University of California
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EE225D

Speech Analysis and Synthesis Overview

Lecture 3
Figure 3.13: Map. Showing the Communications path described in “Agamemnon”.
Alexander Graham Bell
Figure 3.1: Lower Broadway in 1887.
“If I could determine what there is in the very rapidly changing complex speech wave that corresponds to the simple motion of the lips and tongue, if I could then analyze speech for these quantities, I would have a set of speech defining signals that could be handled as low frequency telegraph currents with resulting advantages of secrecy, and more telephone channels in the same frequency space as well as a basic understanding of the carrier nature of speech by which the lip reader interprets speech from simple motions.”

—Homer Dudley, 1935
Figure 31.2: Channel Vocoder Analyzer and Synthesizer
Figure 31.2: Channel Vocoder Analyzer and Synthesizer
General Discrete - Time Model for Speech Production.
**Vocoder Concepts**

**Vocal Tract Analyzer**
1. Short Time Spectral Analysis
2. Linear Prediction Coding
3. Homomorphic Analysis
4. Formant Analysis

**Vocal Tract Synthesizer**
1. Short Time Spectral Synthesis
2. Linear Prediction Synthesis
3. Homomorphic Synthesis
4. Formant Synthesis

**Vocal Source Analyzer**
1. Fundamental Frequency Estimation
2. Voiced-Unvoiced Decision

Input Speech → Coded Transmission → Source Generator → Output Speech
Figure 3.2: Fine Structure and Spectral Envelope of Sustained Vowels.
Figure 19.10: Comparison of (Idealized) measured Spectra for wide and narrow Filter Bank Analyzers.
Figure 3.3: Illustration of Source-Filter Separation by Cepstral Analysis.
The Vocoder

by Homer Dudley, *Circuit Research Department*
Figure 3.6: Dudley’s Waveform Display.
Figure 3.7: Continuation of Dudley’s Waveform Display.
Figure 3.8 : Conclusions of Dudley’s Waveform Display.
Figure 3.4: Wide Band Spectrogram.