

# Prosodic Feature Extraction for Assessment and Treatment of Dysarthria

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## 1. Abstract

Dysarthria, a neurological motor speech disorder caused by lesions to the central and peripheral nervous system, accounts for over 40% of neurological disorders referred to pathologists in 2013[1]. This affects the ability of speakers to control the movement of speech production muscles due to muscle weakness. Dysarthria is characterised by reduced loudness, high pitch variability, monotonous speech, poor voice quality and reduced intelligibility [2]. Current techniques for dysarthria assessment are based on perception, which do not give objective measurements for the severity of this speech disorder. There is therefore a need to explore objective techniques for dysarthria assessment and treatment.

The goal of this research is to identify and extract the main acoustic features which can be used to describe the type and severity of this disorder. An acoustic feature extraction and classification technique is proposed in this work. The proposed method involves a pre-processing stage where audio samples are filtered to remove noise and resampled at 8 kHz. The next stage is a feature extraction stage where pitch, intensity, formants, zero-crossing rate, speech rate and cepstral coefficients are extracted from the speech samples. Classification of the extracted features is carried out using a single layer neural network. After the classification, a treatment tool is to be developed to assist patients, through tailored exercises, to improve their articulatory ability, intelligibility, intonation and voice quality.

Consequently, this proposed technique will assist speech therapists in tracking the progress of patients over time. It will also provide an acoustic objective measurement for dysarthria severity assessment. Some of the potential applications of this technology include management of cognitive speech impairments, treatment of speech difficulties in children and other advanced speech and language applications.

## 2. References

- [1] J. R. Duffy, *Motor speech disorders: Substrates, differential diagnosis, and management*: Elsevier Health Sciences, 2013.
- [2] J. P. Hosom, A. B. Kain, T. Mishra, J. P. H. v. Santen, M. Fried-Oken, and J. Staehely, "Intelligibility of modifications to dysarthric speech," in *Acoustics, Speech, and Signal Processing, 2003. Proceedings. (ICASSP '03). 2003 IEEE International Conference on*, 2003, pp. I-924-I-927 vol.1.