6 SSP 2012 / Assignment 7 (final): TIMIT formants and bandfilter values

The main theme is a comparison of formant frequency values and bandfilter values. As a database we use the vowels of dialect dr1 of the train part of TIMIT data. These data can be found here. *Always treat male and female data separately, i.e. make separate scatter plots, principal components etc.!*

1. Perform a formant analysis (5 formants) and a BarkFilter analysis at the *center* part of the vowels in the train part of the TIMIT corpus for dialect group 1. Also calculate formant frequency values in bark units according to "bark(f) = 7.0 * log10 (f/650 + sqrt (1 + (f/650)^2))", where f is the frequency value in hertz. From now on use frequency values of formants *in bark units only*!
2. Make a scatter plot of the average F1 and F2 with 0.5σ ellipses.
3. Make a scatter plot of the average pc1 and pc2 with 0.5σ ellipses.
4. Show the Correlation matrix of the first three formant frequencies with the first three principal components (pc's).
5. Make a canonical correlation of F1, F2 and F3 versus pc1, pc2 and pc3. Report the values of the 3 canonical coefficients and show the eigenvectors.
6. Make a canonical correlation of F1, F2 and F3 versus the first 18 bandfilter values. Report the values of the 3 canonical coefficients and show the eigenvectors.

For background on TIMIT and its analysis, see Weenink (2006), Speaker-adaptive vowel identification. For canonical correlation analysis see chapter 7.

Hints

- Analyze the whole file and query for the analysis results at the center of a vowel. The centers can be found from the label files.
- The TIMIT label files can be read with Praat.
- For formant analysis apply `To Formant (burg)... 0.005 5 upper 0.025 50`. The value for `upper` equals 5000 for male speakers and 5500 for female speakers. Only keep the measured values for the first three formants.
- For the bandfilter analysis you can use `To BarkFilter... 0.025 0.005 1 1 19`.
  In this way 18 barkfilter values will be measured which cover the spectrum up to approximately 5000 Hz. See also section 8.5.1.2 of Weenink (2006) for the characteristics of the filterbank.
- Collect all data in a Table. Your table will have, besides the vowel info, the three formant frequency values side by side with the 18 bandfilter values. From this table you can extract the various smaller tables that you will need.

Make a report.