TTT4275 Estimation, Detection and Classification
Problem Set Class2

The main topics for this problem set are to get a "hands-on" experience with features, choice of classifer and training/testing. The task is to be implemented in Matlab.
A small labeled data set consisting of three spoken vowels shall be used. The data set consists of 139 recordings of each vowel class. From each recording three features, so called formants, are extracted. The formants represent three frequencies where the sound have peaks in the frequency spectrum. Typical formant frequences differ from vowel to vowel, however they also show a significant variation within the classes. Thus, we have a classical nonseparable problem. The waveform files has five letter names with extension wav. The first letter indicates man/female/boy/girl, the next two person number and the two last the vowel name. The classes to be used in this exercise are quite similar/overlapping, i.e. the classes 'ae','ah' and 'aw'. These waveforms are stored in a directory called 'class3_wav'
The corresponding formants are stored in the Matlab file 'class3_3f.mat'.

Problem 1

(a) Listen to some of the vowels. Note that the recordings have the form of consonant-vowel-consonant (CVC).
Did you have problems discriminating between them? if so, which classes did you find most confusable?

(b) Generate class-based histograms for the three formants using the training set. Also generate 2D-plots of respectively "F1-F2", "F1-F3" and "F2-F3" values for each class.
Discuss the discrimination potential of each formant and formant-pair.

Problem 2

Assume you have chosen to use a single Gaussian for each class model. Define the first 70 samples of each class as set_1 and the last 69 samples as set_2.

(a) Train the classifier using set_1 as the training set.

(b) Test the classifier using set_2. Find the error rate and the confusion matrix both for the training set and the test set.

(c) Repeat the above but now use set_2 as the training set and set_1 as the test set.

(d) Discuss the difference in performance wrt training versus test set. Further discuss the variation in test performance for the two cases.

(e) Does the confusion matrixs agree with your subjective impression from problem 1?