the accuracy of the classifiers output by boosting algorithms improved as more base classifiers were added, even when this did not improve the error rate on training data. An explanation of this phenomenon was provided by the influential “margin analysis.”

In this talk, I will describe practical experience with a method inspired by a proof of the margin analysis. The method is squarely in line with the Occam’s Razor principle, and often works well. Sometimes, however, it fails badly. Examining how and when it fails suggests additional reasons for the success of boosting; formalizing these leads to new theoretical challenges. (Received September 15, 2005)