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Information Science and Technology Seminar Series

Nigel J. Newton
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"A Statistical Manifold Modelled on Hilbert Space, with Applications to Nonlinear Filtering"

Wednesday, April 11, 2012
3:00 - 4:00 PM
TA-3, Bldg. 1690, Room 102 (CNLS Conference Room)

Abstract: The talk will develop an infinite-dimensional Hilbert manifold of probability measures. The manifold, *M*, retains the first and second order features of finite-dimensional information geometry: the α-divergences admit first derivatives and mixed second derivatives, enabling the definition of the Fisher metric as a pseudo-Riemannian metric. *M* was constructed with the Fenchel-Legendre transform between Kullback-Leibler divergences, and its role in Bayesian estimation, in mind. This transform retains, on *M*, the symmetry of the finite-dimensional case. Many of the manifolds of finite-dimensional information geometry are shown to be C^∞-embedded submanifolds of *M*.

The recursive equations of nonlinear filtering are usually expressed in terms of the Ito stochastic calculus, in which the so-called *L*2 theory is particularly simple and elegant. The Hilbert nature of *M* lends itself to this theory. By expressing the equations of nonlinear filtering for Markov processes in terms of stochastic processes on *M*, we show that the quadratic variation of a filter, in the Fisher metric, bears a simple relation to its rate of information supply. The filter representation can also be used as a basis for projective approximations of the type proposed by Brigo, Hanzon and Le Gland.

Biography: Dr. Newton graduated with a B.Sc. in Engineering from the University of Bath in 1978. After a short spell as a Design Engineer with EMI Electronics Ltd., he moved to Imperial College, London, where he studied Control Theory under the supervision of J.M.C. Clark. He was awarded the Ph.D. of the University of London in 1984. After an 18 month period as a postdoctoral researcher at Imperial College, he moved to Essex University, where he is now a Reader. Dr. Newton has spent sabbatical periods at INRIA, IRISA, Brown University and MIT, where he is currently a Research Affiliate. Dr. Newton's research interests are in Stochastic Analysis, and its application to Control Systems and Telecommunications. He recently completed a six-year term as an Associate Editor for SIAM Journal on Numerical Analysis.

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For more information contact Frank Alexander, fja@lanl.gov, 665-4518. If you wish to make an appointment to speak with Dr. Newton, please contact Josephine Olivas, jojo@lanl.gov, 663-5725. Newton will be at LANL, April 9-11.
Hosted by the Information Science and Technology Center (ISTC)