

Background reading: Read chapters 31 to 33 in Gold & Morgan to consolidate the class material on speech coding.

Reading assignment: “A tutorial on MPEG/Audio compression, D. Pan, IEEE MultiMedia, Summer 1995. This will cover some details on wideband audio coding that we covered only briefly in class. Contribute to the courseworks discussion as usual.

<http://www.ee.columbia.edu/~dpwe/e6820/papers/Pan95-mpega.pdf>

Practical assignment: This week deals with speech compression based on LPC representations.

- (a) First consider the LPC filter coefficients. Analyze a speech segment using `lpcfit` (follow the usage shown in this week's Matlab diary). Quantize the `a_i` matrix of filter coefficients between -3 and 3 using `myquant` (as shown in the diary). How many steps do you need for good quality resynthesis (via `lpcsynth`, using the original excitation)? What happens if you use too few steps (quantize too coarsely)?
- (b) Now try converting the `a` matrix to LSPs using `lpca2lsp`, quantizing them (between 0 and 0.5), then converting back to filter coefficients with `lpclsp2a`. How does the bitrate of an acceptable LSP representation compare to the direct filter coefficients?
- (c) Next, consider the excitation. You can quantize the original residual `ex` with `myquant`; experiment to find the best range and number of levels. Then try Multi-Pulse Excitation representation via `lpcMPEenc` and `lpcMPEdec` (use `help lpCMPEenc` etc. to get the usage messages). Try using between 16 and 64 pulses per frame. How does the quality vary? What is the bitrate required for transmission, assuming you quantize the pulse magnitudes with the same resolution as you used for the original residual? (The times are already quantized).
- (d) Finally try the buzz-hiss imitation of the residual implemented by `lpcBHenc` and `lpcBHdec`. How does the sound quality compare with other encodings for the residual? What about the bitrate?

Project: Next week's class will be the project proposal presentations. I look forward to your presentations, which should contain a clear idea and plan for your project.