

Vocal Biomarkers Of Stress In Real Life Environments: Study Design And Insights From The Fragment Project And Colive Voice Study

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Background

Psychological and physiological indices of momentary and chronic stress can be found in voice. In the context of Ecological Momentary Assessment (EMA), vocal biomarkers (VB) are a non-invasive and objective way to measure stress in daily life.

Methods

The FragMent study aims to evaluate how daily activities and exposure to various environments influence stress. The mobile survey will consist of a 15-day Geographically explicit Ecological Momentary Assessment study among 200 participants in Luxembourg with 4 vocal tasks per day.

Stress will be detected with models previously trained on the Colive Voice dataset, an international study aiming to develop VB for various chronic diseases. We used propensity score matching to control for age and gender between groups. We extracted vocal features from each audio sample and used a Mann-Whitney test to compare both groups.

Results

In a text reading task, stress was associated with shimmer ($p=0.032$), MFCC3 ($p=0.03$), MFCC4 ($p=0.002$) and F3 frequency ($p=0.047$). In an A-vowel phonation task, stress was associated with Harmonics-to-Noise Ratio (HNR) ($p=0.032$) and shimmer ($p=0.002$). In a counting from 1-20 task, stress was associated with F2 bandwidth ($p=0.029$), F3 amplitude ($p=0.036$), MFCC4 ($p=0.039$), jitter ($p=0.023$) and shimmer ($p=0.006$).

Discussion

We have identified several voice features associated with stress by altering articulation and muscle tension. These results show the feasibility of using VB for stress and the FragMent study will assess their ecological validity.

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