SELECTIVE MODELLING OF LPC RESIDUAL

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Despite its usefulness in reducing the bit rate for digital speech transmission, the production of natural-sounding speech using conventional LPC techniques has proved difficult. This is largely due to the simplistic model of the excitation source (pitch pulses or white noise). Attempts to overcome the deficiencies in this binary model include residually excited LPC and multi-pulse modelling of the excitation source. However these approaches require a substantial increase in the bit rate over conventional LPC. An alternative approach is code excited LPC which can achieve bit rates as low as 4.8kb/s but at a cost of great computational effort making real time implementation unfeasible.

This paper describes a method of selectively modelling the LPC excitation source for voice coding at 4.8kb/s. The LPC residual is classified as voiced, unvoiced or mixed and modelled using code excited LPC with a separate codebook for each voicing class. Because each codebook is voicing specific, the codebooks can be made relatively small resulting in a much reduced search time for the optimum innovation for each frame.

The selective modelling of the LPC residual does not require accurate pitch determination, thereby bypassing one of the most difficult problems of conventional LPC analysis. Also, the voicing decision is not critical as the effects of "wrong" decisions are reduced by the inclusion of several stochastic Gaussian innovations in each codebook.

Experimental results showing the effects of codebook size, frame size and voicing classification thresholds are presented. A real time implementation of a speech coder using the selectively modelled LPC residual is also discussed.

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