

Parallel sequential Monte Carlo samplers and estimation of the number of states in a Hidden Markov Model

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Abstract The majority of modelling and inference regarding Hidden Markov Models (HMMs) assumes that the number of underlying states is known a priori. However, this is often not the case and thus determining the appropriate number of underlying states for a HMM is of considerable interest. This paper proposes the use of a parallel sequential Monte Carlo samplers framework to approximate the posterior distribution of the number of states. This requires no additional computational effort if approximating parameter posteriors conditioned on the number of states is also necessary. The proposed strategy is evaluated on a comprehensive set of simulated data and shown to outperform the state of the art in this area: although the approach is simple, it provides good performance by fully exploiting the particular structure of the problem. An application to business cycle analysis is also presented.

Keywords Hidden Markov Models · Model selection · Sequential Monte Carlo