

RUTGERS UNIVERSITY
DEPARTMENT OF STATISTICS AND BIOSTATISTICS
HILL CENTER #501, BUSCH CAMPUS, PISCATAWAY

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Seminar

Speaker: Thomas Bengtsson, Bell Labs/Alcatel-Lucent, New Jersey

Title: Computational Obstacles to High-Dimensional Filtering

Date: Wednesday October 15, 2008

Time: 3:20 PM

Place: 552 Hill Center

Abstract

Particle filters are Monte Carlo based schemes that employ a fully nonlinear and non-Gaussian update step to compute posterior distributions. This talk explores the necessary (Monte Carlo) ensemble size requirements for the Particle filter to perform adequately when the system dimension grows. Evidence is provided that the ensemble size necessary for a successful particle filter scales exponentially with the system dimension. Simulations show that when applied naively to a simple problem with a 200-dimensional state, at least 10^{11} ensemble members are required to improve on the prior distribution. Asymptotic arguments are given for two cases: one in which each prior state component is independent and identically distributed, and one in which both the prior pdf and the likelihood are Gaussian. Both arguments reveal that the required ensemble size scales exponentially with the variance of the log likelihood (when the likelihood is conditioned on the data), rather than with the state dimension per se.