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Reconstructed Phase Space Features for Estimating Post Traumatic Stress Disorder

Authors : Andre Wittenborn, Jarek Krajewski

Abstract : Trauma-related sadness in speech can alter the voice in several ways. The generation of non-linear aerodynamic phenomena within the vocal tract is crucial when analyzing trauma-influenced speech production. They include non-laminar flow and formation of jets rather than well-behaved laminar flow aspects. Especially state-space reconstruction methods based on chaotic dynamics and fractal theory have been suggested to describe these aerodynamic turbulence-related phenomena of the speech production system. To extract the non-linear properties of the speech signal, we used the time delay embedding method to reconstruct from a scalar time series (reconstructed phase space, RPS). This approach results in the extraction of 7238 Features per .wav file (N= 47, 32 m, 15 f). The speech material was prompted by telling about autobiographical related sadness-inducing experiences (sampling rate 16 kHz, 8-bit resolution). After combining these features in a support vector machine based machine learning approach (leave-one-sample out validation), we achieved a correlation of r = .41 with the well-established, self-report ground truth measure (RATS) of post-traumatic stress disorder (PTSD).

Keywords : non-linear dynamics features, post traumatic stress disorder, reconstructed phase space, support vector machine
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