# A Study of Noise Compensation Methods for Speech Recognition under Noisy Environments

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**ABSTRACT**

When a speech recognition system in quiet environment is moved to a noisy environment, the recognition rate drops drastically. The compensation of noise effect becomes an important task for noisy speech recognition. In this study, we investigate the behavior of speech cepstral vector due to additive noise. We find that the cepstral vector deviates as the level of additive noise increases. In the case of white noise, the direction of cepstral vector deviation is approximately opposite to the direction of the cepstral vector of the clean speech. As power level of the white noise increases, the cepstral vector of the noisy speech will converge to the zero vector. However, for other types of noise, the change of cepstral vector is approximately at the direction of the difference vector of the noise cepstral vector and clean speech cepstral vector. Base on this behavior, we include a feature deviation vector into the reference model to compensate for the noise effect. The deviation vector is calculated according to the difference value of the cepstral vector of a few noisy speech and the corresponding model state cepstral mean vector. During the pattern matching phase, an optimally scaled deviation vector is added to the state mean vector of the clean speech model so that the clean speech model is adapted to the noisy environment. Experimental results show that the proposed method is effective for white noise and color noises.

Keywords : speech recognition ; environment adaptation ; additive noise ; feature deviation vector

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