

Department of Electrical and Computer Engineering

Title: «Bounds on the Probability of Misclassification Between two Hidden Markov Models»

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Abstract:

In this paper we consider the problem of classification between two known hidden Markov models (HMM's), based on a sequence of observations generated by underlying unknown activity in one of the two models. We use a classifier that minimizes the probability of error (i.e., the probability of misclassification), and we are interested in assessing its performance by computing the *a priori* probability of misclassification (i.e., the probability of error *before* any observations are made). This misclassification probability can be obtained, as a function of the length n of the sequence of observations, by summing up the probability of misclassification over all possible observation sequences of length n , weighted by their corresponding probabilities. In an effort to avoid the high complexity of computing the exact probability of error (which is typically exponential in the length n), we establish upper bounds on the probability of error, and we find the necessary and sufficient conditions for these bounds to tend to zero, exponentially with the number of observation steps. In one technique we construct a product automaton to capture the probability that the two HMM's will independently generate the same observation sequence. In a second technique we show that if one employs a deterministic finite automaton (DFA) to capture the merging of different sequences of observations (of the same length), then Markov chain theory can be used to efficiently determine a corresponding upper bound on the probability of misclassification. This results in a class of upper bounds that can be computed with polynomial complexity in the size of the two HMM's and the size of the DFA. We show the advantages and disadvantages of each technique, and illustrate them via application examples.

Biography:

Christoforos Keroglou received the Electrical and Computer Engineering diploma from Aristotle University of Thessaloniki and M. Sc. degree in Electrical and Computer Engineering from University of Cyprus. He is currently a Ph.D. candidate in the Department of Electrical and Computer Engineering, University of Cyprus under the supervision of Prof. Christoforos Hadjicostis. His research interests include systems and control, with focus on state estimation, fault diagnosis and classification in stochastic automata. He is a student member of IEEE and a member of the Technical Chamber of Greece.