

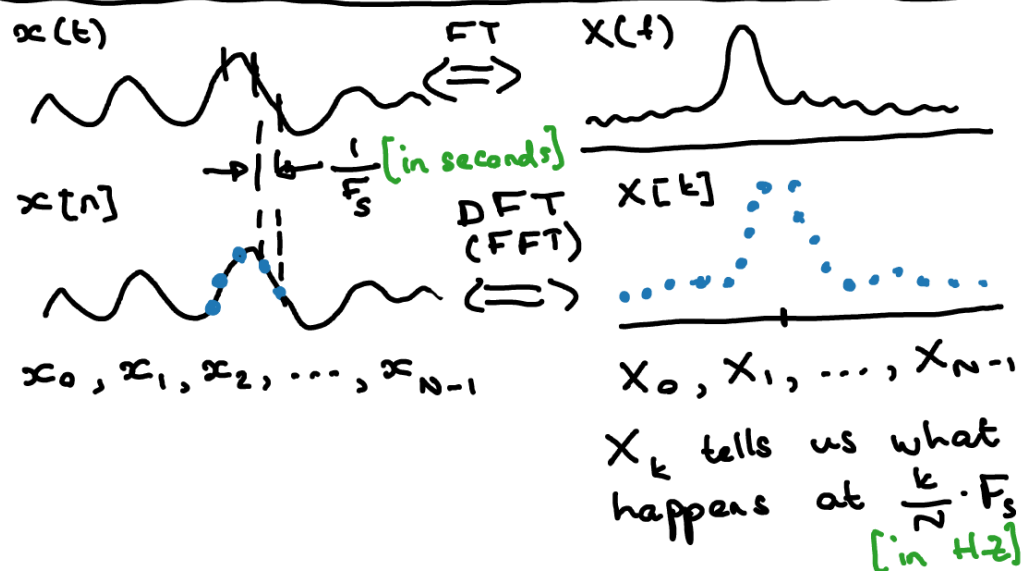
Speech Features for NLP People

The bare minimum you need to know about signal processing

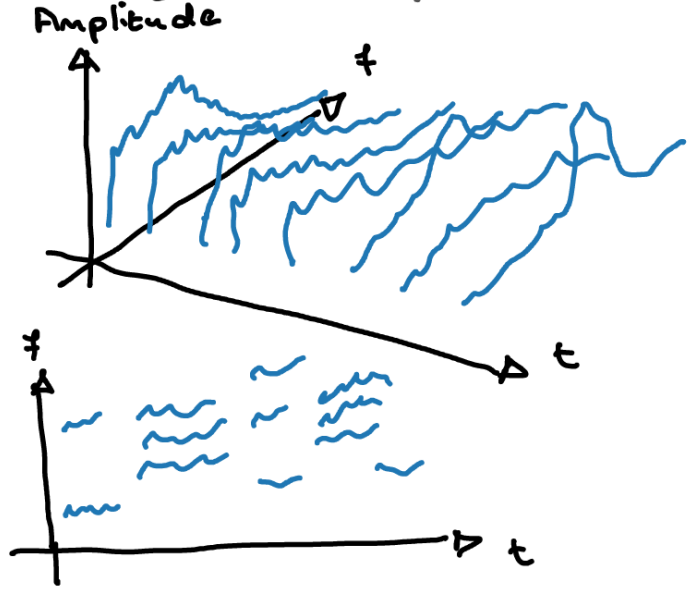
Herman Kamper

<http://www.kamperh.com/>

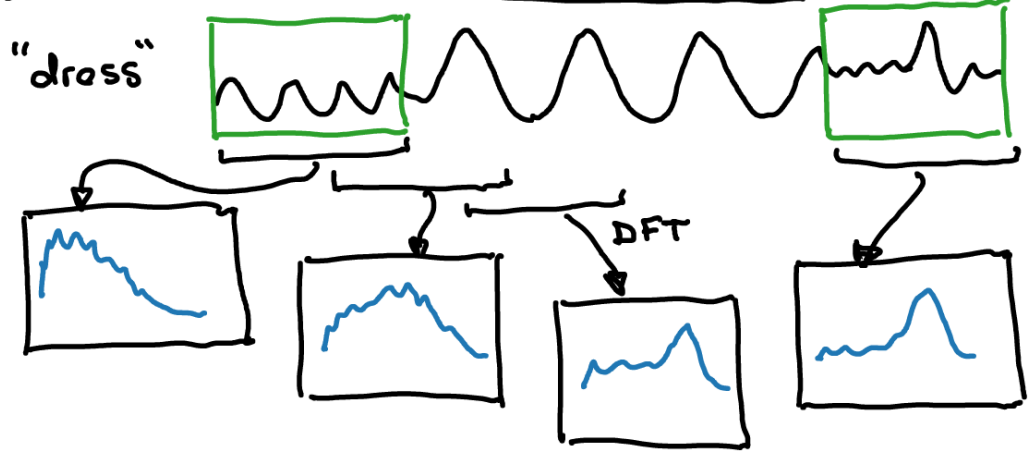
Intro to the (fast) Fourier transform



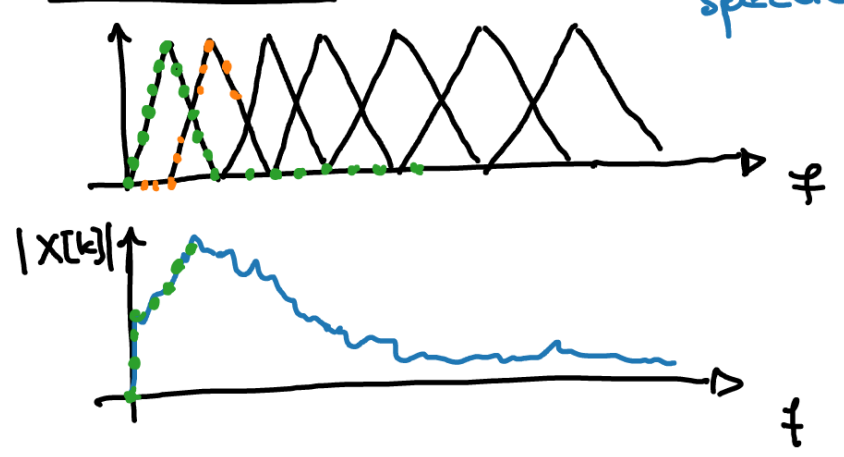
Spectrogram



Short-time Fourier transform (STFT)

