Spike Train Analysis: A Status Report

As described in Kass, Ventura, and Brown (2005, J. Neurophysiology), statistical thinking involves the introduction of statistical models to describe variability, and the use of statistical principles to discriminate good methods from poor ones. This lecture will have three parts. First, I will give a very brief summary of key statistical ideas. Second, as the main part of the talk, I will review work of my own and my colleagues that takes on several important problems: estimating time-varying firing rates, within-trial analysis, dynamic population decoding, and real-time decoding for brain-machine interfaces. Finally, I will discuss the big outstanding problems. These concern both scientific applications of multiple-neuron data analysis, and development of effective real-time prosthetic algorithms.