LPC

A Speech Analysis/Synthesis Method

LPC

- LPC = Linear Prediction Coding
- Model: predict next sample as a weighted sum of past samples.

$$s_n = \sum_{i=1}^{p} a_i s_{n-i}$$

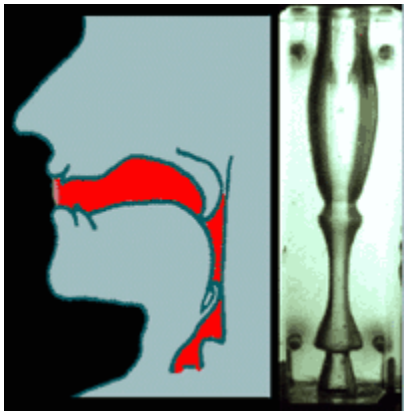
- This formulation gives rise to an *allpole* filter: the response consists of resonant peaks.
- LPC analysis finds the filter with that best approximates the signal spectrum.

LPC Analysis

- The physical analogy is a tube with varying cross-section:
- Conducted in frames (analogous to short-time windows in SFFT)

- Frames give rise to changing coefficients, which model changes in tube geometry (or vocal tract shape)

Acoustic Tube Producing "AH"

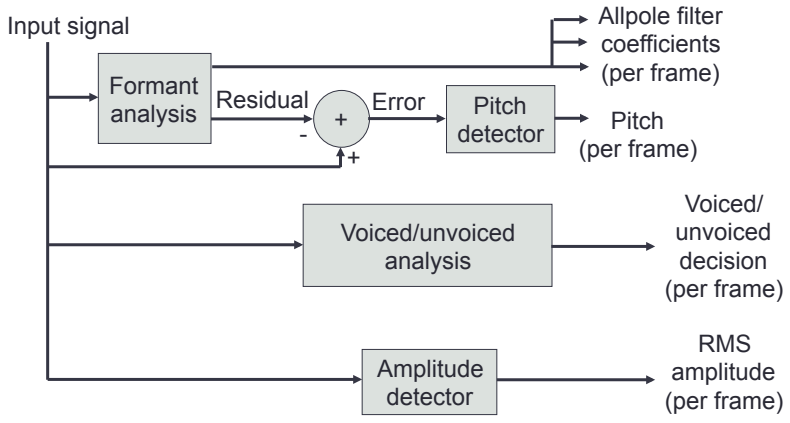


From: the Exploratorium. http://www.exploratorium.edu/exhibits/vocal_vowels/vocal_vowels.html

LPC Analysis, continued

- LPC creates an inverse filter.
- Applying inverse filter gives a *residual.*
- Residual may either be an estimate of glottal pulses → do pitch analysis to estimate source
- Or noise → use noise model for source

LPC



Musical Applications

- Replace source with some other sound
- "Warp" the filter frequencies
- Modify the source and LPC coefficients (glottal pulses or noise) to perform time stretching
- See demos/lpcdemo.lsp