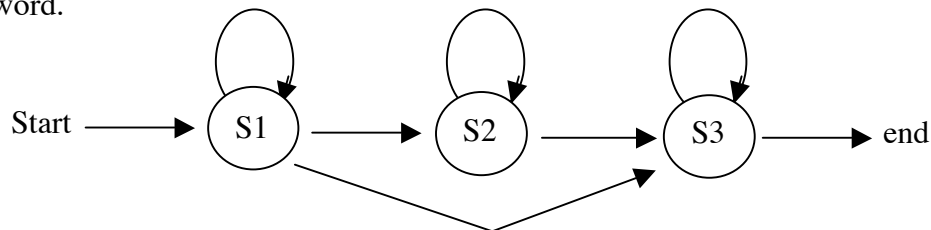


Due: November 4th, 2003

This assignment involves building and testing a highly simplified speech recognition system. We assume that the speech has already been processed and the input is classified into a very small codebook containing the following symbols (each with an intuitive description of what type of sound it represents): S (silence), H (hissing sound), U (unvoiced consonant), V (vowel sound) and W (another vowel sound).

We will be doing word based recognition, and assume the following HMM template for each word.



- a) We are given one instance of training data for the word “sad”. Here we indicate where the actual state transitions from S1 to S2 to S3 with a “/”.

HSWSCH/VVWHCHSCVHUUUV/CSV/

Using this fully tagged data, what transition and output probability distributions would you get for the HMM using the MLE technique? What is the entropy measure of the training corpus with this distribution?

- b) For the Baum-Walsh re-estimation technique, could you use the probability model developed in part (a) directly as the initial probability estimate? If not, why not, and develop some way to get around the problems you identify. Give your initial revised initial probability estimate using your revised technique. What is the entropy measure of the training corpus with this measure? Did it change from part (a) in a way you expected?
- c) Implement the forward and backward algorithms, and the Baum Walsh re-estimation formulas. You are going to compute first three iterations of the algorithm for two different starting distributions. The first is the one you just computed in part (b). For the second, assume a uniform distribution throughout. Give the probability distributions produce by each iteration (i.e., 6 in all) on the following three new training instances for the word “sad”.

HHHVVVSVVVWWWUWC
 HSHHHCWVWVCVWVCWSUCCHV
 SWUHSVUSVCHWWUSCCS

