Bandwidth Extension of Speech Signals

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Abstract

In this contribution an introduction to bandwidth extension of telephony speech is given. Bandwidth extension in this context means the estimation of the frequency parts that have either been suppressed or canceled out by the transmission over a public telephone network. It is presented why current telephone networks apply a limiting bandpass, what kind of bandpass is used and what can be done to (re)increase the bandwidth on the receiver side without changing the transmission system. These bandwidth extension methods represent a cheap way to increase the quality of non-wideband connections and could even increase the quality of wideband connections.

The presented algorithms are based on the source-filter model for the speech production process. Therefore we can split the algorithms into two seperate tasks:

- The first task is the extension of a so-called excitation signal which corresponds to the signal that could be observed behind the vocal cords. For this task we will present several approaches like harmonic modeling, shifting/modulation approaches and non-linear characteristics.

- The second task is the extension of the so-called spectral envelope which corresponds to the transfer function of the cavities that are involved in the speech production process. Approaches for this task include neural networks, codebooks and linear mapping.

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