

Assignment3 - The Backward Algorithm

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1 Verification of our backward algorithm on an infinite HMM

We verified that our implementation of the algorithm worked also for an infinite HMM by manually computing the backward pass for the following HMM setup:

$$q = \begin{pmatrix} 1 \\ 0 \end{pmatrix} A = \begin{pmatrix} 0.9 & 0.1 \\ 0 & 1 \end{pmatrix} B = \begin{pmatrix} \mathcal{N}(0, 1) \\ \mathcal{N}(3, 2) \end{pmatrix}$$

We first generated the random observation sequence $\underline{x} = (0.7172, 1.6302, 0.4889)$ of length 3 using the stated HMM setup. By manual calculations of the forward algorithm this resulted in the following scale factors $\underline{c} = (0.7479, 0.4208, 0.6610)$.

By manually calculating the expected $\hat{\beta}$ (and rounding some numbers along the way) we got the following

$$\hat{\beta} = \begin{pmatrix} 2.8043 & 3.3279 & 1.5129 \\ 1.2316 & 0.9211 & 1.5129 \end{pmatrix}$$

By running our implemented algorithm we got the following

$$\hat{\beta} = \begin{pmatrix} 2.8044 & 3.3278 & 1.5129 \\ 1.2315 & 0.9210 & 1.5129 \end{pmatrix}$$

The results are were similar enough for us to be convinced that our implementation is correct.