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Automatic Classification of Korean Disordered Voices According To Signal Type Using Acoustic Parameters

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Extended Abstract

In summary statement for voice and speech workshop, Titze (1995) proposed that signals should be categorized as type 1, 2, or 3 to recognize the nature of bifurcations in voice signals and the classification is central to all other considerations in acoustic voice analysis. The addition of a fourth type of voice to the Titze's classification scheme is recently proposed by Sprecher et al. (2010).

Many studies related to signal typing are based on visual inspection by a consensus judgment of many experts with spectrogram. However, disadvantages of visual evaluation are that experts differ in their opinion about the spectrogram interpretation and that it is time consuming to acquire the agreement judgments because of necessity of inter- and intra-rater reliability. Therefore it needs software to automatically and objectively classify the pathological voices into four signal types and is able to help in suggesting experts' opinion to provide specific criteria to determine the signal type.

Methods

Jitter (%), shimmer (%), and signal-to-noise ratio (SNR) are estimated using a sustained vowel /a/ from 74 female and 66 male pathological voices taken from database collected in Otorhinolaryngology of Gangnam Severance Hospital.

The signal typing is conducted by the trained three speech-language pathologists (SLPs) in advance. Then, narrowband spectrograms are generated using the Praat software. It is created with a window length of 0.05 seconds, a time step of 0.002 seconds, a frequency step of 5Hz, a dynamic range of 40dB, and a hamming window shape. One-way repeated measure ANOVAs on ranks are performed to test differences among type 1, 2, 3, and 4 signals for each parameter. Multiple pairwise comparisons with the Turkey method and an alpha of 0.05 are employed for all comparisons. Classification and regression tree (CART) is utilized for the classification of signal type using multiple parameters.

Results

There is little difference in the distributions of acoustic parameters such as jitter and shimmer between type 1 and type 2 signals. However, in type 3 and 4 signals, it has a tendency to higher values and a little broad distribution than type 1 and 2 signal. Similarly, SNR decreases from type 1 through type 4 voices, indicating that the evidence of harmonics decreased as signal type increased. It is said that there are useful and meaningful for classification among signal types, because all the parameters show p-values $< .05$. Especially jitter is statistically better performance than other parameters. The average classification performance among signal types is 78.6%. The future work is to develop the parameters to improve the classification performance of signal type and to implement more reliable classifier.

Sprecher, A., Zhang, Y., & Olszewski, A. (2010). Updating Signal Typing In Voice: Addition of Type 4 Signals. *J. Acoust. Soc. Am.*, *127*, 3710-3716.

Titze, I.R. (1995). Workshop on Acoustic Voice Analysis: Summary Statement. *National Center for Voice and Speech*, 1-36.