Title: Fast parameter and confidence interval estimation for Hidden Markov Models using Template Model Builder

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Abstract:

Hidden Markov Models (HMMs) are a class of models widely used in speech recognition and can help other fields to model data such as phylogenetic trees or rainfall occurrence.

There are straightforward ways to compute maximum likelihood estimates (MLEs) of their parameters. However, obtaining confidence intervals usually is more difficult.

In addition, computing MLEs can be time-consuming for large datasets and complex models.

We present a way to speed up core computational procedures for maximum likelihood estimation by up to 50 times compared to common optimization approaches. At the same time, we retrieve reliable estimates of standard errors within our framework.

In a first part, we investigate how to optimize a Poisson HMM with the {\tt{TMB}} package in R and how to retrieve confidence intervals.

In a second part, we compare different optimizers (such as e.g. {\tt{nlminb}}) and minimize the negative log-likelihood directly on different datasets.