

**STANFORD UNIVERSITY**  
**DEPARTMENT OF STATISTICS**  
**DEPARTMENTAL SEMINAR**

4:15 p.m., Tuesday, January 30, 2007  
Sequoia Hall Room 200  
(Cookies at 3:45 in 1st Floor Lounge)

*D. Siegmund and B. Yakir*  
Stanford University and The Hebrew University

**Approximating the Variance of the Conditional Probability of the State of a Hidden Markov Model**

In a hidden Markov model, one “estimates” the state of the hidden Markov chain at  $t$  by computing via the forwards-backwards (Baum-Welch) algorithm the conditional distribution of the state vector given the observed data. The covariance matrix of this conditional distribution measures the information lost by failure to observe directly the state of the hidden process. In the case where changes of state occur slowly relative to the speed at which information about the underlying state accumulates in the observed data, we compute approximately these covariances in terms of functionals of Brownian motion that arise in change-point analysis. Applications in gene mapping, where these covariances play a role in standardizing the score statistic and in evaluating the loss of noncentrality due to incomplete information, are discussed. Numerical examples illustrate the range of validity and limitations of our results.