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Mitigation of Nonlinear Distortion in Speech Signals Using Histogram Matching

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Nonlinear distortion is a common artifact in audio communication equipment. In addition, it is well know that the normalized amplitude distribution of speech signals converges to approximately a gamma distribution after a few seconds. Hence, the transfer function of any memory-less nonlinearity distorting the speech signal can easily be estimated, provided one has buffered enough data. This research shows how both parametric and nonparametric histogram matching algorithms can be employed to remove the effects of these types of distortions. Further, the improvement these algorithms have on speaker identification performance is also studied. This approach represents a radical departure from the traditional approach taken in speech enhancement. The traditional approach has been to first acquire a model or representation of the distortion, noise, or interference that is corrupting the signal, and then attempt to remove this from the signal, usually introducing other forms of distortion in the process. With this approach a model of clean undistorted speech is used that the distorted speech is then matched to.