

Question Set 3

HMM, Speech Recognition, Speaker Verification

1. Given the a priori probability $P(C_k)$ of class C_k , the likelihood $P(X|C_k)$ of a sequence X given the class, and the a posteriori probability $P(C_k|X)$ of the class:
 - What is the relationship between these probabilities?
 - What is the significance/use of these probabilities in the case of speech recognition?
 - Which probability is estimated by a discrete Markov model; by a hidden Markov model (HMM)?
 - Which probability permits the integration of certain a priori knowledge (give an example)?
 - What is the final criterion for classifying the sequence X ?
2. Automatic speech recognition: In practice, what would be associated with the above probabilities?
3. Describe briefly and clearly HMM-based automatic speech recognition system, and the different blocks involved.
 - General description
 - During recognition, how do the different blocks interact, theoretically (fundamental equation) and functionally?
 - How are the syntactical constraints represented and used? Where do they come from and how are they estimated?
 - How are the lexical constraints represented and used? Where do they come from and how are they estimated?
 - Where are the discrete Markov models and hidden Markov models used?
4. What is the use of hidden Markov model in automatic speech recognition?
 - Database/knowledge needed?
 - Parameters and the optimization criteria?
 - Algorithm?
5. Definition and estimation of error rate of continuous speech recognition system
 - Type of errors? Definition of error rate (for speech recognition)?
 - How is it estimated? Information necessary/required for estimating error rate? Algorithm?
6. Given two word sequences S_1 and S_2 , how do we compute the error rate between the two sequences:
 - What are the possible errors?
 - Definition of the error rate?
 - How is it calculated automatically?
7. Description speaker verification system:
 - System and parameters?
 - “Enrollment” (training)?
 - Hypothesis testing? (Decision making)