Multi-band Single Microphone Noise Reduction

Algorithm Overview

Multi-band Single-Microphone Noise Reduction

Oxford Digital Multi-Band Noise reduction can be used to significantly reduce unwanted background/ambient noise picked up by a microphone. The system works 'blind', and is adaptive, i.e. it adapts to the current background noise for the best cancellation in varying environments.

The user (OEM) can set the attenuation of the background noise up to 20dB attenuation, and the algorithm performs well even at this high attenuation amount.

The algorithm is very efficient in use of DSP and the number of bands is scalable from 4 to 16 to provide a cost-performance trade-off.

This technology has already been deployed by a major semiconductor manufacturer as the microphone processing in their SMART phone chips.

Technology

The ODL Multi-band Noise Reduction algorithm divides the incoming audio signal into multiple frequency bands. The bandpass filters are arranged such that the sum of their output has a flat frequency response.

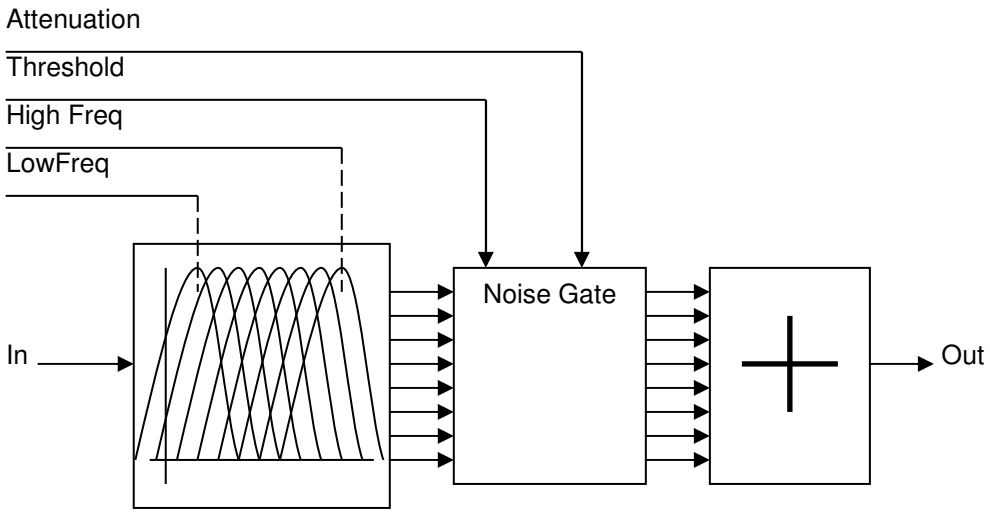

Figure 1 – overall block diagram.

Filters

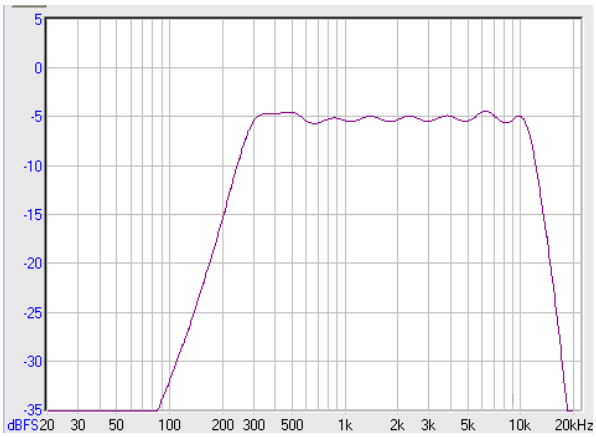

Figure 2. Summed response of 8 filters.

The upper and lower filters may be changed to accommodate differing system bandwidth requirements:

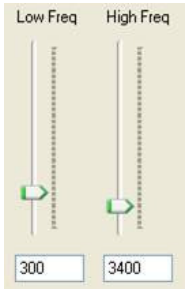

Figure 3 – Filter Frequency Controls

Noise gate

Each band has a noise-gate which can decide whether to pass the signal in the current band or attenuate it. The threshold is calculated dynamically using a proprietary noise floor-estimating algorithm. This algorithm looks at the outputs from all the filters over time and determines an estimate for the level of the current background noise. Combined with a few simple user-controls:

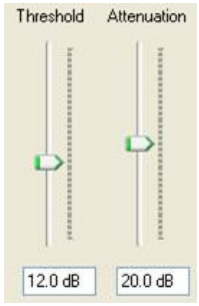

Figure 4 – Threshold and Attenuation Controls

These controls are available for the OEM to set up and give the noise gate and estimator some idea whether the anticipated environment is going to be very noisy, noisy or quite-quiet, and also how much attenuation to apply.

Overall effect

The overall effect is that background noises are reduced by the ‘attenuation’ amount while real signal, such as speech, is allowed to pass.

Example:

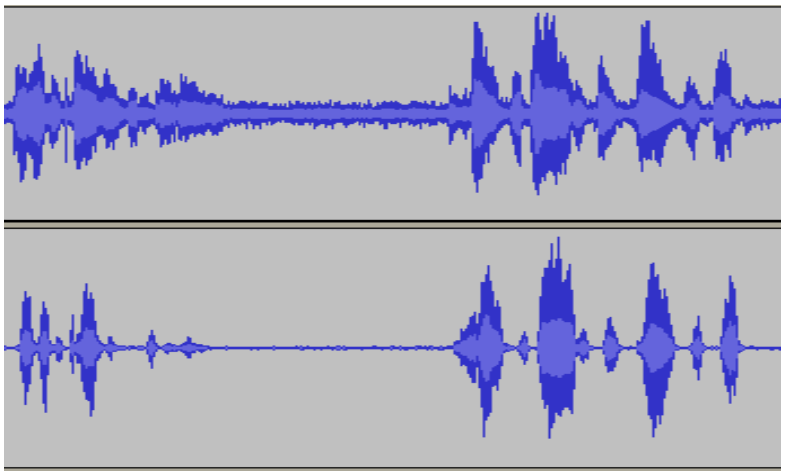

Figure 5 – Top trace is some Noisy Speech, Bottom signal is after processing

Figure 5 shows the effect of the algorithm. A speech signal with high background noise is passed through the multi-band noise reduction algorithm. In the bottom trace we can see the results – the speech is the same level, but the background noise has been very significantly reduced.

Contact Information

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