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ХАРКІВСЬКИЙ НАЦІОНАЛЬНИЙ УНІВЕРСИТЕТ РАДІОЕЛЕКТРОНІКИ

РАДІОЕЛЕКТРОНІКА ТА МОЛОДЬ У XXI СТОЛІТТІ

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61166 Україна, Харків, просп. Науки, 14
тел./факс: (057) 7021397

E-mail: mref21@nure.ua

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POSSIBILITIES OF SPEECH ANALYSIS FOR EARLY STRESS RECOGNITION IN OFFICE ENVIRONMENT

Emad Mohammed Raweh Saeed Al-Qadasi
Supervisor – cand.techn.sc., assoc.prof. Zhemchuzhkina T.V.
Kharkiv National University of Radio Electronics, BME Dep.
Kharkiv, Ukraine
tel. +31(685) 843-267, e-mail: emad.mokhammed.al-kadasi@nure.ua

This work is devoted to speech analysis for early stress recognition in office environment and outlines a study on the use of speech analysis for early detection of stress. It was studied what parameters of speech are changed under stress situations. It has been found out that under stress situations, changes in pitch (fundamental frequency) and in the speaking rate are usual, together with variations in features related to the energy and spectral characteristics of the glottal pulse.

Speech analysis can be an effective tool for detecting stress in office environment, which could help to prevent negative outcomes and improve employee well-being and productivity.

Stress is a common problem among office workers and can lead to a variety of physical, emotional, and mental health issues. Some common problems of stress in office workers include: physical health issues (headaches, muscle tension, fatigue, and other physical symptoms that can affect overall health and well-being); emotional and mental health issues (anxiety, depression, and burnout); reduced productivity and impair job performance; increased absenteeism (employees who experience high levels of stress may take more sick days or be absent from work more frequently); poor morale, leading to low job satisfaction and high turnover rates; conflict and tension, leading to a negative work environment; legal and financial issues, such as workers' compensation claims or lawsuits. So, it is important for employers to take steps to prevent and manage workplace stress to promote employee well-being and reduce the risk of these problems [1].

There are different approaches for stress detection in the office, including: self-reporting, when employees can report their stress levels through surveys or questionnaires, which can be used to track stress levels over time and identify potential stress-related issues; wearable devices, such as smartwatches or fitness trackers, which can measure physiological parameters like heart rate and breathing rate to indicate stress levels; biometric sensors, which can measure physiological parameters like skin conductance, which can be used to detect stress levels; facial expression analysis, which can be used to detect signs of stress in employees by analyzing changes in facial expressions and movements; ambient sensors, such as noise sensors or temperature sensors. Employers can use one or

a combination of these approaches to detect stress in the workplace and implement strategies to reduce workplace stress and promote employee well-being.

Speech analysis is a promising approach for stress detection in the workplace. Here are some possibilities and advantages of speech analysis for stress detection: it is a non-invasive method of detecting stress and does not require any physical contact with employees; it can be used to detect stress in real-time, providing immediate feedback to employees and managers; it is an objective method of stress detection, eliminating potential biases in self-reported stress levels; it is easy to implement in the workplace, as it only requires a microphone and software; it is a cost-effective method of stress detection compared to other approaches like biometric sensors; it can provide a comprehensive analysis of stress levels, including factors like tone of voice, speaking rate, and word choice; it can be used to detect stress in a variety of workplace settings, including remote and virtual work environments.

Pitch is the most frequently extracted feature from speech in stress detection. It has been found that mean value, standard deviation and range of pitch increase under stress while pitch jitter decreases. Minimum, maximum, median and first derivation of pitch are also used. As spectral centroid goes up under stress and energy is concentrated in higher frequency bands, high frequency bands' (above 500 Hz) energy is also considered. Speaking rate also increases, as well as voice intensity. Intensity features like the mean, range and variability can be used in certain environments. Amplitude-based features can be also used: precisely, the perturbation quotient, the degree of subharmonic segments, the noise to harmonic ratio and the degree of voiceless. However, pitch and speaking rate features frequently the most suitable ones, because they can work well even in noisy environments [2].

By using speech analysis for stress detection, employers can identify potential stress-related issues in the workplace and implement strategies to reduce workplace stress and improve employee well-being.

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