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Comment

Leo Breiman

Cheng and Titterington have most commendably brought developments in the neural network field to the attention of statisticians. It is a notable public service. Since their title is worded "...A Review from a Statistical Perspective", room is left for other statistical perspectives.

When I first heard about neural networks some years ago, I was put off by what I considered to be the hype about doing things the way the brain does. The going propaganda seemed to be that here was a set of procedures modeled after the brain that did a miraculously accurate job in a wide variety of tasks. The functioning of these procedures was coded in esoteric language based on terms borrowed from brain mechanisms. The whole thing was reminiscent of the artificial intelligence publicity a decade or two ago.

But in going to neural network meetings, reading and refereeing their articles and talking to many practitioners over the last five years, my opinion has changed. The neural network community consists of different segments. Some are concerned with constructing mathematical network models of the brain. Others are concerned with networks as mathematical entities, that is, their connectedness, dynamics, etc. Probably the largest segment consists of the people doing work on pattern recognition and other predictive problems.

1. THE CHARACTERISTICS OF THIS LATTER COMMUNITY

They are *not* a neural network community. They use any methodology that works on their problems. Often, they use CART or MARS. They experiment with nearest neighbor methods, separating surfaces gotten by using linear programming, radial basis functions, hidden Markov chains, etc. New

methodologies are constantly proposed, and many of these have little resemblance to standard neural networks. Unfortunately, much of the original, and now anachronistic, terminology is retained giving misleading impressions about what is going on.

They are very pragmatic and problem oriented. In fact, the field is better defined by the nature of the problems they work on than by any particular methodology. Typical problems are speech recognition and handwritten character recognition. The range of problems is characterized by high dimensional complex data, often with very large sample sizes (10^4 to 10^7). The goal is to find accurate predictors in classification, regression and time series.

Often, the methodology they use is hand-tailored to the problem they are working on. In this respect, the neural network technology is attractive in that the network and the number of internal nodes can be tinkered with and optimized for the problem. But other methods are employed if they give better results.

Their bottom line is the error rate on the relevant data set. Proposed new methodologies are judged in terms of their error rates on banks of known data sets. But there is little systematic research into the circumstances under which some methods work better than others. This may be because the work is so oriented toward particular problem solving and tailored methodologies.

The people involved are, by background, computer scientists, engineers and physical scientists. They are generally young, energetic and highly computer literate. They have the further good fortune not to have any formal statistical training so that they feel no compulsion to engage in the futile games of modeling data or in endless asymptotics. What they have borrowed from statistics is very slight.

There are important cultural differences between the statistical and neural network communities. If a statistician analyzes data, the first question he gets asked is "what's your data model?" The NN practitioner will be asked "what's your accuracy?" In

Leo Breiman is Professor, Department of Statistics, 367 Evans Hall, University of California, Berkeley, California 94720.