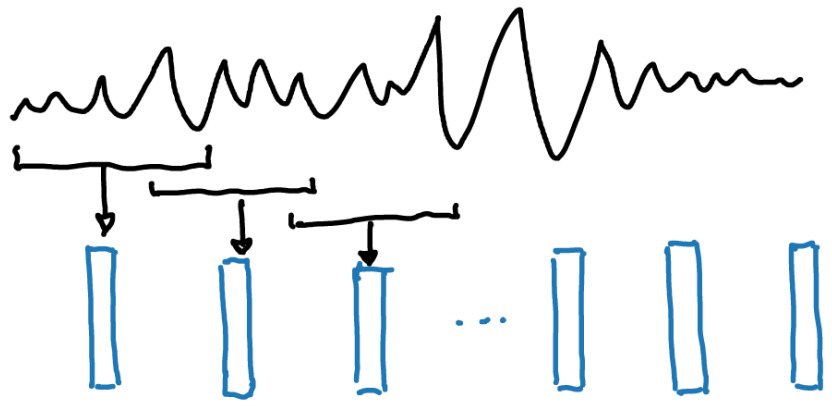


Filter banks



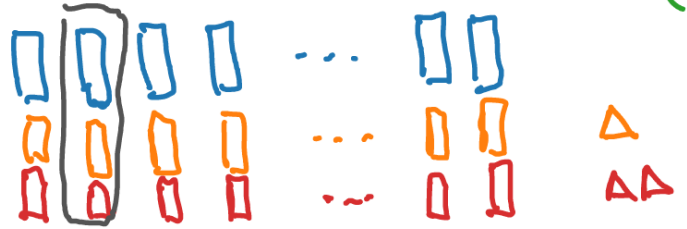
Log Mel-scale spectrogram

Speech feature extraction



Additional aspects

- Windowing $x'[n] = x[n] \cdot w[n]$
for $n=0, 1, \dots, N-1$
- Pre-emphasis filter
 $y[n] = x[n] - \alpha x[n-1]$
- Mel-frequency cepstral coefficients
- Delta and delta-delta (Just with MFCCs)



signal

