Bionic speech recognition

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As speech recognition systems become more commonplace - on the computer desktop top, at the call centre and even in the car - it is increasingly important to ensure that the voice signal is as clear as possible before it is processed by a computer and acted upon. It could mean the difference between anything from a profitable financial deal to a safe vehicle or aircraft maneuver. Similarly, mobile phone conversations and even the clandestine recording of speech for security and law enforcement purposes could benefit.

Now, researchers at the University Campus in Tunis, Tunisia, have published details of a speech enhancement system that uses two distinct tools to reduce the noise from a recorded or sampled voice signal. Talbi Mourad, Salhi Lotfi, Abid Sabeur and Cherif Adnane of the Faculty of Sciences of Tunis, Laboratory of Signal Processing, explain how a bionic wavelet transform and a recurrent neural network can be used for speech enhancement in the *International Journal of Signal and Imaging Systems Engineering*.

"The presence of background noise in speech signal processing constitutes a very serious problem," the researchers explain. Noise affects the performance of speech recognition, coding and synthesis leading to failed voice commands and errors. There are three forms of noise that speech recognition systems must cope with: convolutive, multiplicative and additive. It is the latter, additive noise, that can have the most impact on speech recognition and it is this form of noise that the team addresses with their approach. Additive noise is often referred to as "white noise" and is commonly perceived as random background

hiss on a sound recording.

"Our proposed technique consists of computing in an automatic manner the optimal threshold set to be employed to the bionic wavelet coefficients and this is performed by using an Elman neural network in the bionic wavelet domain," Mourad explains.

The team demonstrated the effectiveness of their approach against F16 fighter jet cockpit noise and the noise inside a Volvo car. "We have applied our hybrid method on several kinds of noises and noisy speech database and the obtained results show an increase in the signal to noise ratio from 5 dB to 12 dB," the team says. "In speech enhancement it is necessary to achieve a compromise between noise reduction and preserving intelligibility," adds Mourad.

More information: "Recurrent Neural Network and Bionic Wavelet Transform for speech enhancement" in *Int. J. Signal and Imaging Systems Engineering*, 2010, 3, 136-144

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