Machine learning 2
Exercise sheet 10

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Hidden Markov Model

Let $A_{i,j}$ the transition matrix between hidden states x_i and x_j. $B_{i,j}$ is the the probability, beeing in state x_i to observe y_j. The following matrices A and B describe two hidden states and two possible observations.

$$A = \begin{pmatrix} 0.1 & 0.9 \\ 0.5 & 0.5 \end{pmatrix}$$

$$B = \begin{pmatrix} 0.2 & 0.8 \\ 0.4 & 0.6 \end{pmatrix}$$

19.a Implementation of Viterbi algorithm

19.b Experiment results

Perform the following experiment: for the Hidden Markov Model of sheet 9, that is, generate sequences of length $l = 5, 10$ and 20; for each length generate a number of $N = 1000$ pairs of output sequences and hidden state sequences. On these sequences, for each length , compare (i) the Viterbi algorithm and (ii) the algorithm which randomly uniformly estimates a state sequence by (i) plotting for each length , and all integers $1 \leq k \leq l$, the relative frequency of the algorithm correctly estimating the hidden state at position k (this is three plots, one for each , and in each plot two curves), and (ii) for each length , computing the relative frequency of both algorithms succeeding in completely identifying the state sequence correctly (this is two numbers for each of the three).

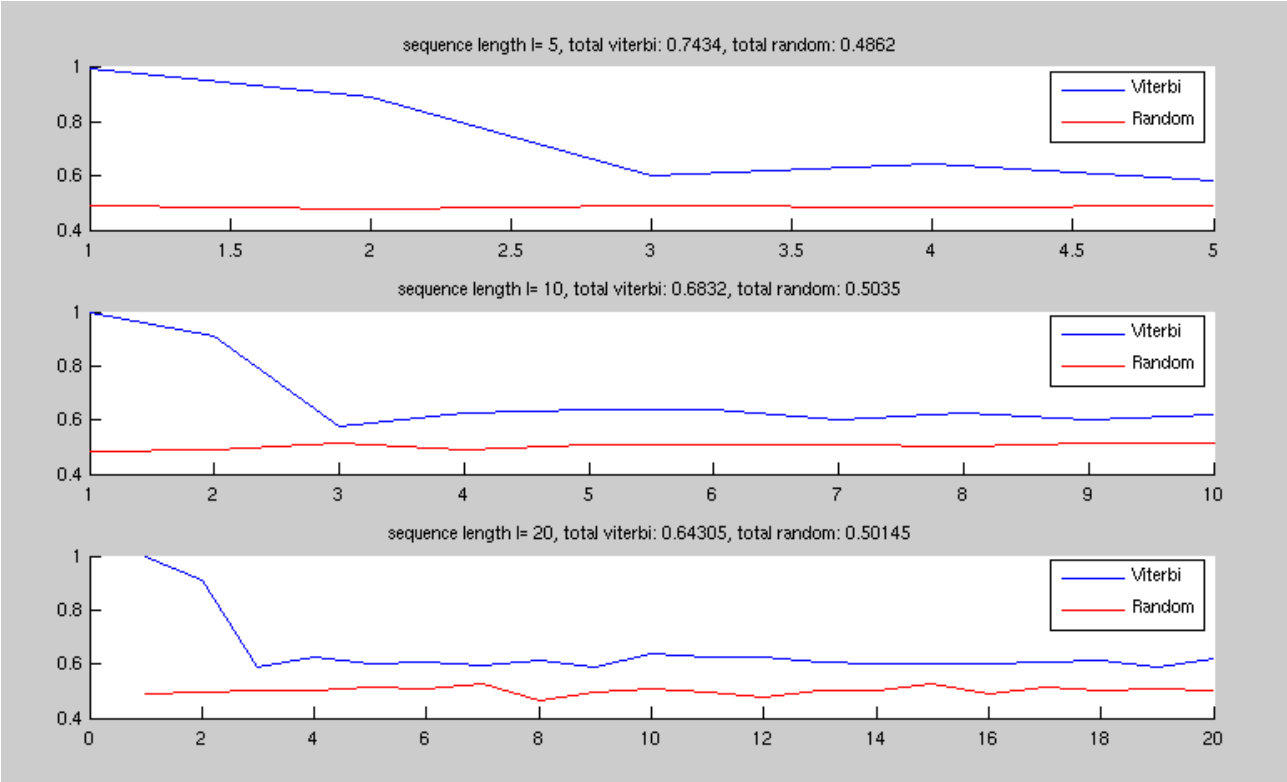

Figure 1: These plots compare the viterbi algorithm results with the funktion which randomly generate the hidden states. The plots show the relative correct detected hidden states with diffrent observation length.