Hidden Markov Models - Practical Session 8

Exercise 1: Model checking, part II

We will continue working with the 3-state HMM fitted in the Practical Session 7 with `moveHMM`. Use the following code or your own code from last week to load the data and get the 3-state HMM results.

```
#install.packages("moveHMM")
library(moveHMM)
rawdata <- read.table("elephant_rawdata.txt", header = T)
data <- prepData(rawdata, type = "UTM")
N = 3
stepMean <- seq(10, 300, length = N)
stepSD <- seq(10, 100, length = N)
stepPar <- c(stepMean, stepSD)
mod3 <- fitHMM(data, nbStates = N, stepPar0 = stepPar,  angleDist = "none", stationary = T)
```

a) Extract the relevant parameters from the `mod3` object and plot a histogram of the empirical distribution of step lengths together with the estimated marginal distribution. You can compare your plot to the same one generated by `moveHMM::plot(mod3)`.

b) Perform simulation-based model checks.
Hints: Copy your HMM simulation code from Practical Session 3 and adapt it to simulate from a gamma distribution with parameters shape and scale.
To compare the elephant data to the simulated data you could look at time series plots, autocorrelation, summary statistics, ...

Exercise 2: State decoding

a) What is the difference between local and global decoding? What are the main advantages of each state decoding strategy?

b) Use the function `plotStates()` on your fitted model to plot the decoded state sequence and the state probabilities.

c) Compute the state probabilities with `stateProbs()`.

d) Compute the most likely state sequence by running the function `viterbi()` on a fitted model.

e) Plot the time series of step lengths and use colour coding to indicate the decoded state sequence.

f) Create a sequence of the most likely states based on local decoding. Check for which observations the results from global decoding and local decoding differ.

Bonus exercise

Rewrite the Viterbi function given on lecture slide 203 for the general N-state case and calculate the most likely state sequence given this function. Create a plot similar to the first one on lecture slide 207.