Multiple speech signal enhancement using a microphone array

Heather E. Ewalt and Michael T. Johnson, Marquette University

The ability to extract and enhance a primary speech signal from an environment with multiple speakers is an important issue [B. Widrow, "A Microphone Array for Hearing Aids;" IEEE Circuits & Systems Magazine, vol. 1, no. 2 (2001)]. While methods exist for a variety of beamforming techniques [M. Brandstein and D. Ward, Microphone Arrays: Signal Processing Techniques and Applications, Springer, New York (2001)] as well as for multi-source filtering in stationary noise [H. Saruwatari, et al, "Speech Enhancement Using Nonlinear Microphone Array With Noise Adaptive Complementary Beamforming," Proc. of IEEE ICASSP, 1049--1052 (2000)], the theory has yet to be developed for integrating spatial filtering with additional enhancement methods to deal with the non-stationary interference from interfering talkers. This paper presents a novel method for incorporating multiple parallel beamformers with traditional speech enhancement algorithms, particularly the Wiener filter and spectral subtraction. By iteratively improving the spectral magnitude estimates of each speech source, substantial improvement in overall signal separation can be obtained. The performance of the algorithm is illustrated using a simulated multiple speaker environment with resulting SNR and sSNR plots. [Work supported by DOE GAANN Fellowship.]