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Fitting Nonstationary General-time-reversible Models to Obtain Edge-lengths and Frequencies for the Barry-Hartigan Model

The Barry and Hartigan (BH) model is very flexible. Due to an identifiability problem, the parameters of the BH model cannot be expected to consistently estimate the actual pairwise frequencies. We define a nonstationary GTR (NSGTR) model for each edge and fit the NSGTR model by minimizing the distance between the estimates of transition probabilities under the NSGTR and BH models. With the best-fitting NSGTR estimates, the internal node frequency vector is interpretable as well as edge-length estimates that are otherwise not yielded by the BH model. These edge-lengths are interpretable as the expected number of substitutions along edges.