

# The variance of the conditional probability of the state of a hidden Markov model

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## Abstract

For a hidden Markov model the variance of the conditional probability of the underlying state, given the observed data, 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, the variance of this conditional probability is computed approximately in terms of exponential functionals of Brownian motion that arise in change-point analysis. Applications in gene mapping, where this variance plays 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.