Quiz 2: Viterbi Algorithm Analysis

Nam Nguyen

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1 Viterbi Algorithm Analysis

In this assignment, we will analyse the performance of Viterbi algorithm under 4 aspects with illustration of shortest path problem. Notice that the Viterbi algorithm is a simple implementation of Dynamic Programming.
Completeness and Optimality: Under problem having finite number of states, the algorithm guarantees finding the solution and terminated after time n.
Time Complexity: Given a Hidden Markov Chain (HMM) having N states and sequence of interest of length T. It is clear that the number of all possible sequences is N^T. However, at each unit time there are at most N^2 addition needed (in shortest path problem) and N comparisons among them. Thus the time complexity is $O(N^2T)$.
Space Comlexity: The space complexity is $O(N^2 + NT)$, where N^2 is storage size of additions each state and NT is comparisons.

References

[1] Shaunak Chatterjee et. al."A temporally abstracted Viterbi algorithm"