Application of Robust Statistics to Acoustic Echo Cancellation

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July 8, 2004

Abstract

With the popular use of hands-free terminals and the long round trip delay typical in today's mixed signal network, the cancellation of acoustic echo is critical for a high quality of service in modern communication systems. An acoustic echo canceller is essentially an adaptive filter which synthesizes the echo of far-end signal using the loudspeaker signal. When the far- and near-end users are talking simultaneously, which is referred to as a double talk situation, the adaptive filtering algorithm mistakes the near-end speech signal as residual echo and adjusts the filter coefficient inappropriately, resulting in a significant increase in the level of echo returning to the far-end. This problem is generally combated with a device called double talk detector. A double talk detector detects the presence of near-end speech signal and put the adaptation of the echo cancellation filter on hold. A practical double talk detector always makes false detections. The notion of robust statistics is applied to adaptive filtering to account for the double talk detection errors. The performance of robust adaptive filtering algorithms employing different nonlinear functions in the update of the filter coefficients and in the update of the scale are evaluated and compared. It is found that double talk robustness can be achieved without noticeable degradation in convergence and tracking performance by applying two Huber's functions with different parameters for the update of the scale and the adaptive filter coefficients.