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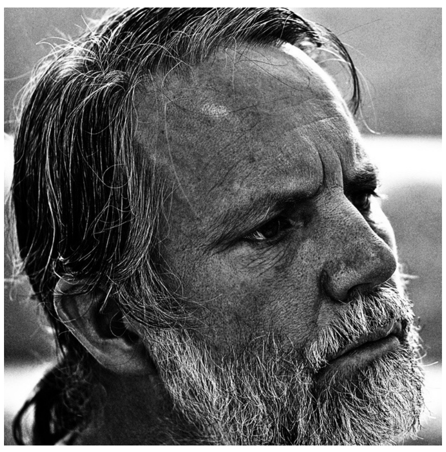
Information Science and Technology Seminar Series



James Theiler
Los Alamos National Laboratory

"Clairvoyance and Confusion: Some Remarks on the Composite Hypothesis Testing Problem"

Wednesday, February 22, 2012
3:00 - 4:00 PM
TA-3, Bldg. 1690, Room 102 (CNLS Conference Room)

Abstract: The composite hypothesis testing problem is one of the great unsolved problems of statistics -- but it is not unsolved because it is particularly hard; it is unsolved because it is fundamentally ambiguous. It is also enormously useful: it lies at the core of what it means to do science, and provides a nice framework to do target detection in multispectral imagery.

For “simple” hypothesis testing, the aim is to distinguish which of two hypotheses is most consistent with observed data. This problem is straightforward, and unambiguously optimal solutions can be expressed in terms of likelihood ratios.

It gets confusing (or composite) when the aim instead is to distinguish between two “families” of hypotheses. The "clairvoyant" solution chooses a single member from each family and then uses the simple likelihood ratio. Although the clairvoyant solution isn't very useful by itself (since, by the very statement of the problem, you don't know which member to choose), it provides a valuable building block for constructing more effective solutions to the composite hypothesis testing problem.

For 50+ years, the so-called generalized likelihood ratio (GLR) has been the workhorse solution for composite hypothesis testing problems, and for good reason: it is straightforward, unambiguous, and quite general. But it is not the only solution, and (except for a very few cases) it is not the optimal solution.

Among the alternatives is a recently introduced class of solutions that goes by the name "clairvoyant fusion" -- the GLR is a special case of clairvoyant fusion (which makes CF a kind of generalized GLR), but the other cases provide new ways to solve composite hypothesis testing problems. This talk will ask some questions about clairvoyant fusion: is it really new? is it any good? how can you tell?

Bayesian zealots will wonder why this abstract has not said anything about their favorite topic. Well, it just did. And so will the talk.

Biography: Theiler received a Ph.D. in Physics from Caltech in 1987, with a thesis on statistical and computational aspects of identifying chaos in time series. He followed a nonlinear trajectory to UCSD, MIT Lincoln Laboratory, LANL, and the Santa Fe Institute. His interests in algorithmic data analysis and in having a real job were combined in 1994, when he joined the Space and Remote Sensing Sciences Group at Los Alamos. His professional enthusiasms include image processing, remote sensing, and machine learning. Also, covariance matrices.

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