

Feature Extraction

1. A speech signal is band-limited with $f_g = 8\text{kHz}$. Which is the minimum sampling rate so that the signal can be exactly reproduced?
2. After sampling the signal is windowed (window-width = 30ms). How many samples are inside the window?
3. What should be the minimal FFT length?
4. Which is the resulting resolution in the frequency domain?

Matlab:

5. Use the function `wavread` and load the wave file „speech.wav“.
6. Window the whole signal (rectangular- and Hamming-Window) and compute the spectrum. Plot and compare your results.
7. Compute the Cepstrum. What is the excitation frequency of the speech signal?
8. Linear Prediction
Compute the LPC coefficients of the speech signal. Plot the spectrum of the transformed LPC-coefficients.

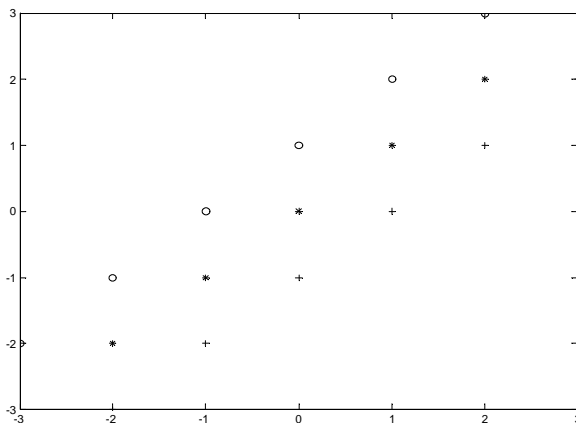
9. Linear Discriminant Analysis

Example points of the distribution:

$$k1 = (-3, -2) (-2, -1) (-1, 0) (0, 1) (1, 2) (2, 3)$$

$$k2 = (-2, -2) (-1, -1) (0, 0) (1, 1) (2, 2)$$

$$k3 = (-2, -3) (-1, -2) (0, -1) (1, 0) (2, 1) (3, 2)$$



the resulting scatter matrices are:

$$S_w = \begin{pmatrix} 2.6471 & 2.6471 \\ 2.6471 & 2.6471 \end{pmatrix}, \quad S_T = \begin{pmatrix} 2.8235 & 2.4706 \\ 2.4706 & 2.8235 \end{pmatrix}$$

Compute the LDA-matrix and transform the samples into the 1 dimensional space