STANFORD UNIVERSITY

DEPARTMENT OF STATISTICS

DEPARTMENTAL SEMINAR

4:15 p.m., Tuesday, April 8, 2003
Sequoia Hall Room 200
(Cookies at 3:45 in 1st Floor Lounge)
Reception to follow at 5:30

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Network Tomography

Network monitoring and diagnosis are key to improving network performance. The difficulties of performance monitoring lie in today's fast growing Internet, accompanied by increasingly heterogeneous and unregulated structures. Moreover, these tasks become even harder since one cannot rely on the collaboration of individual routers and servers to directly measure network traffic. The aggregative nature of possible network measurements gives rise to inverse problems, which are termed Network Tomography by Vardi (1996) to recognize the similarities to medical tomography.

We start with an introduction to the general linear network tomography model, which has as special cases: (i) link delay distribution estimation through multicast end-to-end measurements; (2) origin-destination matrix estimation through link traffic counts. We review earlier methods including a fast and recursive algorithm for (i) (Lo Presti et al, 1999), and a maximum likelihood method via EM (Cao et al, 2000), and discuss why they are either statistically inefficient or computational intractable for large networks. Then we propose a maximum pseudo likelihood (MPLE) approach (Liang and Yu, 2003) for this general network tomography model. A pseudo expectation-maximization (EM) algorithm is developed to maximize the pseudo log-likelihood function. Through simulations and real data sets, we demonstrate in the two special cases above that our MPLE keeps a good balance between the computational complexity and the statistical efficiency of the parameter estimation.

(Based on joint works with J. Cao, D. Davis, and S. Vander Wiel at Bell Labs and G. Liang at UC Berkeley. Papers available at www.stat.berkeley.edu/ binyu/publications.html)